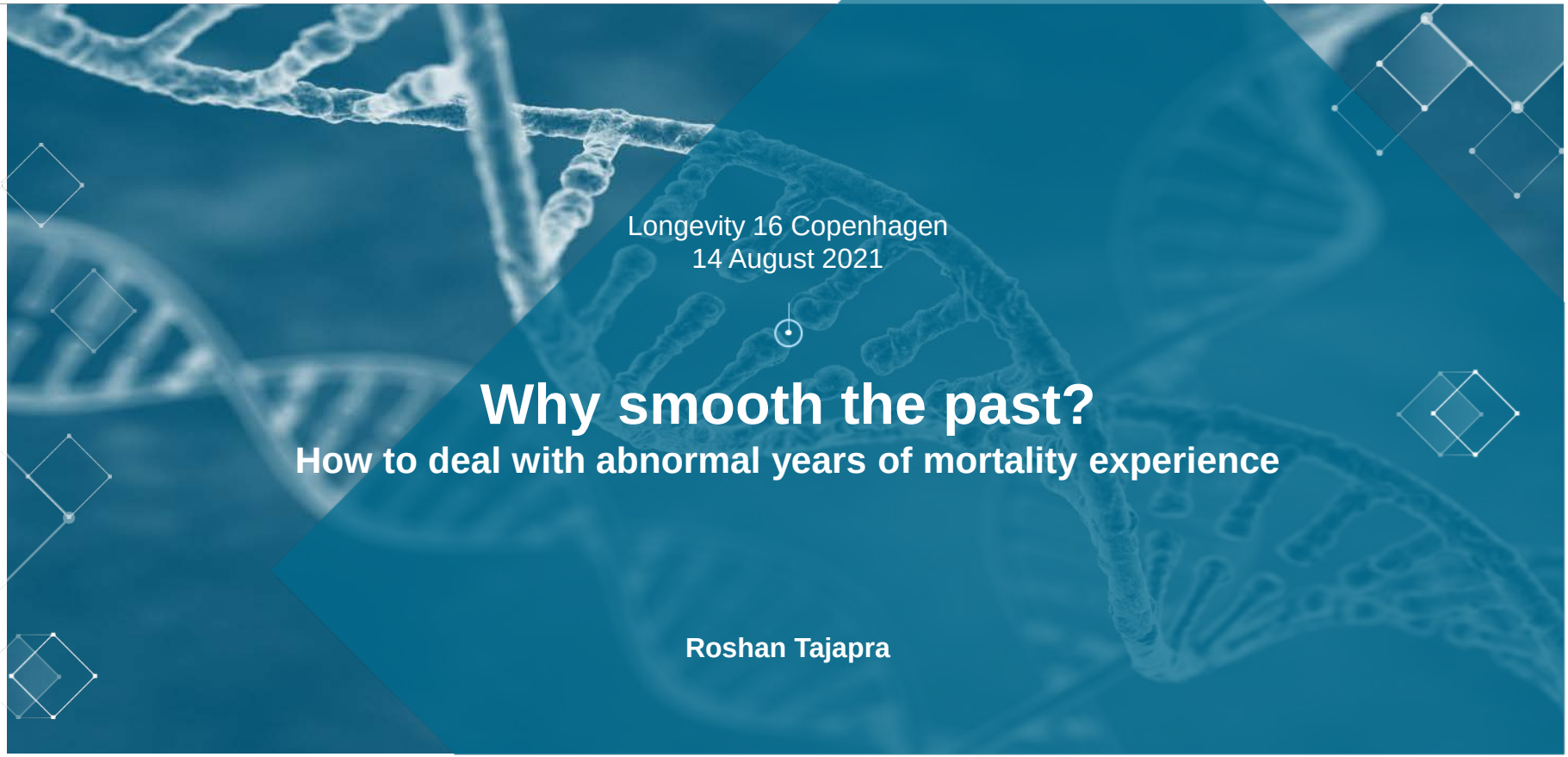


Longevity 16 Copenhagen
14 August 2021

Why smooth the past?

