# *Continuous Mortality Investigation ("CMI") Consultation on CMI_2024*

*I am writing on behalf of Lane Clark & Peacock LLP in response to the Mortality Projection Committee's ("the Committee") consultation regarding the next version, CMI_2024, of the mortality projection model as set out in Working Paper 197.*

*Lane Clark & Peacock LLP ("LCP") is a firm of financial, actuarial, health and business consultants, specialising in the areas of pensions, investment, health, insurance and business analytics.*

We continue to be grateful for analysis carried out by the Mortality Projection Committee and would like to thank them for their ongoing work.

We are generally supportive of many of the changes implemented by the Committee in their proposed CMI_2024 model. However, three areas that we have particular views on are:

1. whether the age-period convergence term to the long-term rate of improvement at the youngest and oldest ages could be extended;

2. whether the "half-life" parameter could be reframed such that it can be more easily communicated and interpreted by lay users of the model; and

3. which parameters should be in the core, extended and advanced layers.

We have set out answers to the questions posed below.

## Multiple period terms – general approach

### 1a) Do you broadly agree with our proposal to amend the Core version of the Model to have multiple period terms rather than one? (Yes/No)

Yes – we strongly support the general approach of multiple period terms.

## Multiple period terms – details

### 1b) How many period terms should the Core version of the Model have? (Two, three, four, other)

When assessing the number of period terms available, we support the notion that the Committee should adopt the fewest number of terms that is required to provide a good fit to the data. As we understand this is the approach taken to determine three period terms, we are broadly supportive of the Committee's proposal of three.

However, we note that a visually better fit (particularly for males) could be achieved at the younger ages with four period terms (based on charts A2G). We explore a range of solutions to achieving a closer fit, and a more appropriate short-term projection, in our response to question 9c.

### 1c) What basis functions should the Core version of the Model use? (Linear, linear with flat edges, quadratic, step function, other)

We understand the logic of the Committee's proposal for a linear basis function and we are generally supportive.

However, if not already performed, the choice of basis function could be more data-driven than the proposed approach. We would like to see further analysis on how the choice of age (currently 60) that forms the "peak" of the linear basis was chosen i.e. was it an arbitrary selection or was it arrived at via an algorithm such as K-means clustering analysis). This could be useful for alternative geographies or data sets.

### 1d) Do you agree with the proposed method for determining three period smoothing parameters from an equivalent single smoothing parameter? (Yes/No)

Yes - we agree with the principle that a single smoothing parameter should be selected by a user, which in turn is translated into the necessary three age-period smoothing parameters.

We have no material comments on the proposed methodology used to do this.

### 1e) Do you agree with the Model having a single Extended equivalent period smoothing parameter that will be automatically adjusted by the Model, with other parameters relating to period terms being Advanced parameters? (Yes/No)

Yes (other than position in the model that the single equivalent should sit). We do not think it is necessary for any smoothing parameters to be within the extended layer of the model.

Instead, we suggest all smoothing parameters are contained within the advanced layer.

Within the advanced layer, we would support the optionality to either select a single period smoothing parameter (which is then converted) or specifying separate age-period smoothing parameters as required.

## Fitted overlay – general approach

### 2a) Do you broadly agree with our proposal for the Core version of the Model to set all weights to 100% and fit an overlay? (Yes/No)

Yes – we strongly support the general approach of a mortality overlay with 100% weight given to each year of data.

## Fitted overlay – details

### 2b) Do you agree with our proposal to apply the same uplift (as a proportion of underlying mortality) and the same decay pattern at all ages (fitted separately by gender)? (Yes/No)

Yes – we agree with a single overlay approach within the core and extended models on the grounds of simplicity.

However, we note the data does not support this – with different ages having different impacts. Our support is therefore a balance on simplicity versus fitting the data. It may be useful to have the option for further refinement of the overlay parameterisation within the advanced parameters.

