



Continuous Mortality Investigation

Institute and Faculty of Actuaries

CMI update

Hamish Wilson Chair of CMI Assurances Committee
Jon Palin, Secretary of CMI Mortality Projections Committee

Presentation to IFoA Life Conference, 21 November 2019

CMI

CMI

- Wholly owned by Institute and Faculty of Actuaries
- Independent executive and management

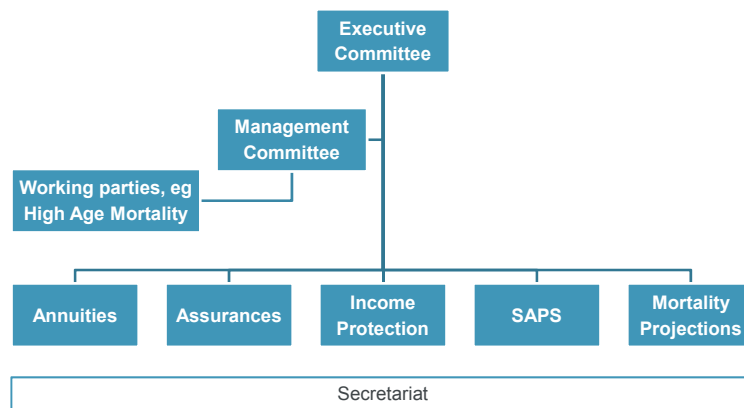
Funded by subscription but free for academics and non-commercial research

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.*

Our vision is to be regarded across the world as setting the benchmark for the quality, depth and breadth of analysis of industry-wide insurance company and pension scheme experience studies

CMI structure



Assurances

Assurances Committee activity

Date	Activity
December 2014	Experience report for 2007-2010 (WP75)
May 2016	Proposed "08" Series accelerated critical illness tables released for consultation (WP89)
October 2016	Proposed "08" Series term assurance mortality tables released for consultation (WP92)
January 2017	Final "08" Series accelerated critical illness and term mortality tables released (WP94)
June 2018	Experience report for 2011-2015 (WP108) and survey on future data collection / analyses
October 2018	Using the CMI Model for term assurances (WP110)
July 2019	Experience report for 2011-2016 (WP123)
November 2019	Additional analysis of 2011-2016 dataset (WP125)
Feb 2020	Experience report for 2016-2018

Aims of GLM analysis (WP125)

- To assess the fit of the "08" tables to the more recent data
 - are new tables are warranted?
- To understand better the underlying risk drivers of experience
 - One-way analysis (A/Es) can double-count high or low experience
 - Generalised Linear Models (GLMs) consider the effects of multiple factors simultaneously
- Provide (large) data contributors with useful benchmarking analysis.

2011-2016 Term assurances dataset

- “All offices” results for 2011-2016 issued with Working Paper 123 in July 2019
- UK term assurances issued on standard rates
- 44,000 mortality (including terminal illness) claims and 39,000 accelerated critical illness
- Consistent data contributors (apart from 2014)
- Includes an allowance for late-reporting – in particular, for 2016.



21 November 2019

IFoA Life Conference 2019 - CMI update

7

2011-2016 GLM dataset

- Dataset used in GLM analysis is a subset of “all offices” results for 2011-2016; we excluded data for:
 - Young and old ages, to use 30 to 60 for accelerated critical illness and 35 to 70 for term mortality, consistent with the 2007-2010 analysis
 - Family Income Benefit (FIB) policies
 - Multi-tie and unknown distribution channel
- 38,000 term mortality claims and 34,000 accelerated critical illness
- Includes:
 - Age, gender, smoker status, duration
 - Office
 - Distribution channel (bancassurance, IFA, non-intermediated and single-tie)
 - Sum assured band (initially £0-£25k, £25k-£75k, £75k-£125k and £125k+)
 - Product type (predominantly level and decreasing)
 - Commencement year
 - Calendar year
 - Single/joint life status.