How to deal with abnormal years of mortality experience

Roshan Tajapra

SCOR The Art & Science of Risk | Life

AGENDA

1. **Introduction**
2. The Elephant in the Room
3. An Elegant Solution?
4. Practicalities
5. Conclusion

Introduction

- Exceptional mortality in 2020/21 poses a problem for setting base mortality rates
- Many actuaries ignoring or applying limited credibility to 2020/21 data for future experience analyses
- A better solution exists!
- Here we provide a framework to allow inclusion of outliers

Longevity 101

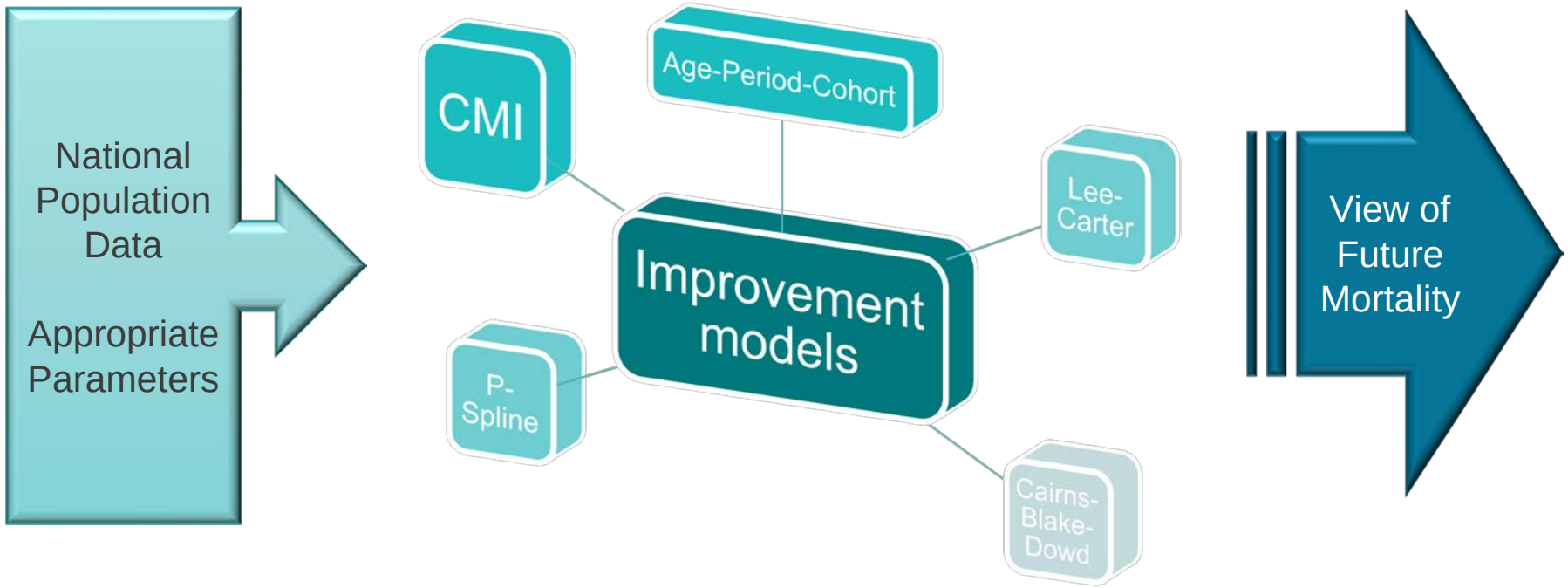
Base Mortality

(Population) Size Matters!

Graduation methodology

- **Large population:**
  - ✓ Graduate own experience directly
- **Mid-sized population:**
  - ✓ Compare own experience to reference mortality table, and adjust if necessary
- **Small population:**
  - ✓ Use most appropriate reference table
- Group by appropriate rating factors (postcode, wealth, health, etc)
- Keep assumptions up to date using latest experience data

