Continuous
Mortality Investigation

Institute and Faculty of Actuaries

CMI Mortality Projections Model

Steve Bale
Chair of the CMI Mortality Projections Committee

9 September 2026 | Longevity 21

Agenda

- Context – the CMI and its Mortality Projections Model
- Evolution of the CMI Model through the pandemic
- International use of the CMI Model
- Recent and current research
- Questions

Context – the CMI and its Mortality Projections Model

Continuous Mortality Investigation (CMI)

- Owned by the UK's Institute and Faculty of Actuaries
- Mission:
  - To produce high-quality impartial analysis, standard tables and models of mortality and morbidity for long-term insurance products and pension scheme liabilities on behalf of subscribers and, in doing so, to further actuarial understanding
- Funded by commercial subscribers
  - Most outputs restricted to authorised users
  - Some work (e.g. mortality monitors, high-age research) is public

Overview of the CMI Model

- A model of mortality improvements, that can be applied to any base table
- Separate model for males and females, updated annually
- Projections are interpolated between **“initial”** and **“long-term”** improvements
- **Initial improvements**
  - Calibrated to historical data
  - Standard “Core” model uses the England & Wales general population
- **Long-term improvements**
  - Different influences on mortality in the past and future
  - CMI does not provide an assumption – users must form their own view

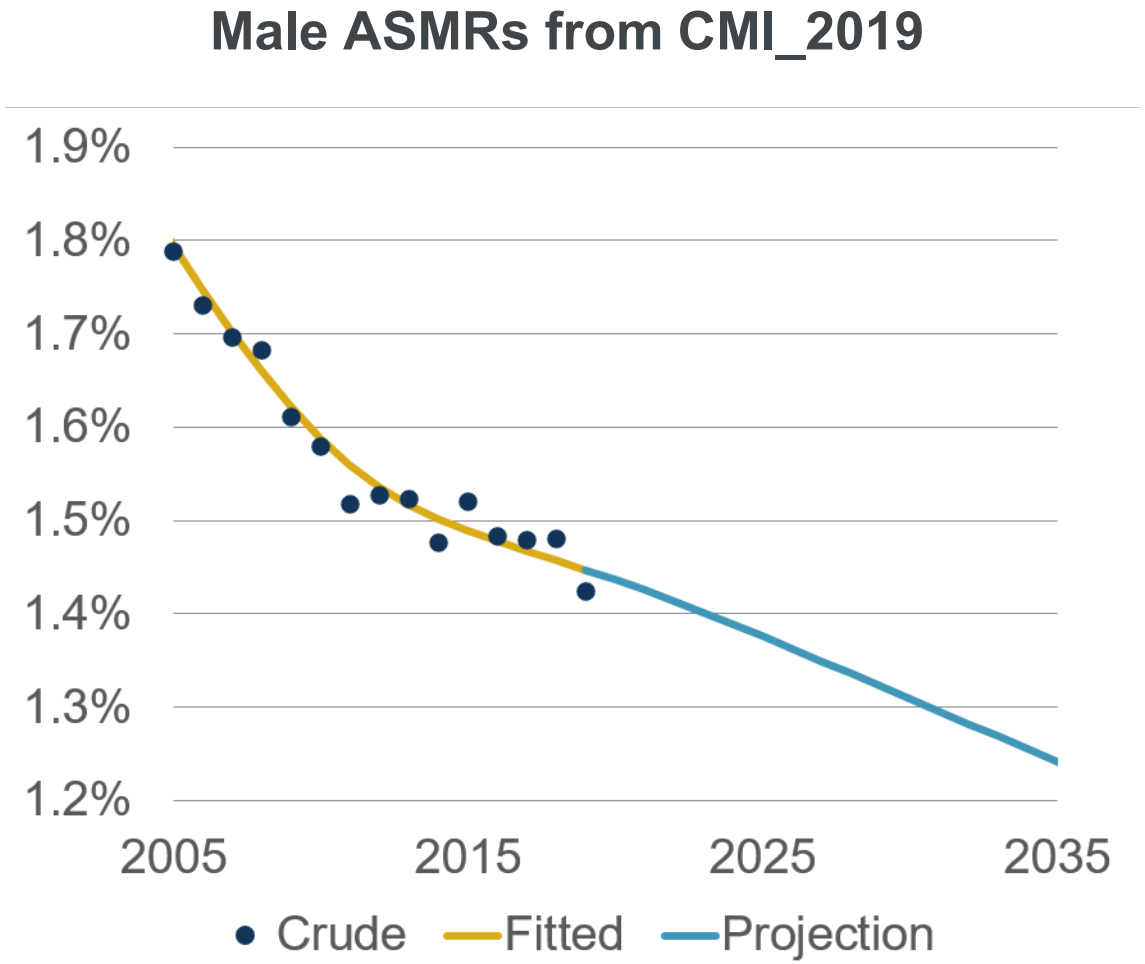
CMI Mortality Projections Model

- Updated annually and very widely used by UK pension schemes and insurers
- Pragmatic rather than the most sophisticated model:
  - Needs to be understood by non-experts e.g. pension scheme trustees
- Not giving “the answer” – calibrated to historical data but users must form their own view of the long term to inform projections
- A “common language” – users can compare and communicate views
- A framework with “Core” parameters that can be adapted to reflect:
  - Different populations
  - Different views of recent and future mortality

Evolution of the CMI Model through the pandemic

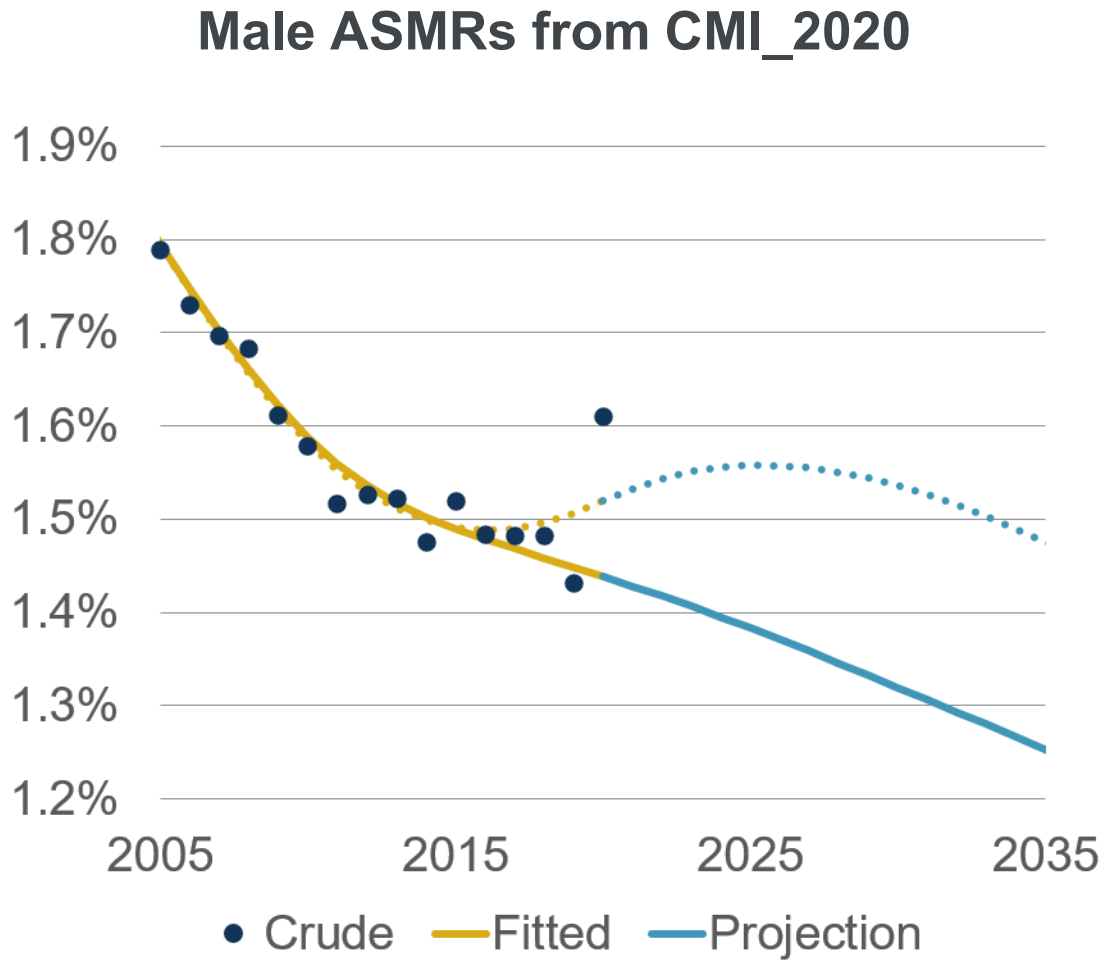
CMI_2019

- Fitted to 1979-2019 data for England & Wales
- Relatively steady pattern to historical mortality, despite annual volatility
- The CMI Model fits the data well
- Implied initial improvements and projection look plausible