21 November 2019

IFoA Life Conference 2019 - CMI update

8

2011-2016 GLM methodology

- GLM analysis used a number of models
- All models use expected claims as an “offset” term, starting with the “08” Series accelerated critical illness and term mortality tables (“AC08” and “T08”)
- GLMs only model the additional effects of the various factors, on top of those already incorporated in the tables (i.e. gender, smoker status, age and duration)
- We used 3 models to assess and adjust the fit of the “08” tables to the 2011-2016 data
- After adjusting the 08 rates, we used:
 - Simple Model:
Office + Calendar Year + Product Type + Distribution Channel + Sum Assured Band + [Commencement Year]
 - Office Interaction Models; eg:
Log(Claims)=Log(Expected Claims) + Office + Sum Assured Band + Office:Sum Assured Band
 - Gender / Duration / Sum Assured Band model
Gender + Duration + Sum Assured Band + Gender:Duration + Gender:Sum Assured Band + Duration:Sum Assured Band

Assessing the fit of the “08” tables to the 2011-2016 data

Accelerated critical illness

- Statistically significant differences for gender, smoker status and duration
- Age was not significant
- Experience in 2011-2016 generally lower than AC08 rates
- But higher at short durations for non-smokers

Term mortality

- Statistically significant differences between gender, age and duration
- Experience in 2011-2016 generally lower than T08 rates
- But higher for females at short durations

Conclusions

- We should consider producing a new set of tables
- Propose to use the dataset to 2018
- Commence work in 2020, after releasing the “all offices” results.

Experience by risk factors

Having re-shaped the AC08 and T08 tables:

- We looked at the experience by Office, sum assured band, distribution channel, product type, calendar year and commencement year (mortality only)
- Single/joint life status was not significant for ACI or mortality.

Accelerated critical illness

Key drivers are:

- Office and
- Sum assured band

Term mortality

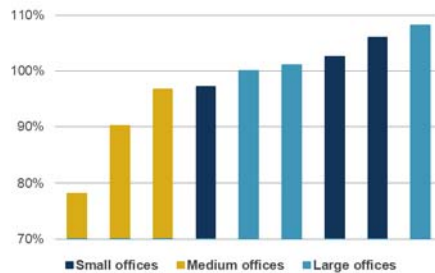
Key drivers are:

- Sum assured band
- Distribution channel and
- Calendar year
- (Not office)

Experience by office

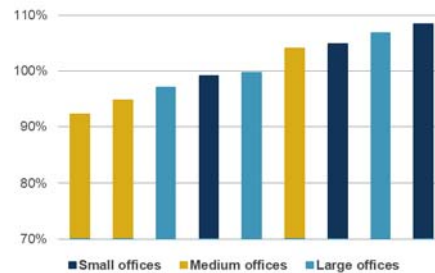
Accelerated critical illness

- Statistically significant variable
- One office appears to have very light experience ...
- Others vary from 90% to 108%



Term mortality

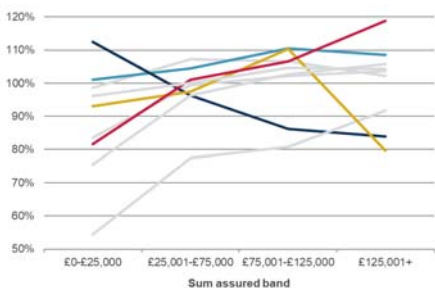
- Experience varies from 92% to 108%
- Model suggests
 - NOT statistically significant...
 - No need to adjust after allowing for sum assured band and distribution channel.



Experience by sum assured band

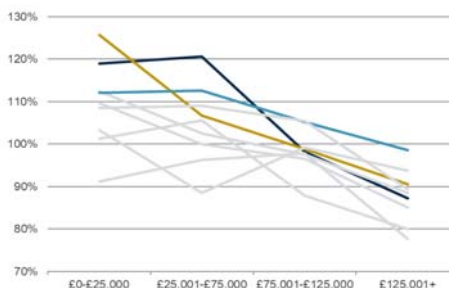
Accelerated critical illness

- Statistically significant variable
- Lowest sums assured have the lightest experience ...
- but not true for all offices



Term mortality

- Statistically significant variable
- Clear pattern of reducing experience with increasing sum assured ...
- holds for most offices



21 November 2019

IFoA Life Conference 2019 - CMI update

13

Evidence of antiselection?