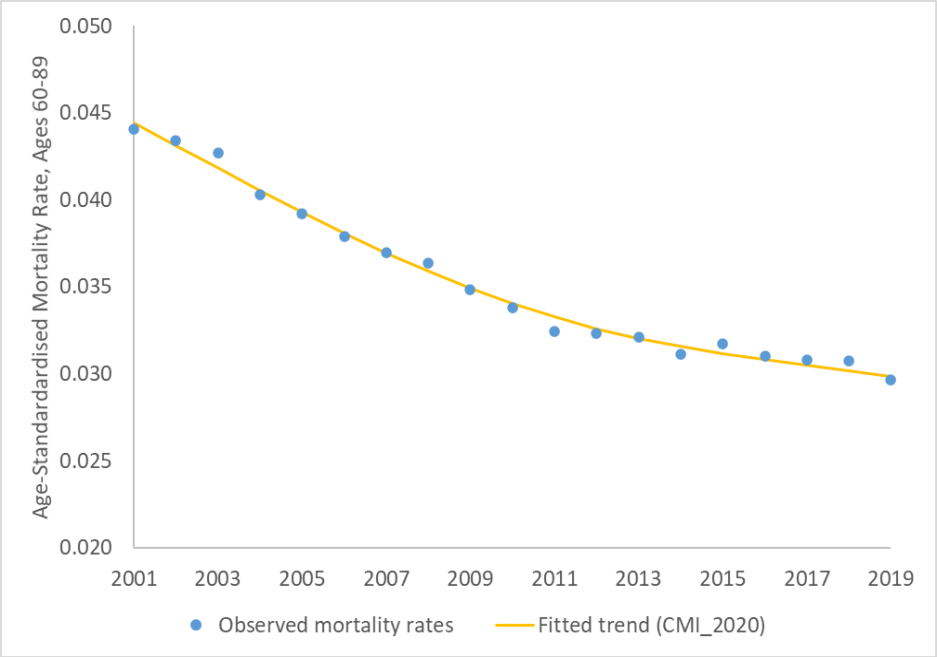
Mortality improvements



Past Improvements

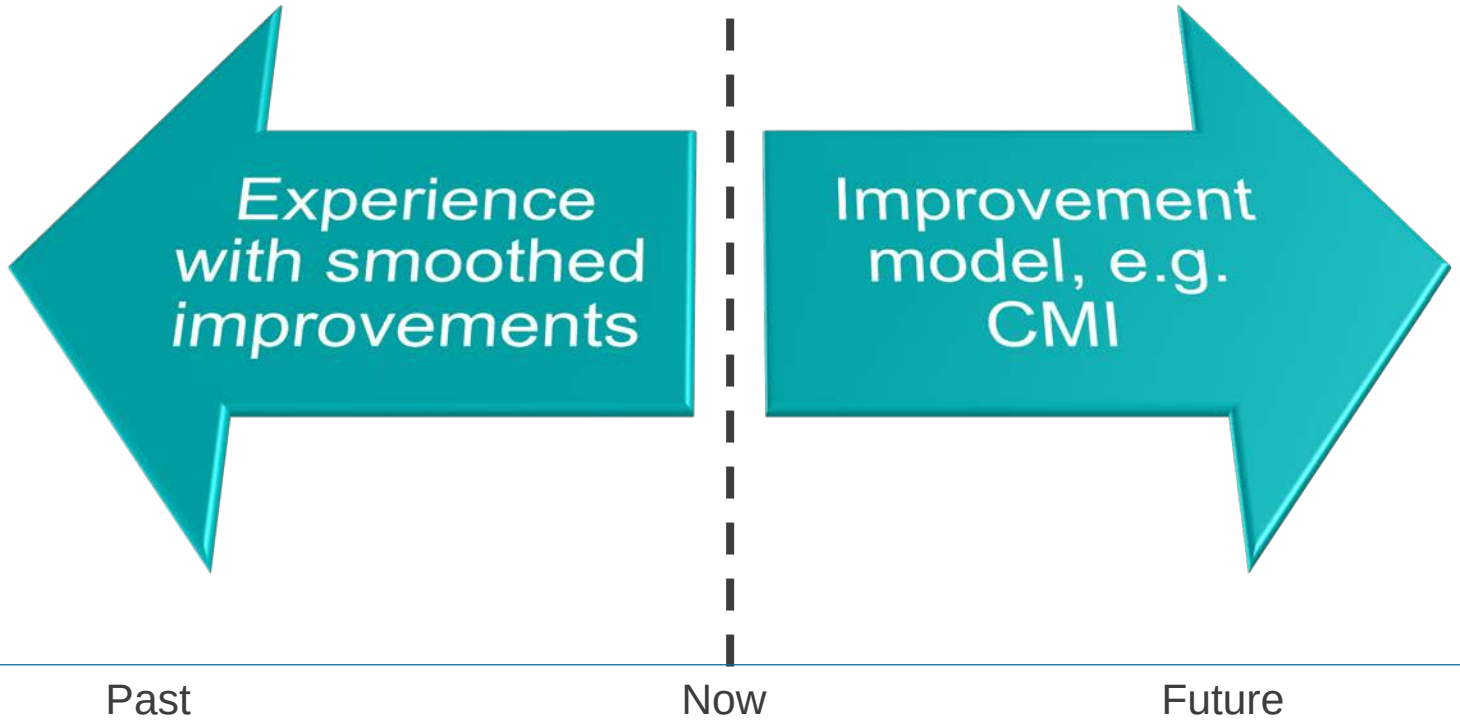
Bringing Base Mortality up to Date

- Reference mortality tables graduated using experience across several years
- Require past view of improvements to bring mortality table up to date
- But we already have this!