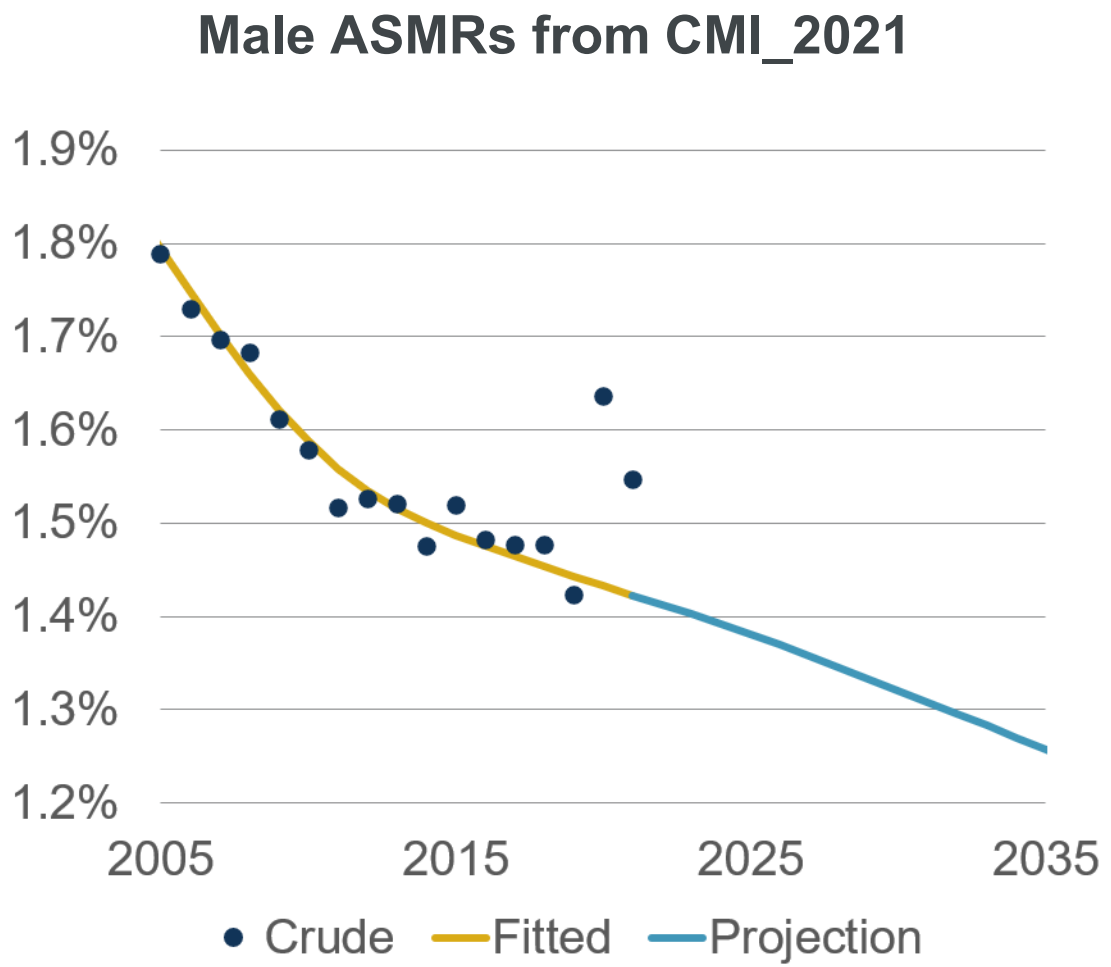
CMI_2020

- Fitted to 1980-2020 data for England & Wales
- No weight given to 2020 data
- Usual approach would have given an implausible projection