### 2c) Do you agree with our preference for exponential rather than linear decay of the overlay component? (Yes/No)

Yes - on balance we agree with an exponential decay component due to how it fits the E&W data, although, based on the proposals, linear would be easier to explain to non-technical users.

However, we have concerns about how the concept of half-life can be easily interpreted and communicated to trustees of defined benefit pension schemes (see our response to questions 2e and 9c below).

### 2d) If we do use exponential decay, what is your preference for the half-life? (0.5 years, 0.75 years, 1 year, 1.25 years, other)

Whilst we believe that a range of views is acceptable, we generally agree with the Committee that either a half-year of 1 or 0.75 could be suitable values for the core half-life.

On balance, we are comfortable with the proposal of a half-life of 1 year (or an alternative expression with equal meaning) for the core model. When forming this view we took a number of factors into consideration outside of our best-estimate view of the future and the fit. For example, we view the value of 1 as better reflecting the subjectivity of the assumption whereas a less-round value may imply that the parameter is more “accurately” derived.

It may be useful and appropriate to inform users what value of the model's half-life parameter gives the closest fit (using a defined statistical fit test).

Finally, we note from the scenarios provided by the Committee that the impact of different half-lives (over the range 0.5-1.25 years discussed) is largely run-off once mortality data is available up to around 2027, thus having limited impact on versions of the CMI model beyond CMI_2027.

### 2e) Do you agree with the proposal to express the exponential decay using a half-life rather than an annual percentage reduction? (Yes/No).

No - as explained earlier, we have concerns about using the terminology of "half-life" on the grounds of easy communication, and potential confusion (i.e. talking to lay persons about life expectancies and half-lives).

As a minimum step, we would prefer the half-life to be reframed as a proportional drop of additional deaths each year i.e. we are supportive of the underlying modelling but would prefer it be expressed in an alternative way.

We believe that this would have the benefit of being more easily explained to lay users of the model whilst retaining the statistical rigour of the proposed approach. It is also more in line with how other parameters of the model are articulated (i.e. as annual change) and has less of a natural sticking point of 1 year.

In question 9c we set out our thoughts of more significant change whereby the focus is instead placed on a parameter that directly controls the underlying trend.

### 2f) Do you agree with the proposal to use the combined (underlying plus overlay) rates for the Core output, rather than the underlying rates? (Yes/No).

Yes.

### 2g) Do you agree with the "APCOI" name for the version of the APCI model with the overlay added? (Yes/No)

Yes – although we do not think this it is necessary to consult on this element.

## Cohort constraints

### 3a) Do you agree that the Model should continue to constrain cohorts at the youngest ages? (Yes/No)

We do not have a strong view as to whether this should be done conceptually.

However, we note that in the proposed model the cohort elements sum to zero, and are then constrained i.e. the youngest ages are still impacting the fit of the older cohorts. An alternative way would be to only fit the model over non-constrained ages, or ages of most interest (i.e. without the youngest ages).

### 3b) If we do constrain cohorts, do you agree with the proposal to do this after fitting the APCOI model, rather than while fitting it (as described in Section 10 and Appendix 4)? (Yes/No)

Yes – albeit we do not have a strong view. We are more concerned with whether the resulting cohorts appear reasonable.

### 3c) If we do constrain cohorts after fitting the APCOI model, do you agree with the details of the proposed method in Section 10.3? (Yes/No)

We do not have a strong view. We are more concerned with whether the resulting cohorts appear reasonable.

## Method for fitting the APCOI model

### 4a) Do you agree with the proposed method for fitting the APCOI model (described in Section 11 and Appendix 5)? (Yes/No)

Yes - it appears to be an improvement so we are generally supportive but we have no material views.

However, we do not think this it is necessary to consult on this change.

## Extended and Advanced parameters

### 5a) Do you agree with the proposal in Section 6.5 for which parameters should be Extended or Advanced? (Yes/No)

No – we propose the following.