- Improvements models give **smoothed** view of past



Source: own calculations using national population data for E&W, age-standardized using European Standard Population 2013

Summary of Current Position



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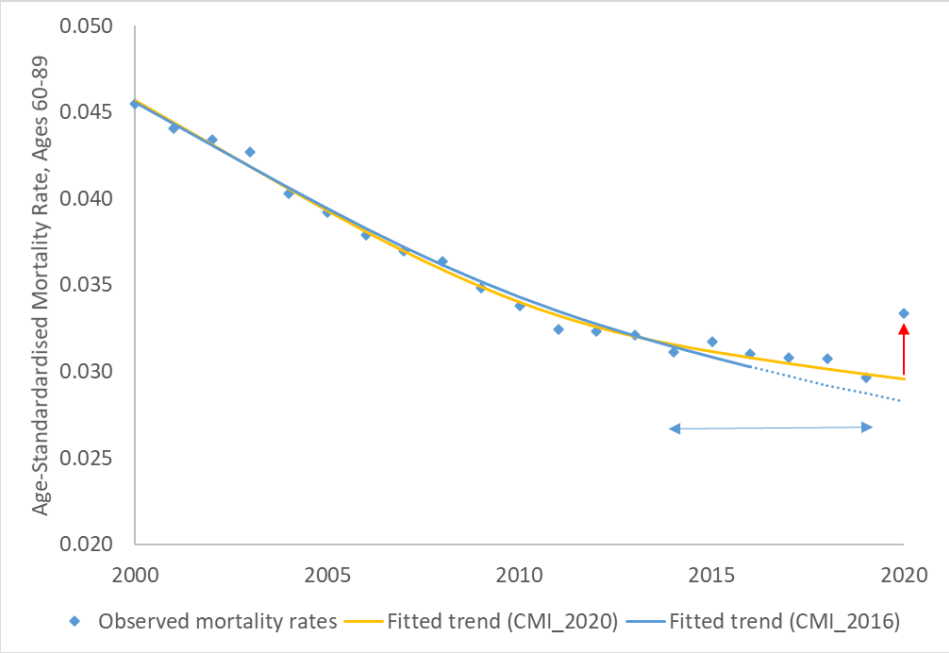
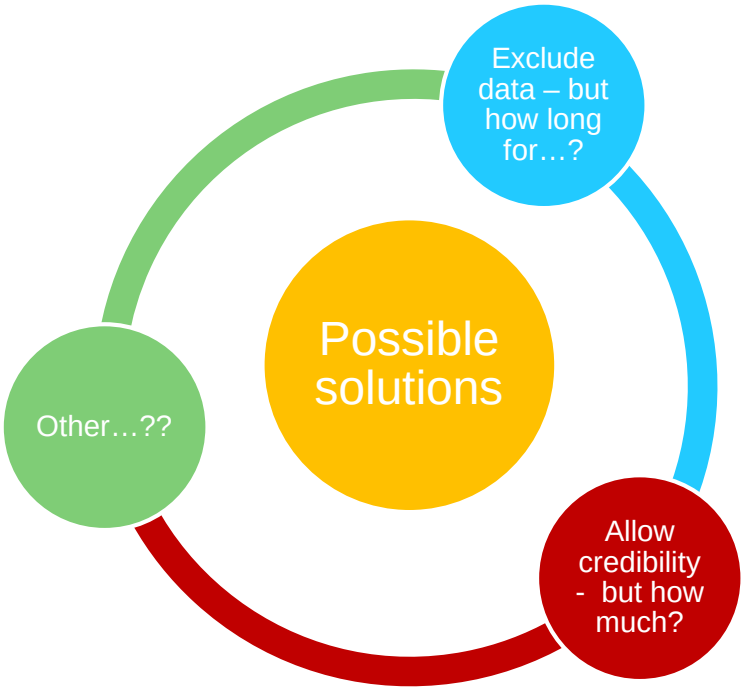
The Elephant



How to deal with COVID?