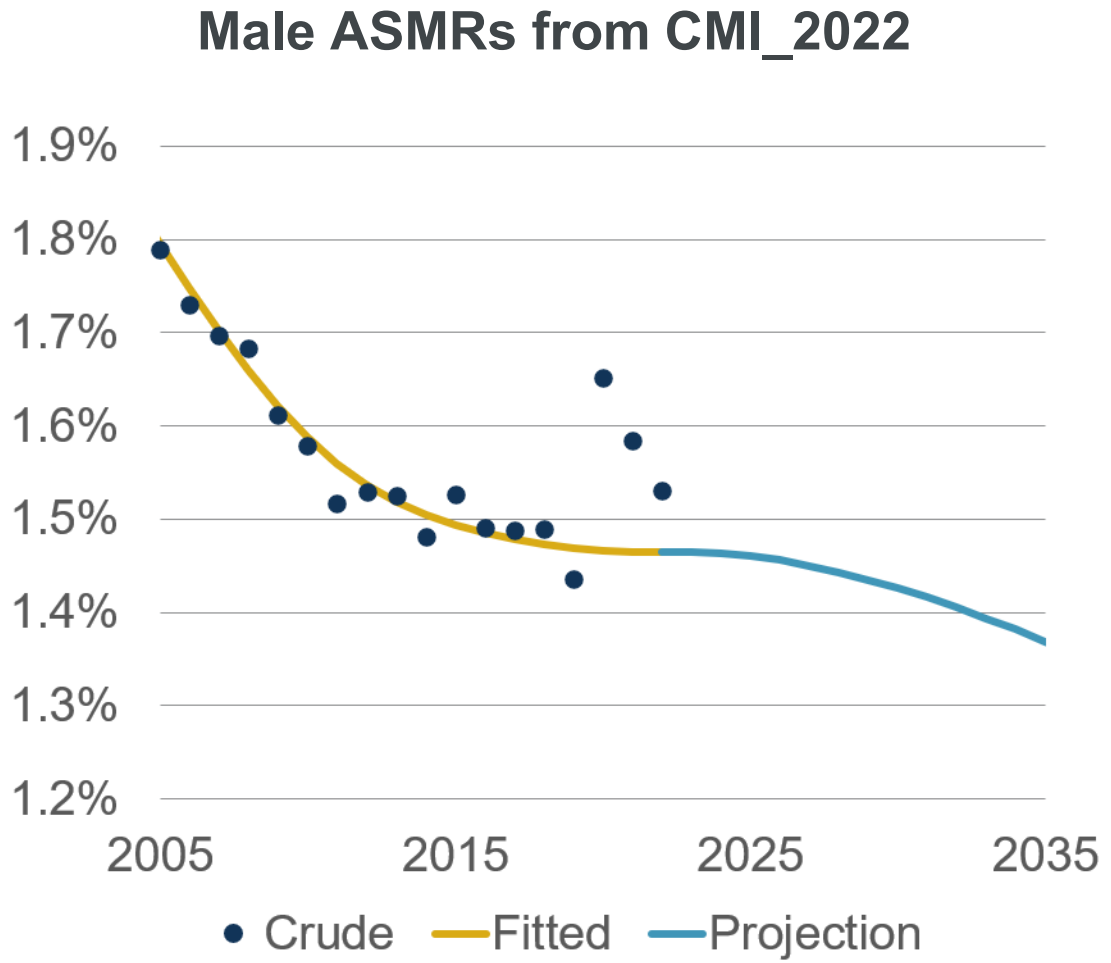
CMI_2021

- Fitted to 1981-2021 data for England & Wales
- No weight given to 2020-21 data



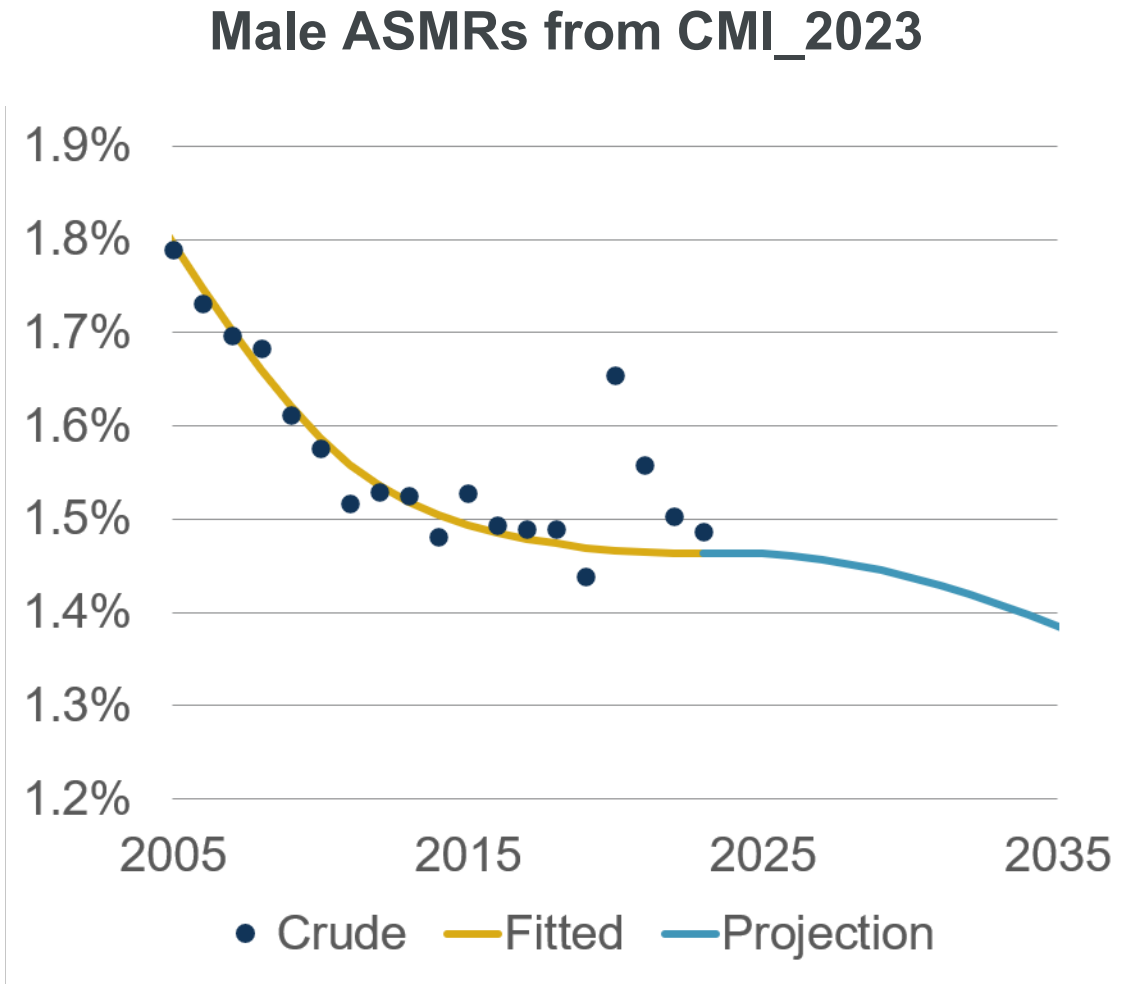
CMI_2022

- Fitted to 1982-2022 data for England & Wales
- No weight given to 2020-21 data
- Partial weight given to 2022 data
- Emphasis on subjective plausibility of long-term projection and life expectancy impact – rather than short-term pattern of mortality



CMI_2023

- Fitted to 1983-2023 data for England & Wales
- No weight given to 2020-21 data
- Partial weight given to 2022-23 data
- Emphasis on subjective plausibility of long-term projection and life expectancy impact – rather than short-term pattern of mortality



CMI_2024 changes to the CMI model

- For CMI_2016 to CMI_2023:

$$\log m_{x,t} = \alpha_x + \beta_x(t - \bar{t}) + \boldsymbol{\kappa_t} + \gamma_{t-x}$$

Single period term No overlay

- For CMI_2024 and CMI_2025:

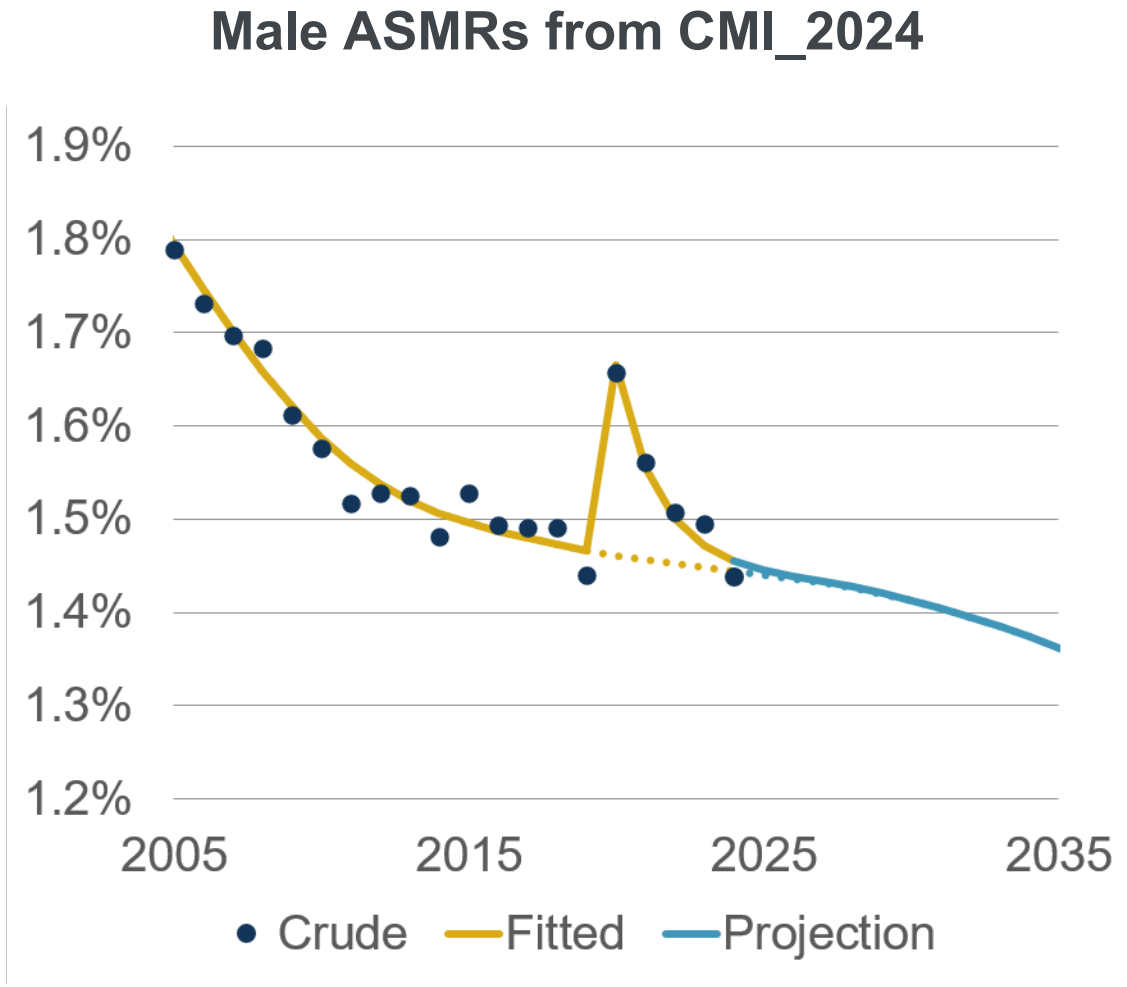
$$\log m_{x,t} = \alpha_x + \beta_x(t - \bar{t}) + \sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{B_x^{(i)} \kappa_t^{(i)}} + \gamma_{t-x} + \boldsymbol{\delta \times I_{t \geq 2020} \times R_{x,t}}$$

Multiple period terms Flexible overlay

- For the Core version of the CMI Model, the overlay decays exponentially with half-life H: $\boldsymbol{R_{x,t} = 0.5^{(t-2020)/H}}$

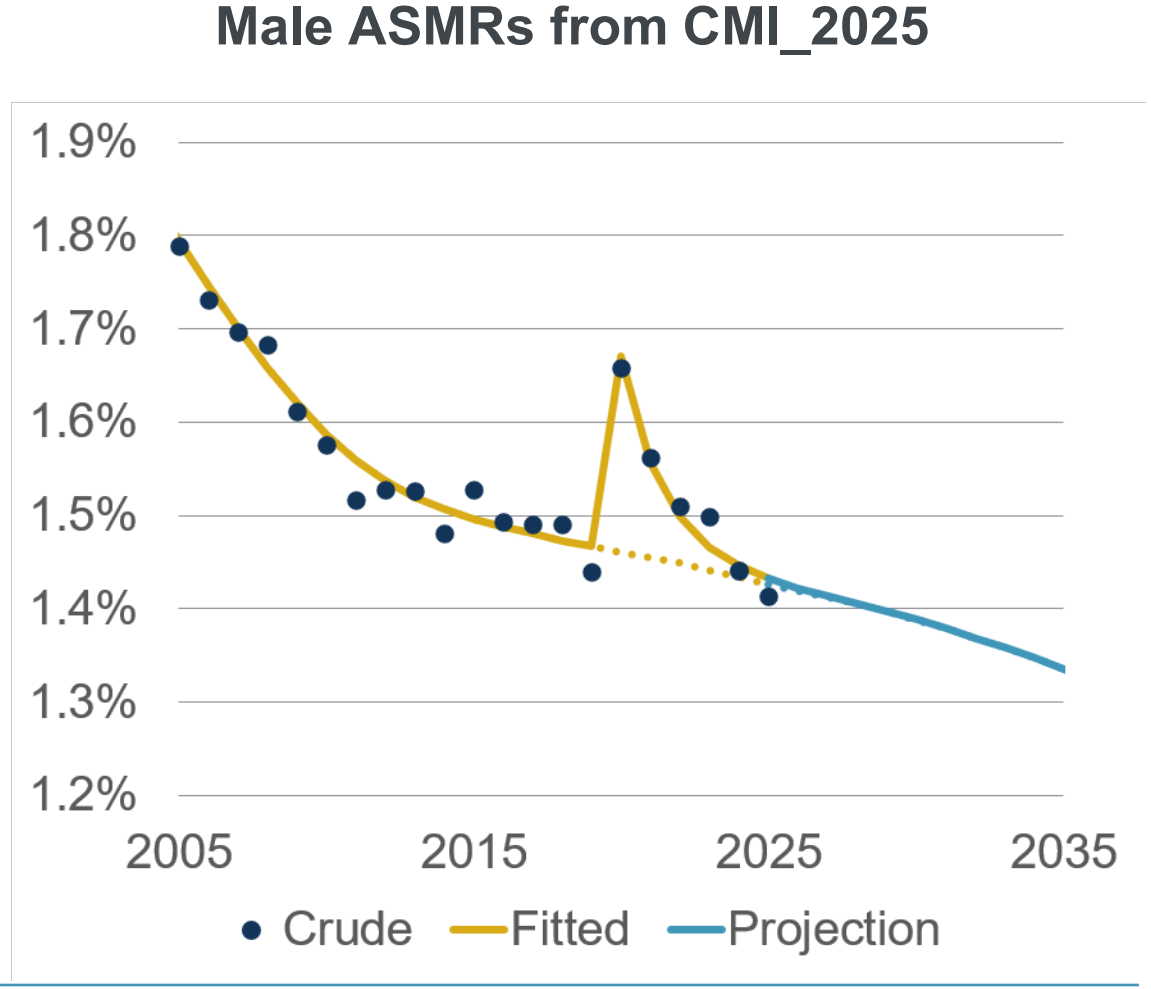
CMI_2024

- Fitted to 1984-2024 data for England & Wales
- Full weight for all years
- Explicit “overlay” to reflect the pandemic impact