Core:

- Long-term rate of improvement
- Initial addition, A, parameter

Extended:

- Half-life (or equivalent)

Advanced:

- All other parameters, including the period smoothing parameter currently found in the extended model.

We understand that the distribution of the parameters across the layers of the model (i.e. whether a parameter is in core, extended or advanced) is of more importance to pensions consultancies rather than insurers.

In this spirit, we suggest that the parameters should be distributed across core, extended and advanced in line with how frequently non-core versions are adopted by trustees of defined benefit pension schemes.

In our experience:

- All trustees determine a long-term rate of improvement given that it is not specified in the core model.
- Many trustees use the A parameter to reflect the differences in the population of their scheme against the general population of England and Wales. Regardless of whether a trustee wishes to adopt a non-zero value of the A parameter or not, by forcing users to specify a parameter further emphasises that the CMI model has been fitted to the general population and users should consider how it should be modified to be used for alternative populations. It could be positioned differently to the long-term rate with the Committee advocating a value of 0% pa if the user wants to reflect improvements in the general population.
- Increasingly few trustees choose non-core versions of the Sk parameter. However, consultants often feel obliged to describe this parameter to their clients when they are using the extended version of the model as it needs to be specified in their advice.
- Having a single parameter in the extended model will allow users to either use this parameter or not without needing to describe any superfluous parameters.

## Adoption of CMI_2024

### 6a) How likely would you be to use CMI_2024 with a similar approach to our proposal at some point, even if not adopting it immediately?

As a pensions consultancy it is inevitable (i.e. 100% probability) that we use the CMI_2024 model in its core form at some stage, if it is within our range of comfort.

### 6b) If you are unlikely to use CMI_2024, please say why and describe what alternative approach you are likely to take

n/a

## Projected life expectancy

### 7a) Setting aside any opinion on the methods used, how does the male life expectancy at age 65 shown in bold in Table 6.1 compare to your best-estimate view based on mortality improvements for the general population of England & Wales?

The life expectancies shown are dependent on the choice of base table, the long-term rate, as well as the core parameterisation of the model. As such, we don't think answering this question sheds particular light on the aspects of the model that are being consulted on.

### 7b) Setting aside any opinion on the methods used, how does the female life expectancy at age 65 shown in bold in Table 6.1 compare to your best-estimate view based on mortality improvements for the general population of England & Wales?

See 7a.

### 7c) Do you have any further comments on this? For example, how your response would vary by age, or how your response is affected by the change to three period terms?

Please see our comments in question 9c.

## Software

### 8a) We propose to remove the existing overlay feature (available for CMI_2022 and CMI_2023) from the software. Do you agree with this? (Yes/No)

We do not use this feature and are indifferent as to whether it is retained.

### 8b) The consultation software allows the user to consider the possible outcome of a future version of the Model for different mortality scenarios. Is this a useful feature that should be included in the published software for CMI_2024 and later versions? (Yes/No) Do you have any comments on its implementation?

Yes – this additional feature is useful. We often have needed to manipulate data to enable us to model scenarios and welcome the new feature.

We would find it helpful if this feature was expanded to give the full output of illustrative future CMI models.

### 8c) Do you agree with our proposal to retain the direction of travel (modified to vary by single age as described in Section 8.5) in the Model? (Yes/No)

Yes.

## Other

### 9a) Do you agree with our proposal to not make any changes to the CMI_2024 calibration dataset for the effects of recent changes to registrations of deaths, as noted in Section 2 and Appendix 1? (Yes/No)

Yes. However, we note that there appears to be a seasonal impact of registration delays which could impact other CMI outputs (such as the mortality monitor).

### 9b) Do you have any comments on the proposed Model Review Policy (set out in Section 7)?

We welcome that the Committee has implemented a transparent structure for how it will assess whether future data should warrant further investigation.

We believe that the thresholds used within the Pillars are broadly as we would expect them to be.