The Epicycle Solutions

- Could exclude data, but this feels like bad science…
- Allow pandemic years some credibility. But how to determine how much? And what if pandemic lasts longer than 2 years?
- Use more years of pre-pandemic experience? But this places more reliance on past improvements basis…

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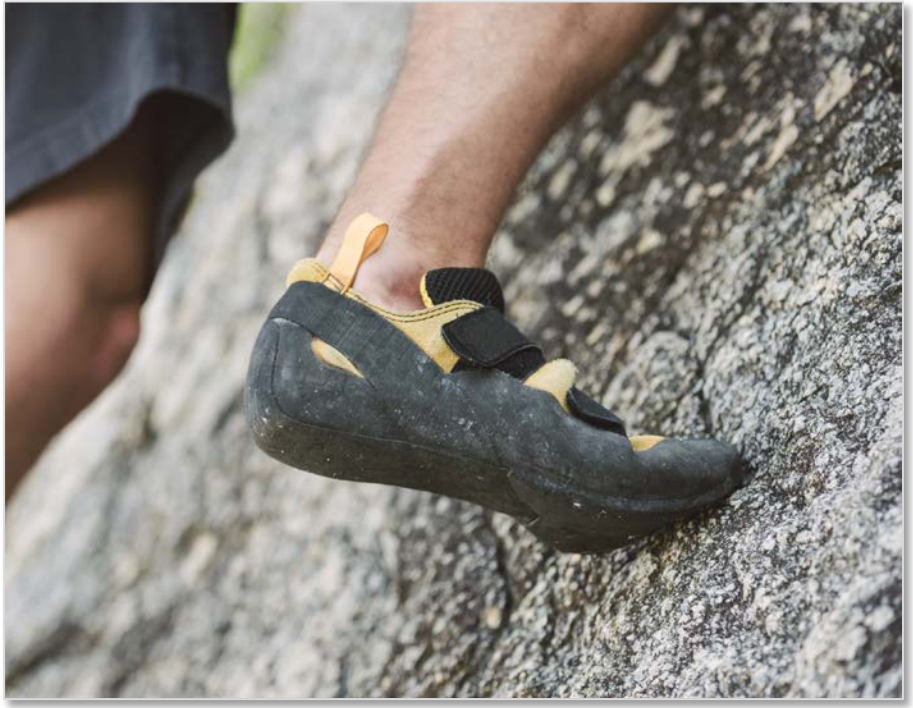
Our solution