Accelerated critical illness

- Some evidence of antiselection for females
- Less clear for males

Term mortality

- Strong evidence of positive selection for males and females
- Limited number of claims at short durations

Female experience by duration for highest sum assured bands



21 November 2019

IFoA Life Conference 2019 - CMI update

14

Annuities

Reordering of Annuities Committee activity

Original plan

2011-16 all offices results
Working Paper 117 (Feb 2019)

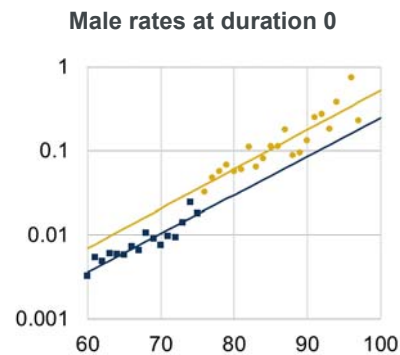
Draft "14" Series tables
using 2013-16 data (Nov 2019)

2015-18 all offices results
(Dec 2019)

Final "14" Series tables
using 2013-16 data (Feb 2020)

Annuities graduations – key challenges

- More granular data than for “08” tables, so more tables
 - by product
 - potentially by duration
- First and second lives
 - Unable to distinguish the for many offices
 - Differences in durational effects
- Young ages



Data and G(2) fit, ages 60-75 only

Data and G(2) fit, ages 76-100 only

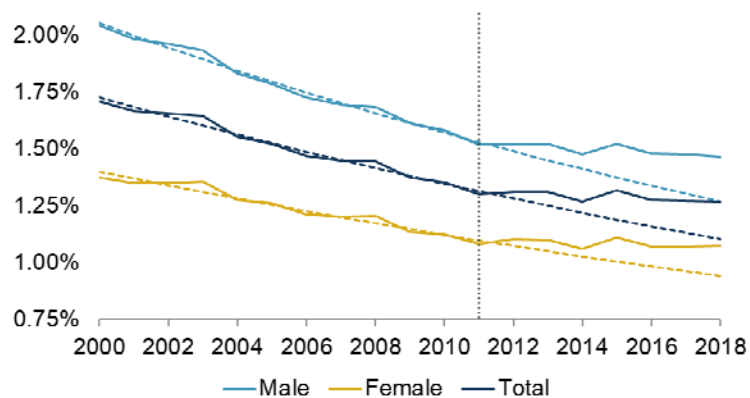
Mortality Projections

Mortality Projections Committee activity

- **CMI Mortality Projections Model**
 - Updated annually with new data – CMI_2019 due February/March 2020
 - Occasional updates to the method – including CMI_2018 in March 2019
- **Monitoring mortality**
 - Quarterly reports on the general population of England & Wales
 - Q3 2019 published in October 2019; end-2019 due in January 2020
- **Annual “interim update” working papers**
 - Various analyses, intended to be of interest to users of the Model
 - Next one due in December 2019 – some provisional results here

Historical mortality rates

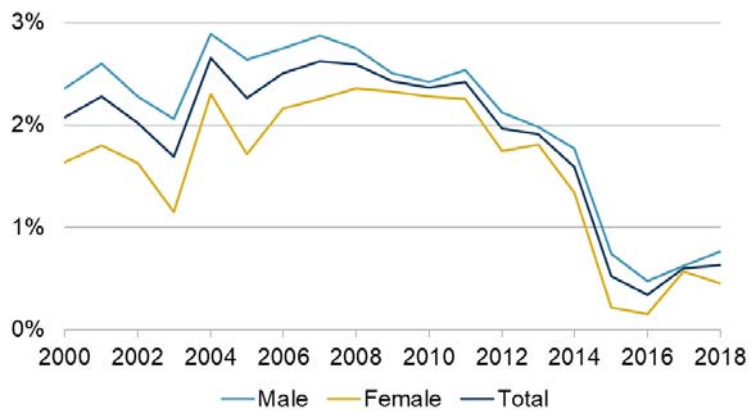
Standardised mortality rates (age 20-100) with 2000-2011 trend lines



Source: CMI calculations based on ONS data for England & Wales.

Historical mortality improvements

Five-year average standardised mortality improvements (age 20-100)



Source: CMI calculations based on ONS data for England & Wales.