However, we note that test 2B (change in life expectancy at age 65 being greater than 0.5%) has a high probability of being triggered in the short term. Table A3.1 implies that a mortality improvement in 2025 of less than -1% or greater than +1% broadly result in a change in life expectancy of c±0.5%. This may be acceptable to the Committee as it could be reasonably viewed that the years immediately following a major pandemic should be examples of years that the test has been designed to trigger for.

As per our comments in our response to question 9c below, changes in life expectancy at age 65 in isolation can be misleading. Test 2B could be broadened to consider a range of life expectancies.

## 9c) Do you have any further comments on our proposals, or any other aspect of the Model?

See below.

### Communication of headline results – description of new parameter

Whilst we welcome the modelling behind the new half-life, H, parameter, we have some concerns about how easy it is to explain and understand.

The first of our concerns surrounds using a “half-life” rather than an annual fall (or other description) as we discuss in our response to question 2e.

Our second concern is the widespread, and understandable, pushback we have experienced when we have described the new overlay parameter of *“So assuming more excess deaths leads to longer life expectancies?”.* Intuitively, many initially expect assuming more excess would lead to lower life expectancies, albeit they do understand the opposite is true after some explanation of the modelling and the relationship between the overlay and the underlying trend.

If the Committee were able to reframe the new parameter to focus on the proportion of the underlying trend that is apparent, it may lead to less confusion i.e. it is the underlying trend that is the material component to future life expectancies and so may be the more appropriate place for a user to input a parameter choice.

For example, would it be possible to reframe the balance between the overlay and the underlying trend by specifying what proportion of total deaths over the last year were excess deaths i.e. a user may specify that 3% of deaths in 2024 were excess deaths.

### Communication of headline results – life expectancy at age 65

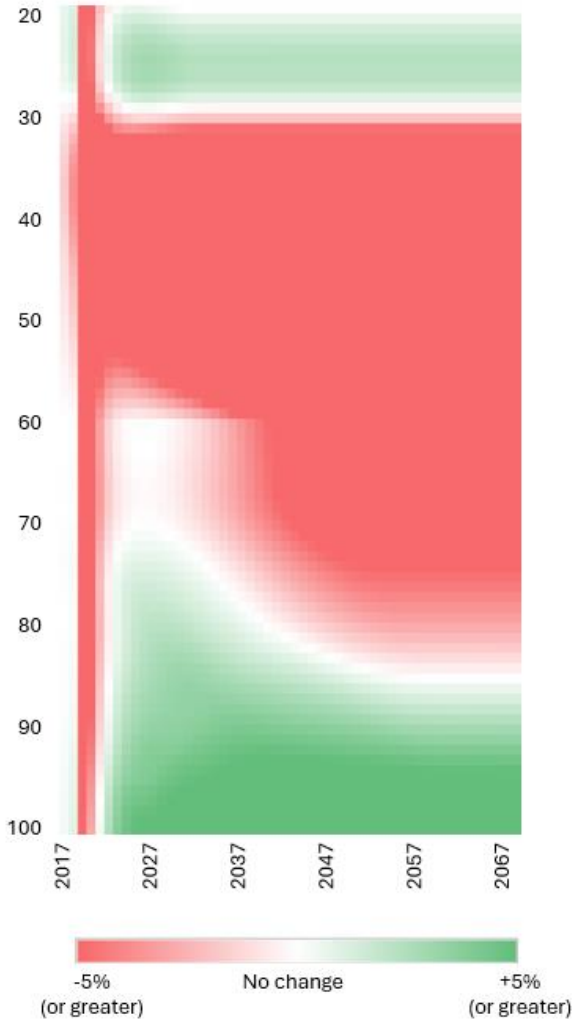
We note that a headline statistic that is often quoted by the actuarial community when a new version of the CMI model is released is the change in life expectancy at age 65.

However, we note that for CMI_2024 this happens to be not representative of the overall changes.