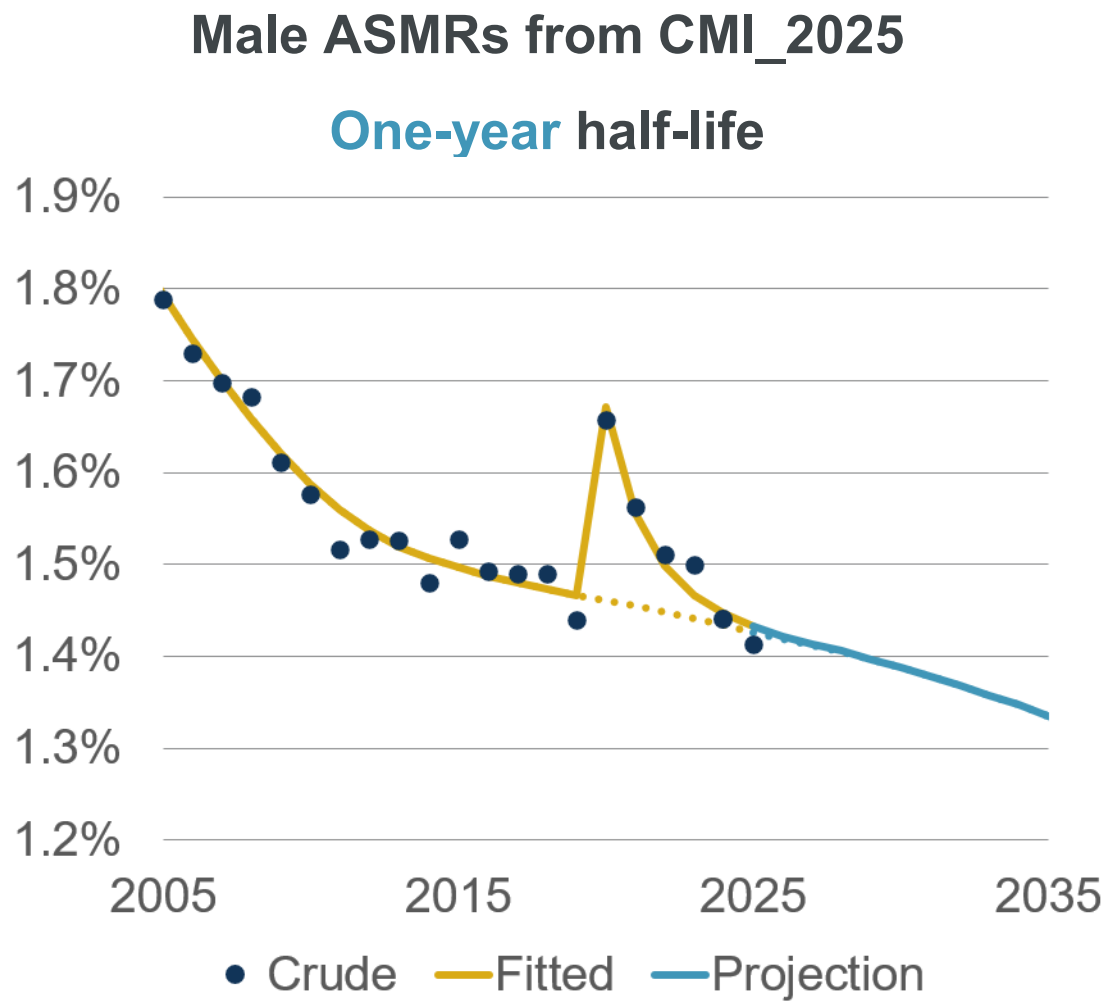


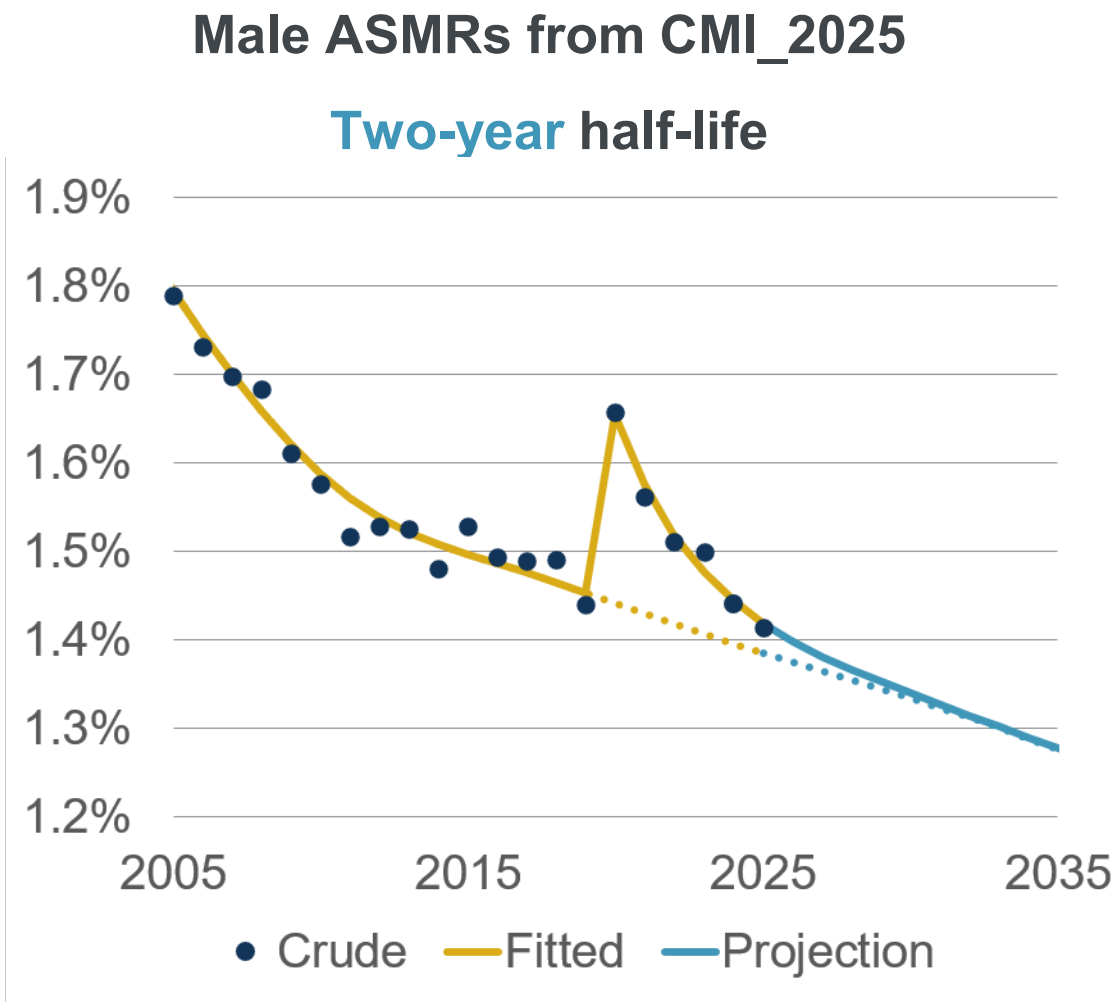
CMI_2025

- Fitted to 1985-2025 data for England & Wales
- Full weight for all years
- Explicit “overlay” to reflect the pandemic impact
- CMI benchmarking survey shows wide adoption or intended adoption by UK insurers and reinsurers