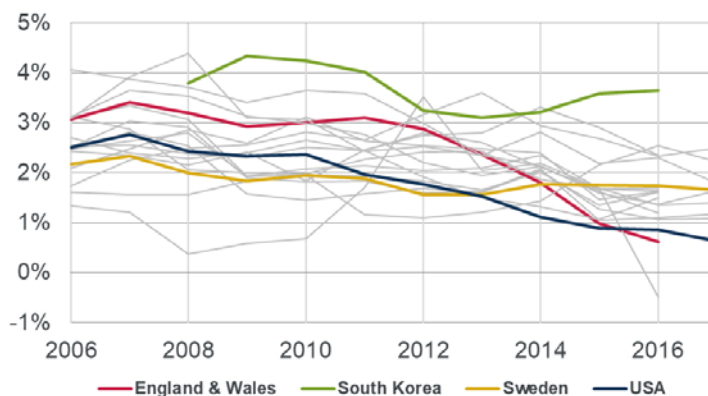
21 November 2019

IFoA Life Conference 2019 - CMI update

21

International comparison (provisional)

Five-year average standardised mortality improvements (age 65-89)



Source: CMI calculations based on Human Mortality Database.

21 November 2019

IFoA Life Conference 2019 - CMI update

22

Quarterly mortality monitoring

- Based on provisional weekly deaths data, published by the ONS
- Turn raw death counts into standardised mortality rates
- A public service, and an “early warning” for the next version of the Model

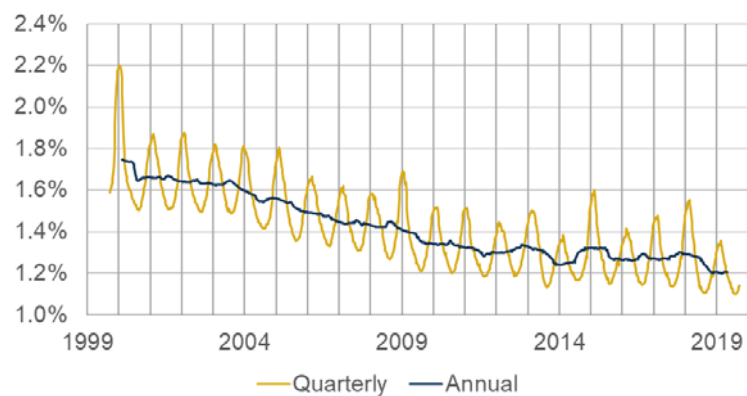
21 November 2019

IFoA Life Conference 2019 - CMI update

23

Seasonal mortality

Quarterly and annual average standardised mortality



Source: CMI calculations based on ONS data for England & Wales.

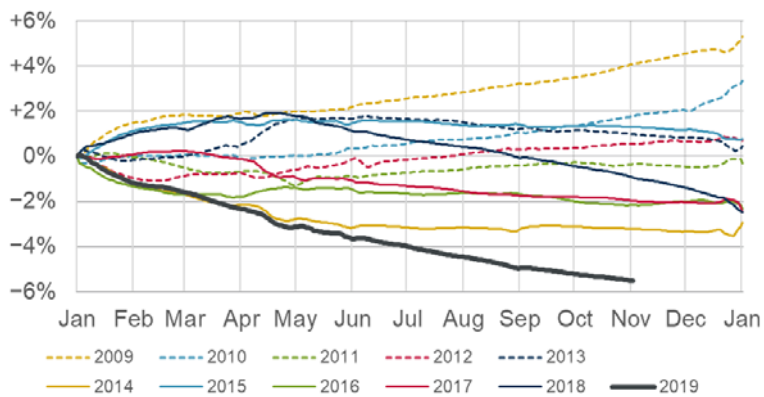
21 November 2019

IFoA Life Conference 2019 - CMI update

24

Relative mortality

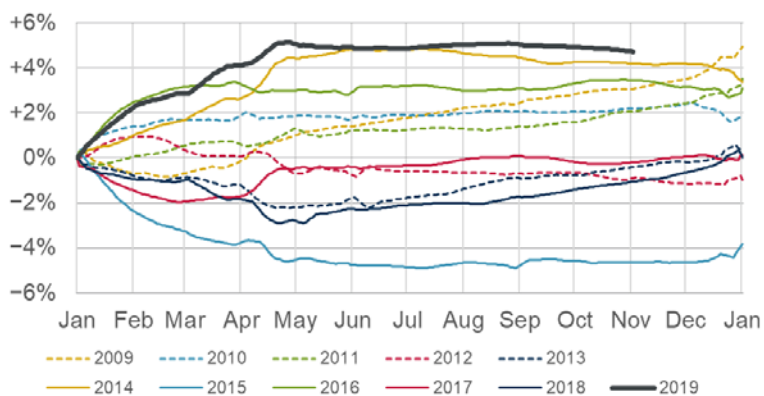
Cumulative standardised mortality relative to the 2009-2018 average



Source: CMI calculations based on ONS data for England & Wales.