The changes made by the Committee since the previous model result in a cohort of benign changes in mortality rates from around age 65 today. For all other cohorts the change is much more significant. The same is true for both males and females (see chart for males below).

Given the shape, we feel that a heatmap such as the one below would have been a useful addition to the consultation working paper.

**Difference in q-rates between CMI_2023 and CMI_2024**
*(green implies lower mortality rate in CMI_2024)*



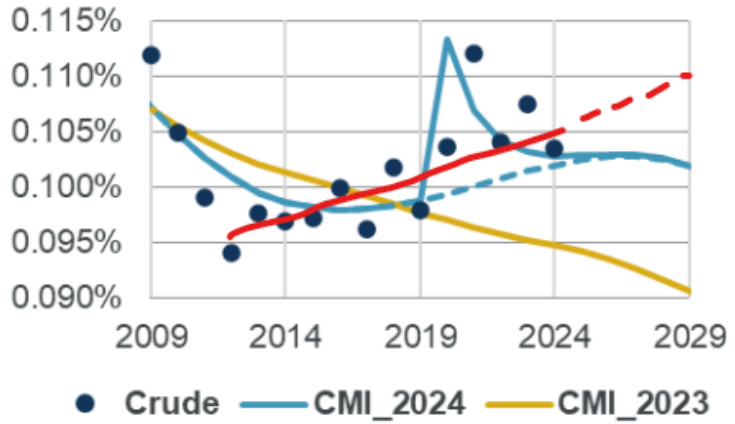

## Projected mortality rates at younger ages

We welcome the changes made to the age-period component that has resulted in a closer fit to past data at younger ages.

However, the CMI model is now required to project from fitted mortality rates that are increasing over time.

We observe that for young males, the model appears to almost immediately revert to mortality improvements, despite the past decade showing worsening mortality. We have illustrated this idea on chart 6C of the consultation paper below with a red line of where it might be reasonable to have expected the model to project mortality rates in the short term.

**Chart 6C: Males, ages 20-44**




It may be possible to reduce this impact by one of the following options:

- Implement non-zero direction of travel parameters.
- Extend the age-period convergence to the long-term rate at younger ages. We understand that the convergence period is short given the

fluctuation of mortality rates at younger ages. However, it could be argued that given the work carried out for the CMI_2024 model, the Committee could be more confident with the age-period and cohort effects identified and therefore do not require the model to converge to the long-term rate so quickly. This would be our preference.

- Use four age-period terms. Chart A2G of the Consultation depicts a more intuitive short-term increasing trend in mortality rates for the 20-44 age group.

## Projected mortality rates at the oldest ages

We understand that the Committee have focused (at least illustrated in the Working Paper) on the age group 75-100 for the oldest ages under consideration.

However, we wanted to highlight that the fit and short-term projection at older ages may require further attention.

When we viewed how the CMI_2024 model fitted to the 90-100 age group, we noticed that the fit by age was not as pleasing as it is for the wider 75-100 age group. We found that the mortality improvements revert to the long-term rate almost immediately. However, over 2010-2019, there was only minimal mortality improvement for this age group.

A possible solution to this could be to lengthen the age-period convergence to the long-term rate at older ages. In the core model, this is set to linearly decrease from 20 years to 5 years between ages 80 and 95.

We understand that this convergence appears to have been unchanged since Working Paper 39. When it was introduced, its aim was “in keeping with the general concept of mortality improvement rates running to zero relatively quickly after age 100”.

However, this logic now appears to be contradicted, given that the short convergence period has the impact of speeding up mortality improvements at older ages.