A more elegant solution…

e into future

past year

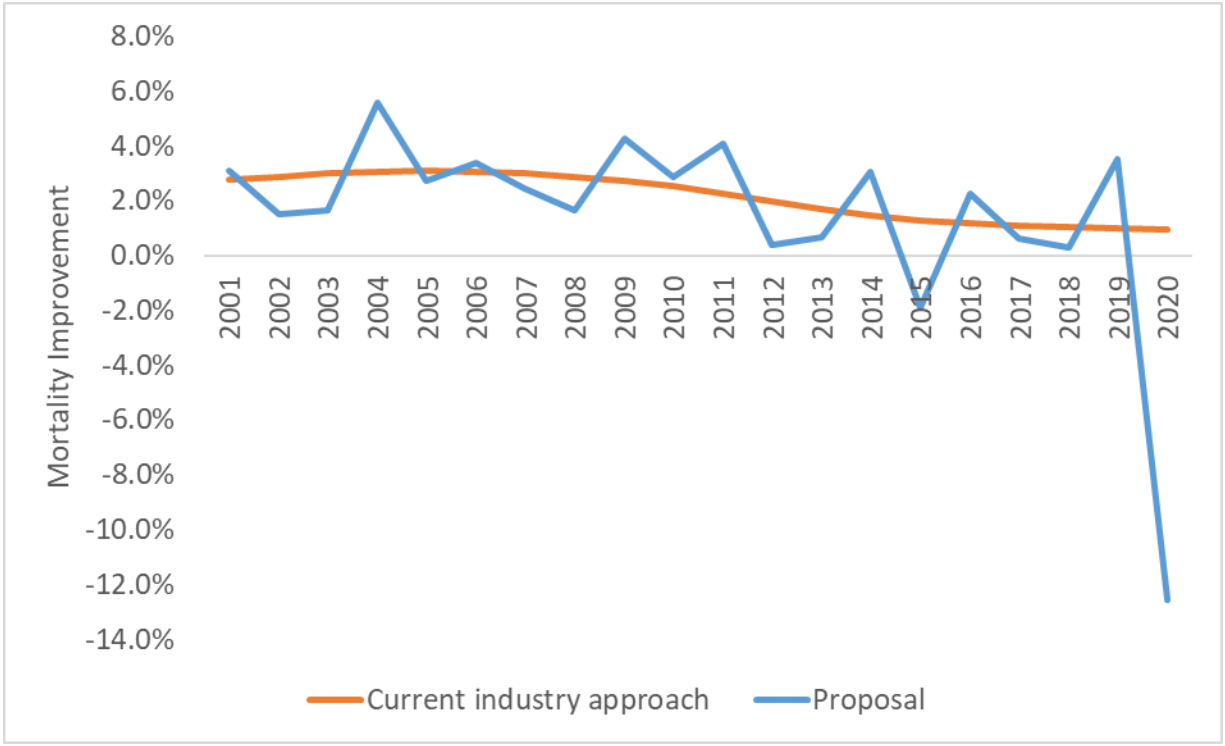
Consideration points



Challenges

- Mortality improvement are normally calculated using national population data.
- Need to be careful if last observed improvement is not in line with expected trends, else we may lock in a step change in mortality
- Still require some age smoothing to avoid unusual mortality artefacts in the base tables

Summary


8.0%
6.0%
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2.0%
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-4.0%
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-8.0%
-10.0%
-12.0%
-14.0%
Mortality Improvement
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Current industry approach
Proposal

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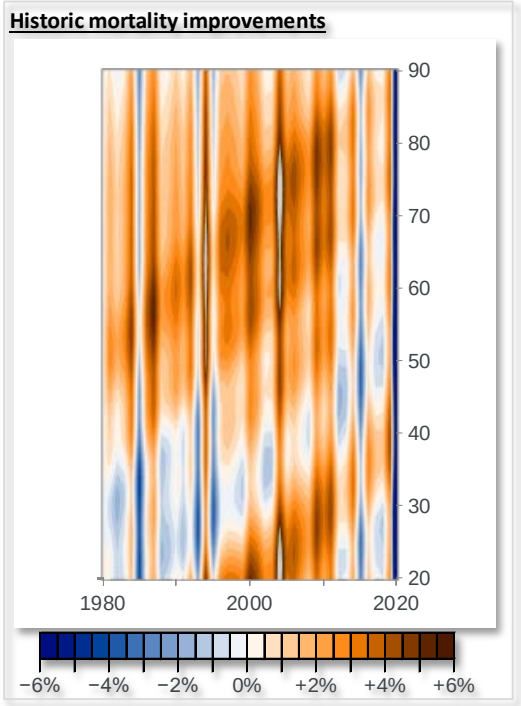
Implementation