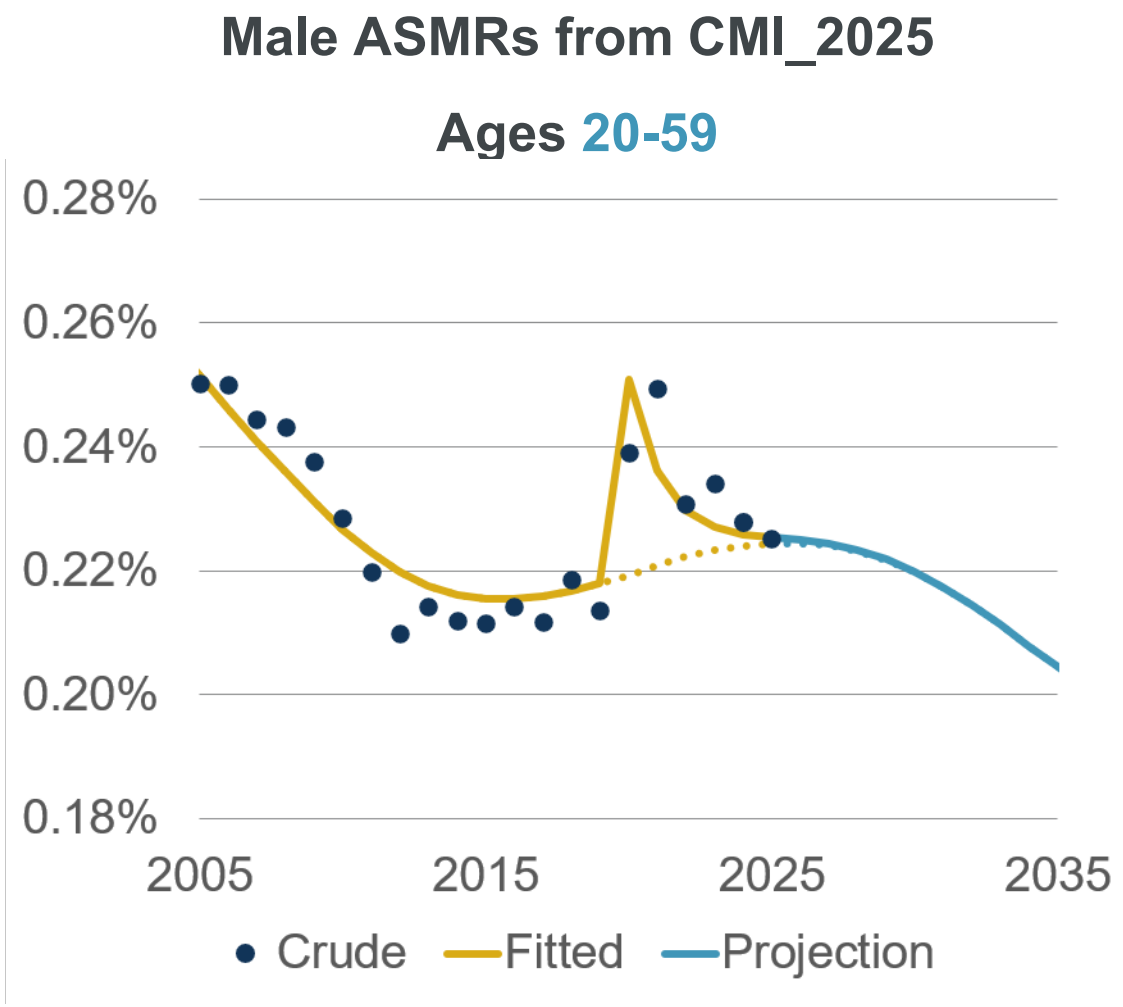


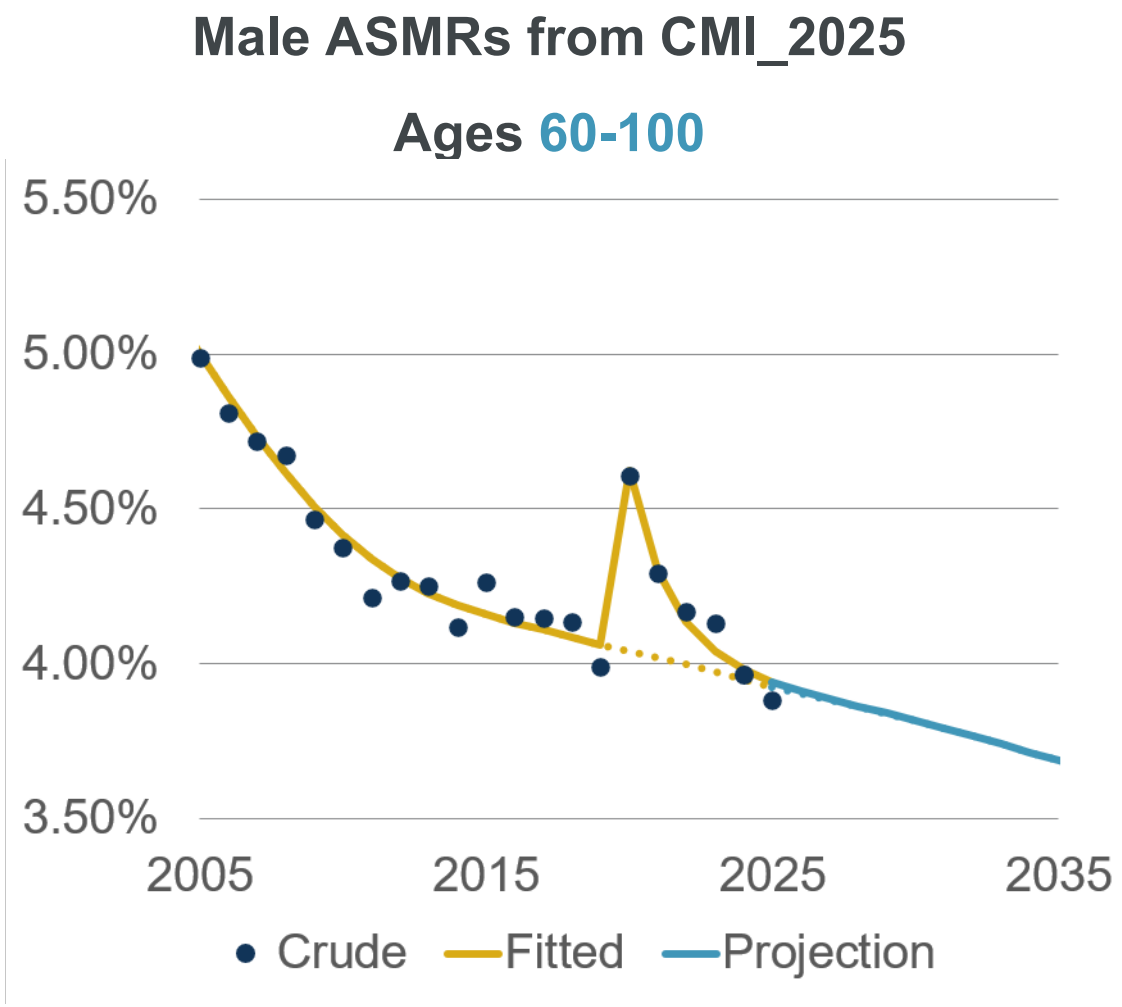
CMI_2025: Impact of different half-life assumptions