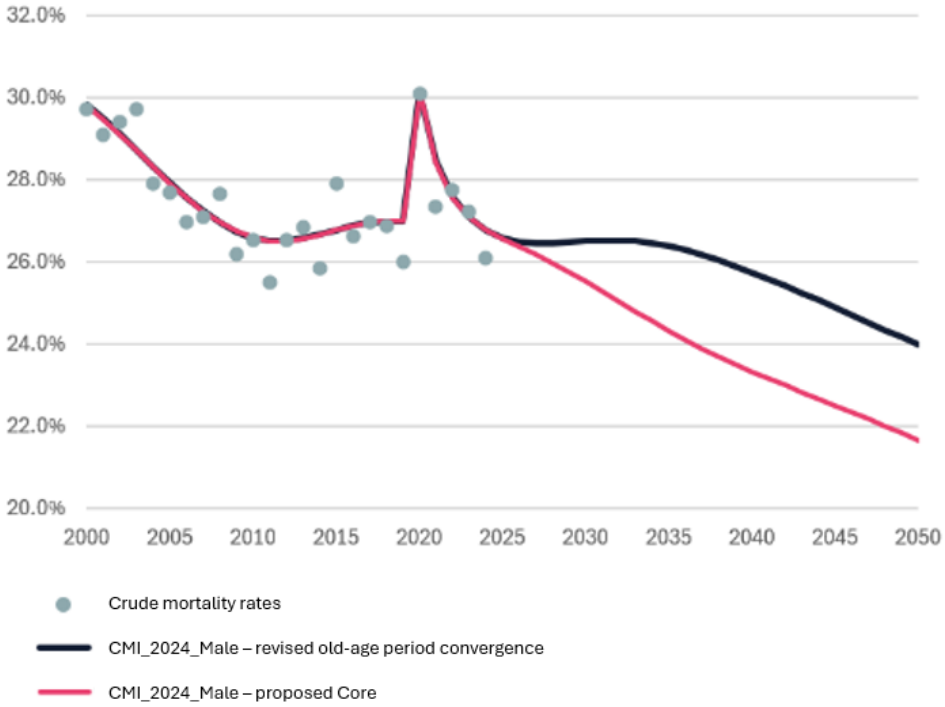
We also understand that the feature of trending to a long-term rate more quickly at older ages does not appear in the ONS mortality projections model.

We appreciate that the Committee has a finite resource to consider and investigate refinements to the model. However, it may wish to consider a refinement to this convergence shape for CMI_2024. If the Committee wished to wait until CMI_2025 it may find that the impact has an opposite effect on life expectancies (in terms of age shape) to the changes it is proposing for CMI_2024, and so may wish to avoid a potential see-saw swing between subsequent CMI models.

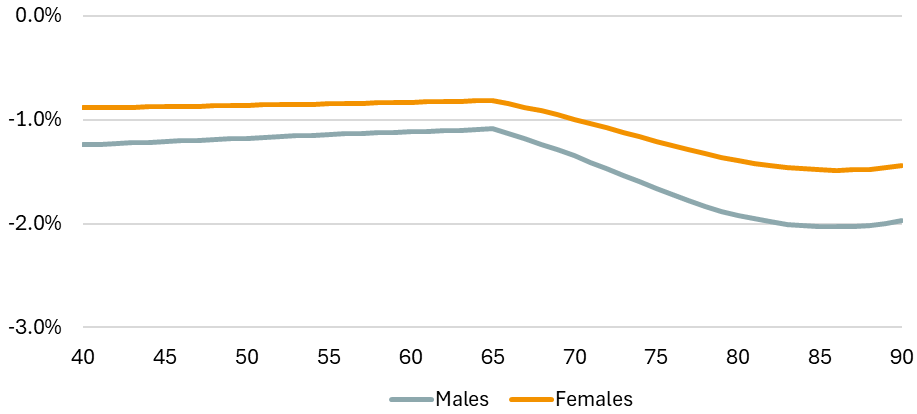
For illustration, we have set out below the ASMRs for males aged 90-100 for the proposed CMI_2024 with and without the changes discussed above made to the age-period convergence[1]. All other parameters are the same. As you can see, the near-term future projection is more similar to the improvements witnessed over the previous decade.