Mortality improvements

Cumulative annual standardised mortality improvement



Source: CMI calculations based on ONS data for England & Wales.

CMI_2019

- No changes in method planned
- Based on data to early-November, we might see an annual improvement of around 4.5%
- That would lead to an increase in life expectancy of
 - 0.75% (males)
 - 0.6% (females)
- But experience in November and December could change this.

Approximate change in life expectancy at age 65, between CMI_2018 and CMI_2019, for different improvements in 2019

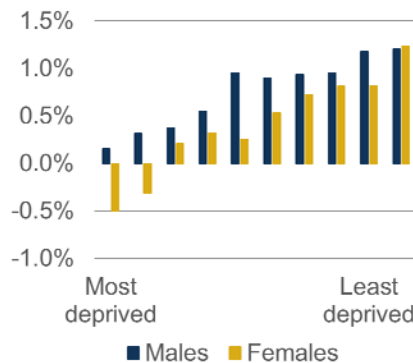
Improvement	Male	Female
+6%	+1.3%	+1.1%
+3%	+0.2%	+0.1%
0%	-1.0%	-0.9%
-3%	-2.3%	-1.9%

Source: CMI calculations. Life expectancies use S3PxA tables, and an illustrative long-term rate of 1.5% p.a.

Making the Model work for your population

- Model is calibrated to the general population of England & Wales.
- It is typically applied to pensioner or insurance portfolios, which may have different characteristics.
- In recent years, higher socio-economic groups in England & Wales have had higher improvements.

Improvements by deprivation decile, 2001-2017, England & Wales



Source: CMI calculations, using ONS data by Index of Multiple Deprivation

How to adjust initial improvements?

- Period smoothing parameter (S_K)
 - Intended to reflect how quickly we recognise new data
 - Some users have used it to modify initial improvements
 - But impact on improvements of a given change in S_K varies over time
- Recommend use of the “initial addition to mortality improvements” (A)
 - Introduced in CMI_2018
 - Specifies additional initial age-period improvements at ages 20-85
 - Tapers to nil at age 110 (like the Core shape of the long-term rate)
 - Affects historical improvements also; relevant since the base table date
- Software has recently been updated to allow “A” to be used with Advanced parameters
- More complex changes possible using Advanced parameters

How much to adjust initial improvements?

- Historical analyses of specific datasets can be a guide to past differences in mortality improvements.
- For projections, also need to consider other factors, including:
 - Credibility of analyses – statistical uncertainty, and any artefacts of the data
 - Which factors have caused past differences, and whether they are likely to persist
 - The extent to which mortality rates for different groups may converge or diverge over the convergence period

Analyses of improvements in CMI datasets

- SAPS – included in previous interim papers, to be updated in December, including review of method
- Assurances – included in the interim paper for the first time, but hard to draw firm conclusions due to numbers of deaths
- Annuities – currently analysing the 2015-2018 dataset, and will then look at improvements

Uncertainty in population data

- Following the 2011 census, the ONS revised its population estimates.
- If revisions to 2012-2020 data following the 2021 census were the same size as revisions to 2002-2010 data following the 2011 census, then:
 - male life expectancy could fall by around 0.8%
 - female life expectancy could fall by around 0.5%
- Note that this is an indication of uncertainty, not a prediction, and methods for the 2021 census will be different from the 2011 census.
- See the interim update paper for more details.