CMI_2025: Trends at younger and older ages

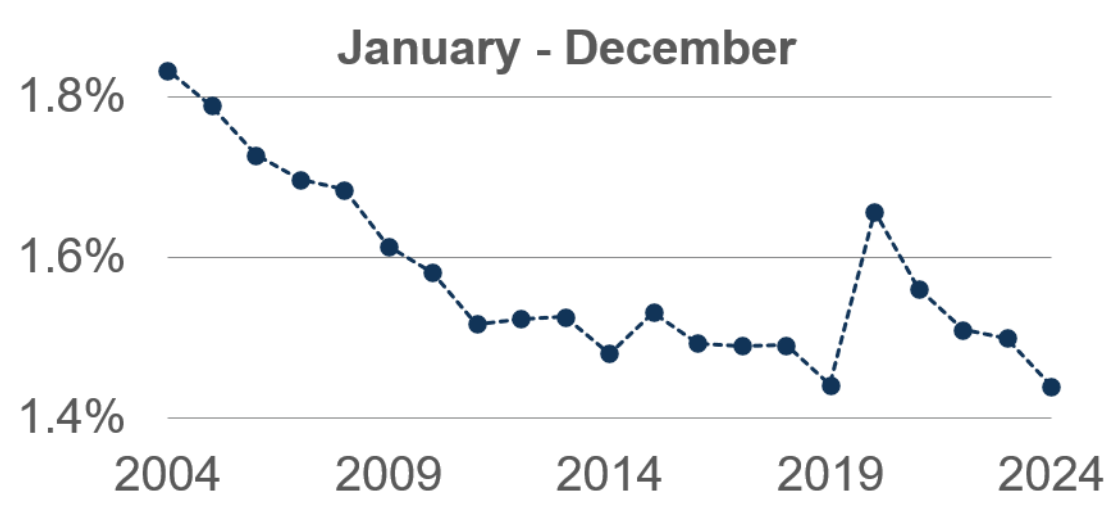


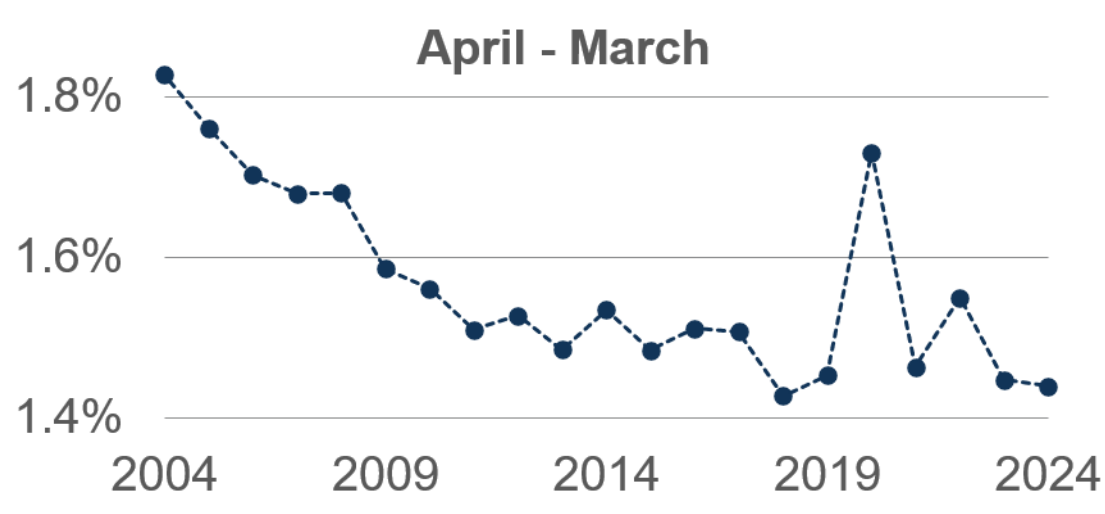


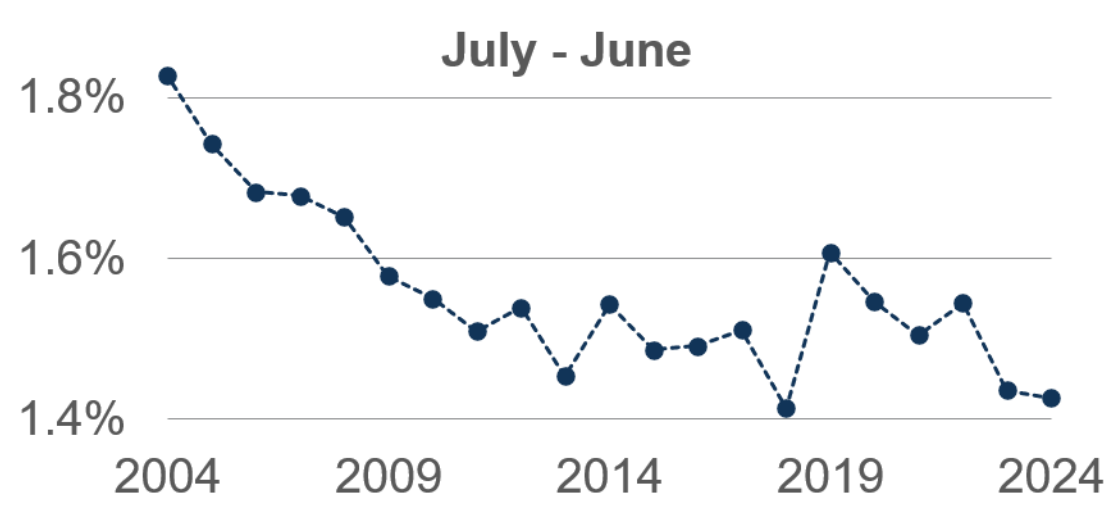
Non-calendar years

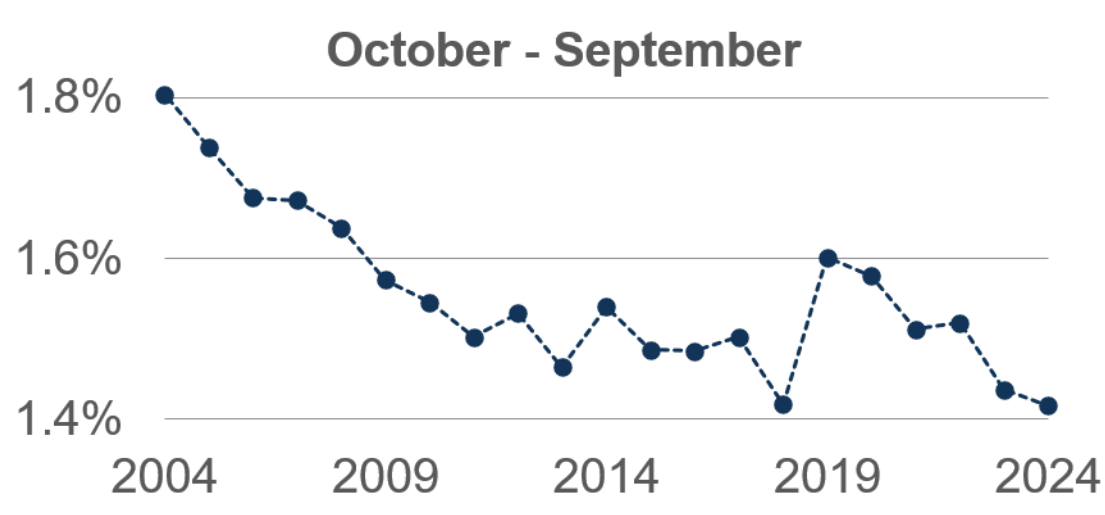
- We typically use calendar year data, and this has informed our view of the pandemic impact over time
- However, other periods give a different picture
- The following slide compares male ASMRs for years beginning in January, April, July and October

Non-calendar years









International use of the CMI Model

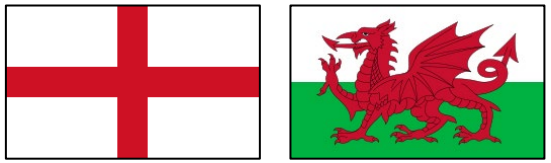
International use of the CMI Model

- The Core CMI Model is calibrated to data for England & Wales
- CMI Model software can easily use other datasets:
  - Direct link to Human Mortality Database (HMD)
  - Option for automatic adjustment of smoothing parameters for datasets of different sizes
  - Flexible overlay for different timing and impact of the pandemic
- CMI Working Paper 208 considers other countries

International use of the CMI Model

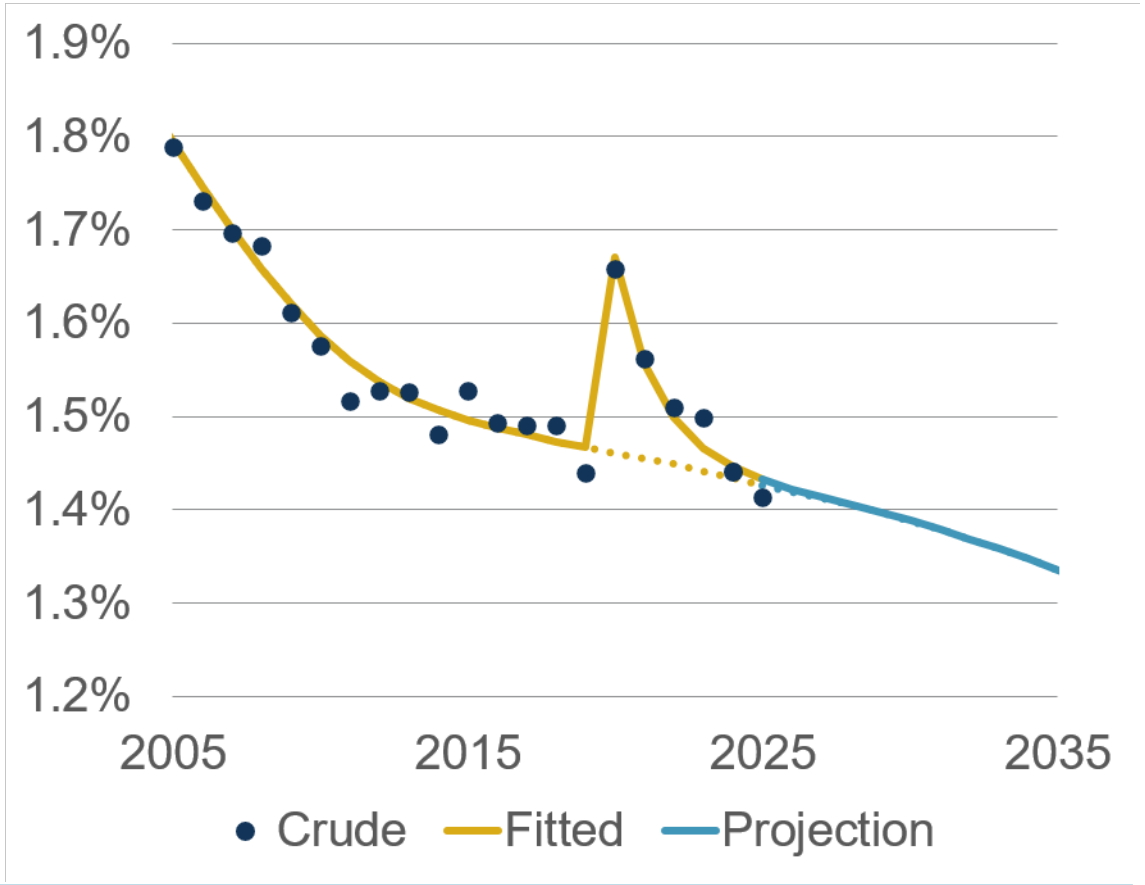
- We show indicative results for Italy, USA and Japan, using the latest available HMD data and simple modifications to the Core parameters
- **Results in this section are illustrative, and the use of particular methods, data or parameters here does not imply that we think they are suitable for any particular territory, age group, or portfolio, or for any other purpose**

