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Post-pandemic long-term mortality in Australia

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Abstract

The pandemic has introduced unprecedented mortality shocks, necessitating a reassessment of established life expectancy projections. By drawing on international longevity studies, the paper investigates how global insights can inform mortality projections within Australia's unique demographic, healthcare system, and specific COVID-19 response. This paper will hence explore post-pandemic mortality trends in Australia, with a focus on the long-term implications of the COVID-19 pandemic on longevity projections.

The publication of the Australian Life Tables in December 2024 by the Australian Government Actuary will play a crucial role in recalibrating mortality and longevity assumptions for both actuarial and policy applications. This paper will critically assess these forthcoming tables, examining how they may be applied while accounting for biases introduced by COVID-19 and the uncertainties surrounding its long-term effects.

Keywords: Longevity, COVID-19, Mortality, Australian Life Tables, Mortality improvements

Contents

1. Executive summary

The Australian Life Tables 2020–22 (ALT 2020–22), released in December 2024, provide an updated mortality benchmark for the Australian population. However, these tables rely on an observation period marked by unusual volatility. Furthermore, the mortality improvements that come with the tables are calculated using a retrospective approach that does not account for cohort effects and makes no explicit adjustment for the mortality surge in 2022 due to the pandemic. This raises questions for stakeholders on how best to interpret and apply the ALT in long-term projections.

To address these limitations, we introduce the Cohort-Linked Australian Improvement Rates (CLAIR), based on a forward-looking APCI model that explicitly captures the COVID-19 mortality shock. By modelling cohort effects and pandemic-related distortions, CLAIRs offer a robust and forward-looking basis for longevity projections.

To offer some reassurance to Australian actuaries who voiced concerns last year when the author trimmed a year off their cohort life expectancy, let us say upfront: this approach does not further widen the known gap between the ALT-based retrospective factors and a forward-looking stochastic modelling. Instead, it introduces a reasoned, structured framework for modelling and navigating the volatility of recent years with greater confidence and for calibrating projections based on a specific view around the areas of uncertainty that remain.

2. Disclaimers

- This paper only reflects the views of the author. It does not represent views of any past or present employer.
- Only publicly available data were used.
- The paper explores mortality through both an epidemiological and actuarial lens. The author thoughtfully acknowledges that behind every statistic lies a human story—lives marked by struggle, resilience, and loss—and pays heartfelt tribute to all those who have been affected by the pandemic.

3. The great mortality trend disruption

COVID-19 disrupted mortality projections actuaries were relying on.

The pandemic has profoundly disrupted global mortality trends, introducing volatility that reshaped projections of life expectancy and health outcomes. Mortality rates surged not only from direct COVID-19 infections but also due to indirect causes. Excess deaths were recorded worldwide, with older populations and those with pre-existing conditions bearing the brunt of the impact. Moreover, the indirect effects of the pandemic—such as deferred healthcare, delayed diagnoses, mental health deterioration, and increased cardiovascular disease prevalence—compounded the challenges of projecting future mortality.

Long-term complications and higher overall mortality rates are found among COVID-19 survivors (Scott, 2023), showing that the impact of the virus will linger. As immunity wanes over time and each new infection can have adverse effects, this suggests COVID-19 hasn't just disrupted past trends—it may have changed the baseline mortality in the years ahead.