Practicalities

CMI2020_M, S(k) = 0

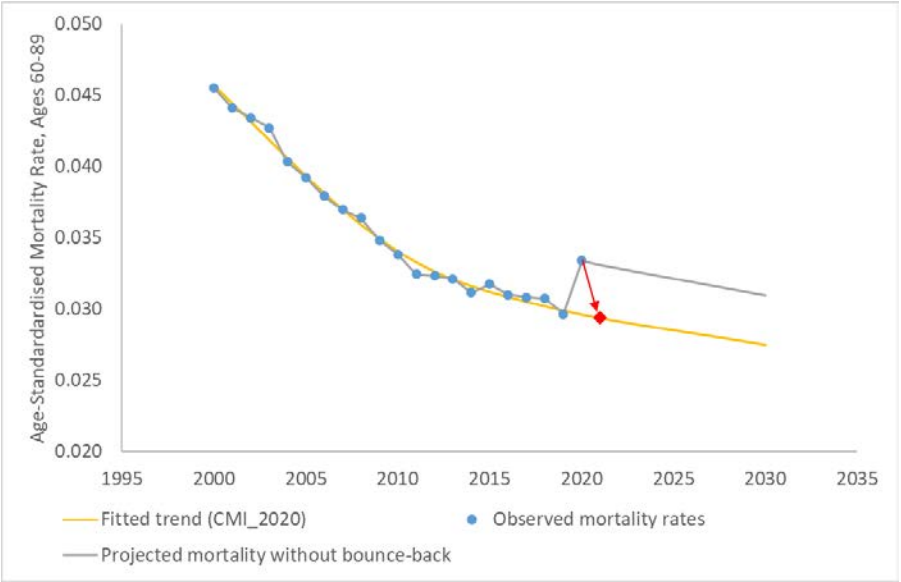


The Bounce-Back Adjustment

Setting the initial rates

- By removing period smoothing, we don't have a sensible starting point for the projection.
- Without adjusting the projection, unusual results will be locked in for all future years
- The solution?
  - Define prior view of mortality trend
  - Derive improvement rate required in 1st year of projection to revert final observed mortality rate to the prior view.

Don't lock unusual mortality into the trend basis!



Base Table Adjustment

Watch out for double counting!

- Graduated reference tables include a prior view of past mortality improvement
  - E.g. SAPS S3 tables graduated using CMI_2017
- This may lead to double counting!
- The solution?
  - Adjust base tables to:
    1. Remove prior view of improvements
    2. Add unsmoothed past improvement

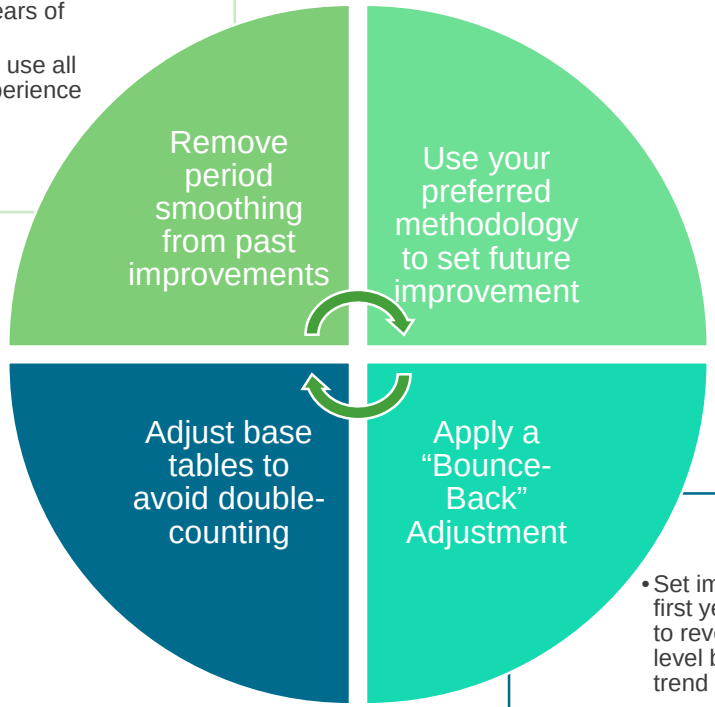
Extreme example

	y1	y2	y3	y4	y5	Total
Actual deaths	990	1010	995	1150	980	5125
Expected deaths (smoothed imps)	1000	1000	1000	1000	1000	5000
A/E	99%	101%	100%	115%	98%	103%

	y1	y2	y3	y4	y5	Total
Actual deaths	990	1010	995	1150	980	5125
Expected deaths (unsmoothed imps)	992	1007	991	1154	984	5128
A/E	99.8%	100.3%	100.4%	99.7%	99.6%	99.9%

Summary

- This captures abnormal years of data
- Allows us to use all years of experience



- Set improvement in first year of projection to revert the mortality level back to the prior trend

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Conclusion

- Exceptional mortality in 2020/21 poses a problem for setting base mortality rates
- Don’t ignore the elephant! Excluding 2+ years of data is not viable in the long term
- Using unsmoothed past improvement is an elegant solution
- Need to adjust improvement rate in first year of projection to get back to trend
- Adjust base mortality tables to avoid double-counting

Questions?