England & Wales



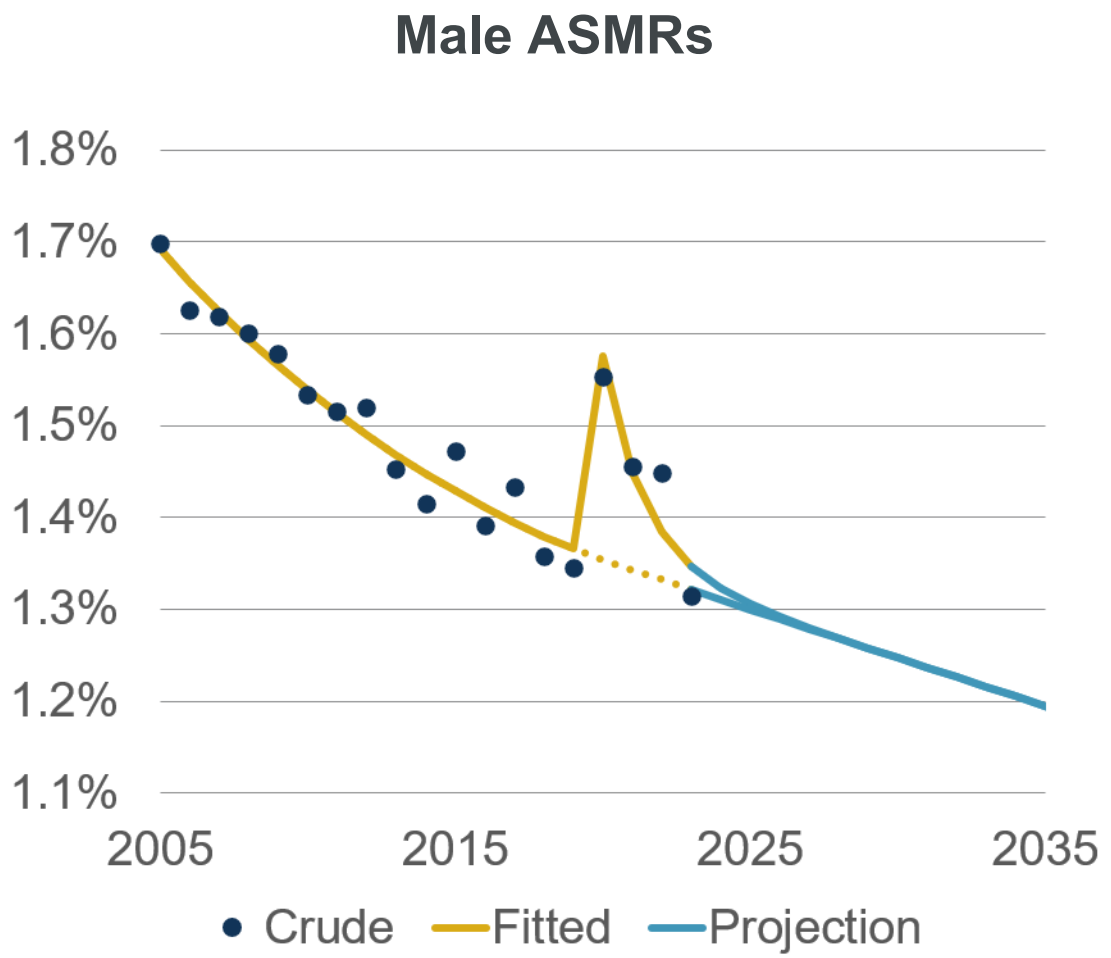
- Fitted to 1985-2025 data
- Pandemic impact starts in 2020
- Half-life of one year

Male ASMRs



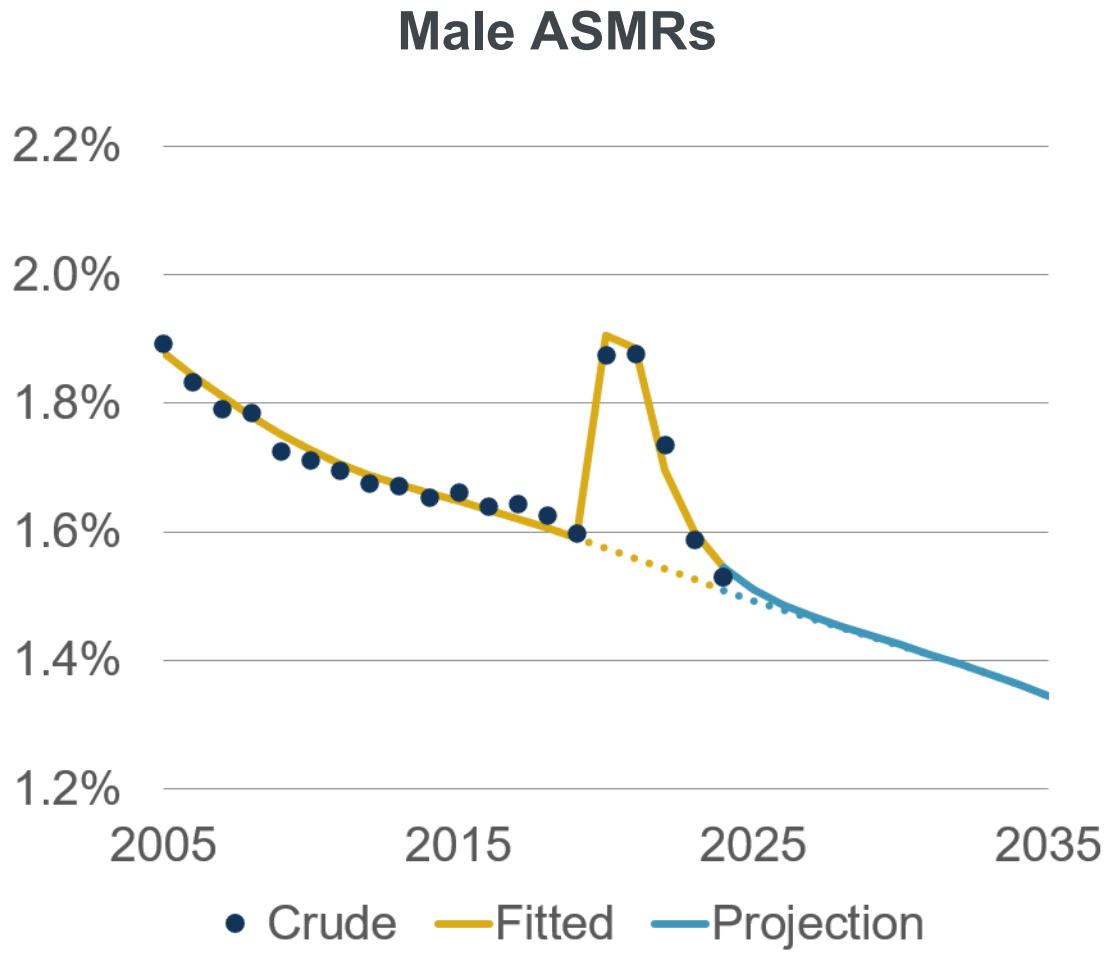
Italy

- Fitted to 1983-2023 data
- Pandemic impact starts in 2020
- Half-life of one year
- CMI Model Core assumptions do not seem unreasonable for Italy

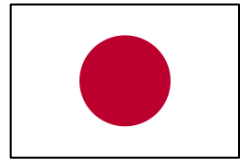


USA

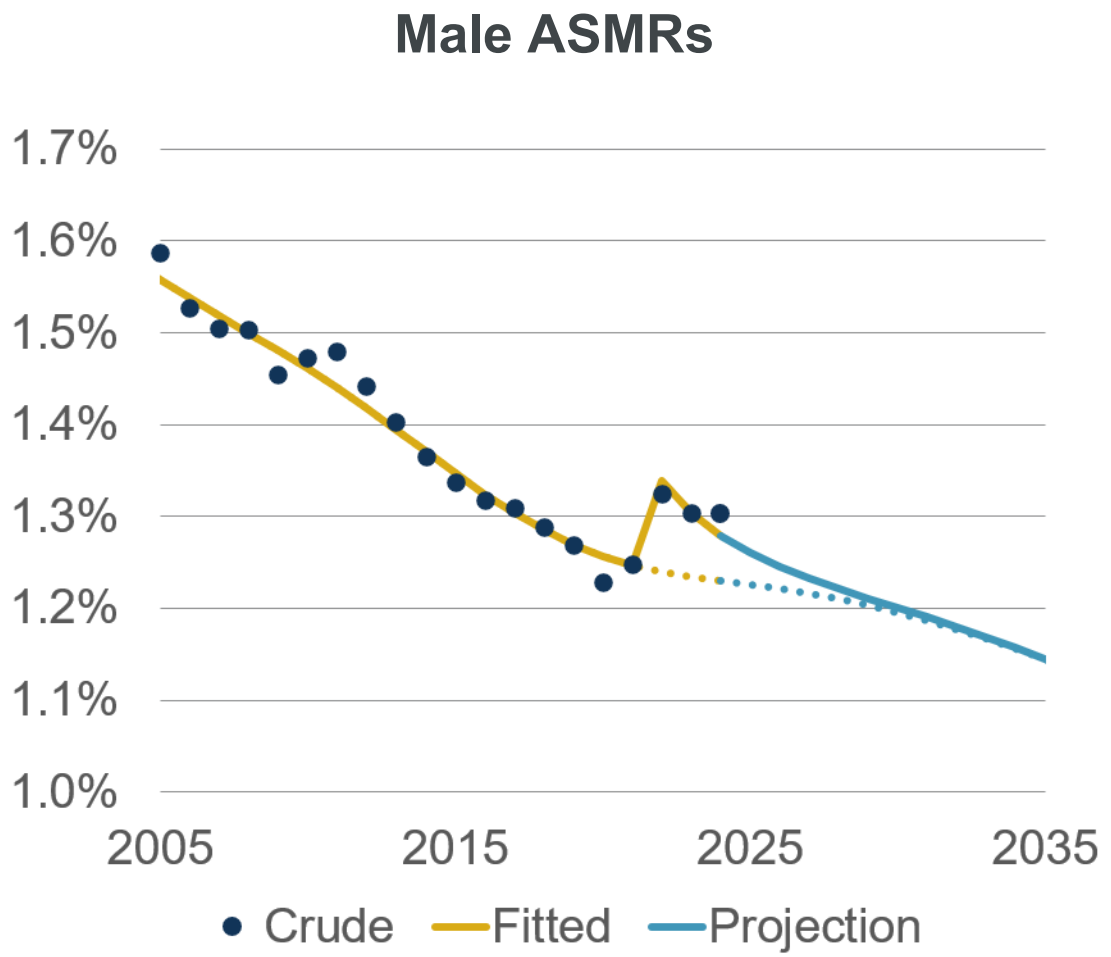
- Fitted to 1984-2024 data
- Equal pandemic impact equal in 2020 and 2021, then halving each year