[1] We have illustrated keeping the age-period convergence at 20 years at all older ages.

***Male ASMR over ages 90-100***




***Difference in life expectancy between proposed Core CMI_2024 and proposed CMI_2024 with longer old-age convergence***




*Note: ages below age 65 represent the difference in deferred life expectancies to age 65*

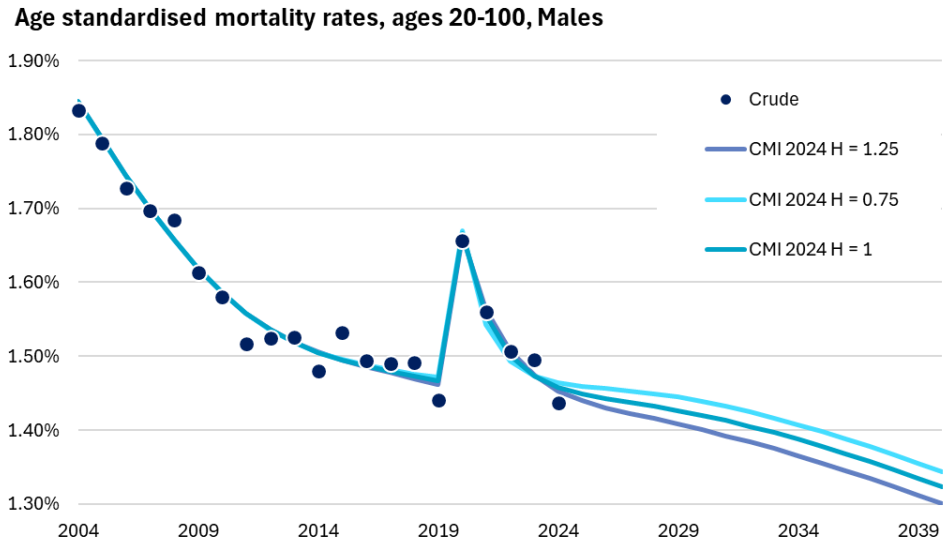
## Sensitivity to 2023 and 2024 data points

We note that in the derivation of the half-life parameter to use in the core model, care has been taken to determine how well data points since 2020 fit the model.

We note that:

- The lower 2024 point seems to be a predominant driver as to why half-lives above 0.75 seem to be preferred.
- If the 2024 point was higher – perhaps in line with 2016-2018, then a materially different conclusion could be taken as to the appropriate value of the half-life (i.e. in line with Scenario 2 put forward by the Committee). For example, a half-life of 0.5 or less may create a better fit to the data and would materially change life expectancies.

Whilst we do not necessarily feel that this is sufficiently worrying to move the proposed parameterisation of the core model, we felt that it was worth shedding further light on the apparent over reliance being placed on the latest data point.




## Non-England and Wales populations

We understand the Committee's choice to model the run-off of excess mortality in England and Wales as a decay function. However, we note that when looking at data by calendar year it is coincidental that this appears appropriate given:

- The pandemic did not elevate mortality rates excessively until April 2020 (i.e. not the whole calendar year); and
- The waves of the pandemic were not uniformly distributed, nor did they necessarily decay in severity in a consistent manner.

As such, the application of the current methodology appears to be suitable in a narrow range of outcomes of the pandemic.

When the CMI_2024 model is fitted to data from other jurisdictions, the shape of mortality run off may not align with a decay model fitted to calendar years. For example, some countries did not see any excess deaths until 2022.

We would request that the Committee consider:

- Any guidelines to the scenarios in which the CMI_2024 model can be applied (e.g. with a single peak of excess mortality that appears to decay over time).
- Whether it could emphasize that the core calibration of the CMI_2024 model applies to England and Wales only (e.g. via a naming convention of an "E&W Core").
- Whether any additional flexibility could be introduced such that the model could be applied to different shapes of excess mortality over the pandemic period.

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