Interim update working paper

- Already discussed:
 - Mortality improvements by IMD
 - International mortality improvements
 - Mortality improvements for CMI datasets
 - Uncertainty of population estimates
- Also:
 - How seasonal mortality varies by IMD
 - Calibrating the Model to UK, Scotland or Northern Ireland

Longer term plans

- No specific changes to the Model planned
- Survey at <https://tinyurl.com/MPCsurvey2019>
 - Asking for views on the Model, and MPC's wider work
 - Responses by 31 December
- If we make changes, potentially coincide with post-census changes to exposure data.
- Feedback always welcome at projections@cmilimited.co.uk

For completeness

Income Protection Committee activity

Date	Activity
July 2010	IPM 1991-98 graduations finalised (WP48)
February 2012	Experience report for 2003-2006 (WP60) Summary statement of revised methodology (WP59)
April 2014	IP Rate Table Tool released to help practitioners make use of published graduations
April 2014	Report and database of experience by cause of sickness, 1991-2009 (WP72)
March 2017	Experience report for 2007-2010 (WP96)
August 2017	Report on 2003-2010 experience by benefit amount and policy duration (WP102)
July 2018	Proposed "IP06" claim inceptions rates (WP109)
Mar 2019	Final "IP06" claim inceptions rates (WP120)
September 2019	2011-16 experience report (WP124)
Spring 2020	New terminations graduations expected to be released for consultation

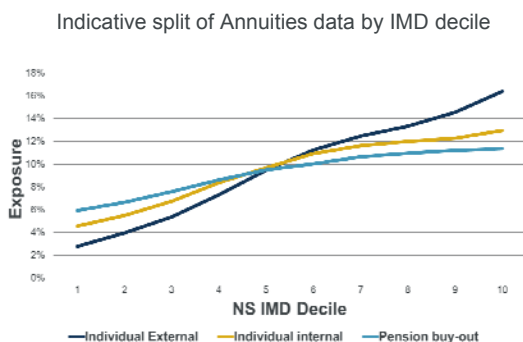
SAPS Committee activity

Date	Activity
Nov 2015	Mortality experience by industry classification of SAPS pensioners for the period 2006-2013 (WP86)
Feb 2016	Mortality experience of SAPS pensioners for the period 2007-2014 (WP88)
Feb 2017	Mortality experience of SAPS pensioners for the period 2008-2015 (WP95)
Jan 2018	Mortality experience of SAPS pensioners for the period 2009-2016 (WP104)
May 2018	Proposed "S3" Series mortality tables released for consultation (WP107)
Dec 2018	Final "S3" Series mortality tables (WP113)
Feb 2019	Mortality experience of SAPS pensioners for the period 2010-2017 (WP118)
May 2019	Mortality experience by industry classification of SAPS pensioners for the period 2009-2016 (WP121)
Dec 2019	Mortality experience of SAPS pensioners for the period 2011-2018

And finally...

The CMI Postcode mapping tool

- CMI keen to analyse mortality/morbidity by socio-economic status
- We are now seeking a data field that data contributors have pre-mapped from postcode to the Index of multiple deprivation
- The tool generates two measures:
 - A UK-wide academic measure
 - A Country- or region-specific measure (splitting England into nine regions)



Future CMI investigations

- Responses to survey of Subscribers in 2018 included lots of suggestions for future work
- “New” areas now under consideration include :
 - Guaranteed acceptance Whole of Life plans
 - Lapses under protection products
 - Enhanced annuities
 - Redemptions under Equity Release Mortgages
 - Persistency of workplace pensions





Questions



Comments

The views expressed in this presentation are those of the presenters.

If you have questions after the session, please email
info@cmilimited.co.uk

Follow the CMI on Linked-in to receive updates:
<https://www.linkedin.com/company/continuous-mortality-investigation/>



Continuous Mortality Investigation

Institute and Faculty of Actuaries

Continuous Mortality Investigation Limited
 Registered in England & Wales (Company number: 8373631)
 Registered Office: 7th floor, Holborn Gate, 326-330 High Holborn, London, WC1V 7PP

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)

Continuous Mortality Investigation Limited ('the CMI') is wholly owned by the Institute and Faculty of Actuaries.

Disclaimer: This document has been prepared by and/or on behalf of Continuous Mortality Investigation Limited (CMI). This document does not constitute advice and should not be relied upon as such. While care has been taken to ensure that it is accurate, up-to-date and useful, CMI will not accept any legal liability in relation to its contents.

© Continuous Mortality Investigation Limited