Japan



- Fitted to 1984-2024 data
- Pandemic impact only starts in 2022, not in 2020
- Little change in mortality between 2022 and 2024: example uses a half-life of two years, not one year
- Too soon to model the pandemic run-off for Japan with confidence



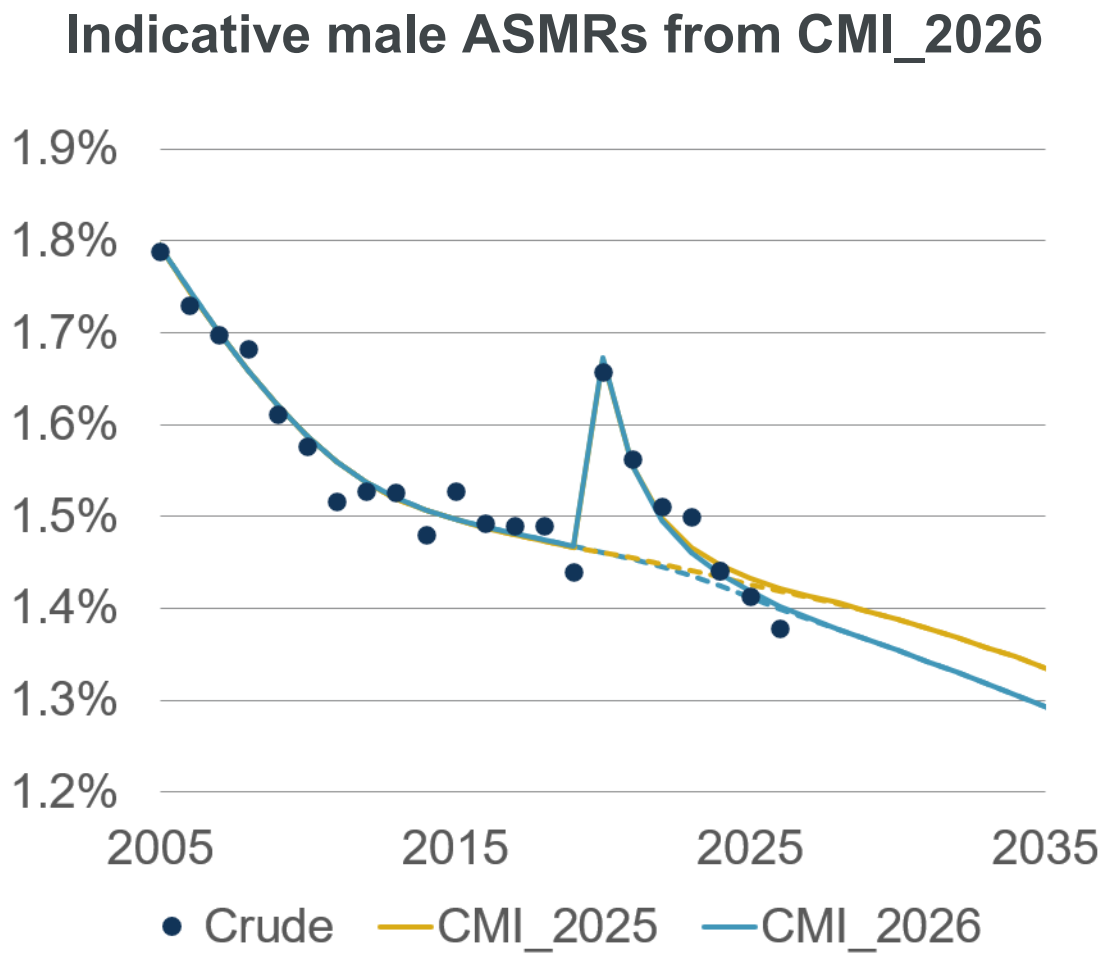
Current research

Recent and current research

- **Impact of 2026 data on the model**
- **Death registration delays**
- Non-calendar-year data
- High age population estimates
- Projection methods
- Mortality displacement
- Interaction between base mortality and improvements

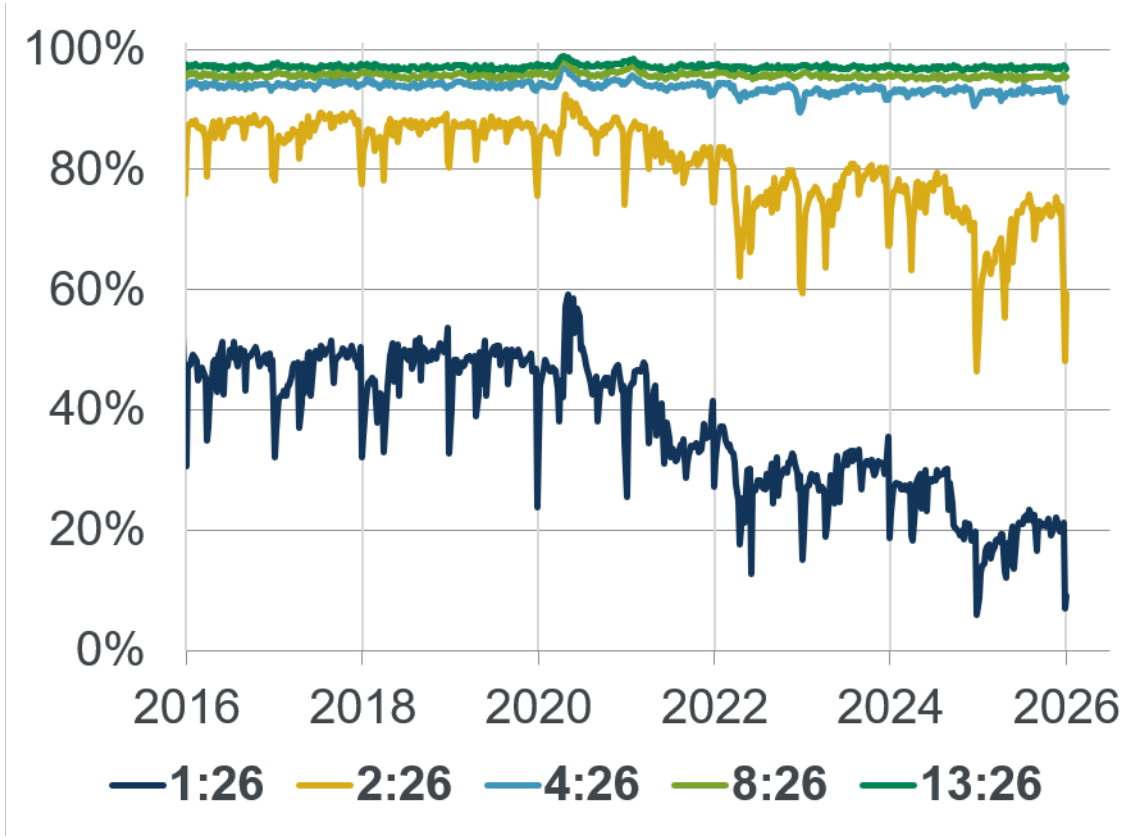
Indicative CMI_2026 (based on data to June)

- Fitted to 1986-2026 data for England & Wales
- Full weight for all years
- Explicit “overlay” to reflect the pandemic impact
- Data for 2026 here is based on experience to June, and will change
- Methods for CMI_2026 may change



Registration delays

- The CMI Model, and most CMI outputs, use deaths based on registration date
- Working Paper 211 considers the impact of instead using deaths based on date of occurrence, with an allowance for reporting delays
- Reporting delays have increased over time, particularly since reforms in September 2024, but the impact on the CMI Model is relatively small



"N:26" is the proportion of deaths registered within 26 weeks which were registered within N weeks

Questions
Comments

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Continuous Mortality Investigation Limited
Registered in England & Wales (Company number: 8373631)
Registered Office: 1-3 Staple Inn Hall, High Holborn, London, WC1V 7QJ

Correspondence address: Two London Wall Place, 123 London Wall, London, EC2Y 5AU, United Kingdom
Email: info@cmilimited.co.uk
Tel: +44 20 7776 3820

Website: www.cmilimited.co.uk (redirects to www.actuaries.org.uk)

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