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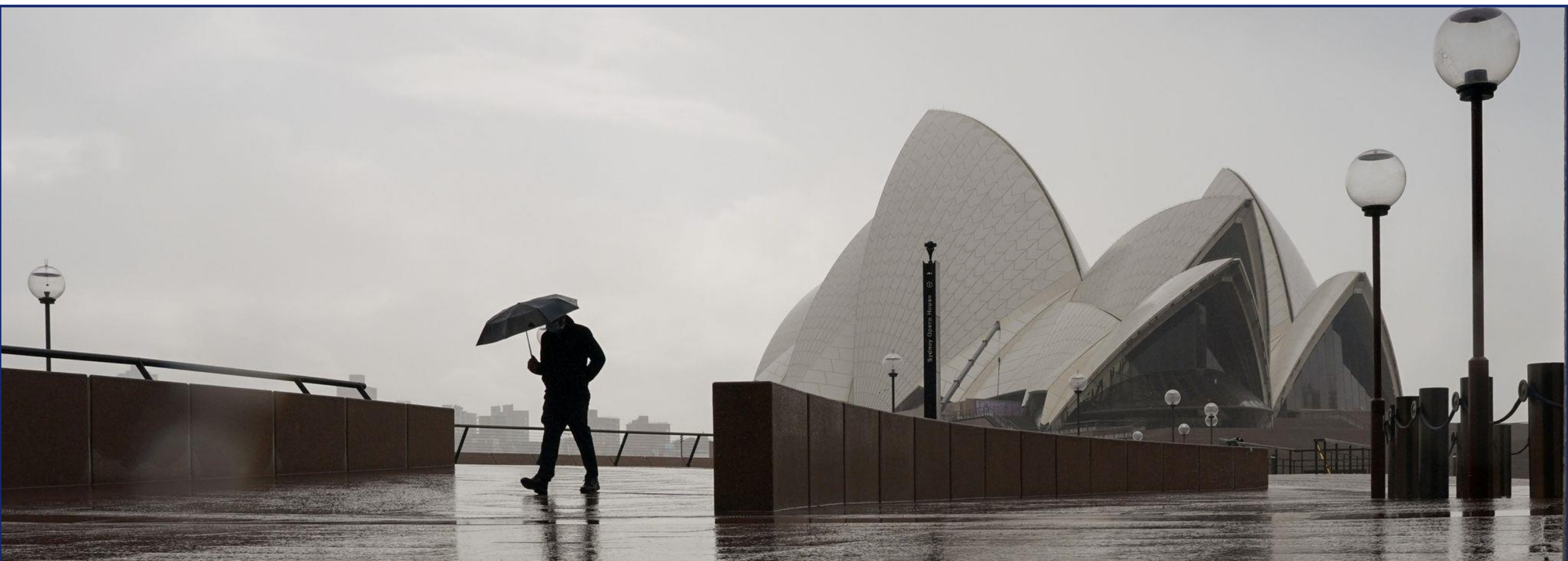
The Actuaries Institute's Mortality Group notes: "In our view, the "new normal" level of mortality is likely to be higher than it would have been in the absence of the pandemic. (…) While we think that the level of excess mortality will decline, COVID-19 is likely to continue to cause some excess mortality for some years to come, directly as a cause of death and less directly, as a contributor to other causes such as heart disease." (MWG, 2024)

Confronted with such profound disruption, and with traditional projection models unable to accommodate the mortality shock, what responses can actuaries offer?

To address these challenges, actuarial bodies around the world have initiated a range of research efforts, methodological updates, and collaborative frameworks. The following section explores the initiatives of key actuarial bodies, providing insight into how the profession is adapting its models and assumptions to the post-pandemic reality.



4. Post-pandemic mortality trends viewed by professional bodies

Several actuarial bodies around the world regularly publish mortality improvement tables or maintain standards for mortality improvement assumptions, which are widely used by actuaries to reflect changes in longevity trends and to set assumptions for a range of actuarial applications. Here is a summary of ongoing work by actuarial bodies, each backed by extensive research and publications.

a. The Society of Actuaries (US)

The Society of Actuaries' (SOA) Retirement Plans Experience Committee (RPEC) released the paper "RPEC 2024 Mortality Improvement Update," highlighting the impact of the COVID-19 pandemic on mortality rates. Although US mortality rates have significantly declined since the pandemic's peak, emerging data through June 2024 indicates a small amount of excess mortality still persists among the 65+ population.

While the worst effects of the pandemic on mortality have diminished, the RPEC believes there remains insufficient post-pandemic data to develop an updated MP scale. As a result, RPEC has decided not to release a new scale in 2024 (SOA, 2024). In effect, mortality improvement tables have not been updated with pandemic experience.

b. The Canadian Institute of Actuaries

The *Mortality Improvements Research* report (CIA, 2024), provides a foundation for updating mortality improvement assumptions in Canada and uses a new methodology compared to previous mortality improvement tables.

The research utilised an APCI model, similar to the UK's CMI model, based on mortality experience data from 1980 to 2019, hence excluding COVID-19 pandemic years. The findings confirm that using 2020 or 2021 for projections would likely distort the results, failing to capture the true long-term mortality trend. This aligns with studies published in 2021, which highlighted the challenges of integrating pandemic years into projections.

Again, no allowance is made for pandemic years in the future mortality improvements. The CIA continues to rely on pre-pandemic trend.

c. Koninklijk Actuarieel Genootschap (Netherlands)

In response to the challenges of projecting mortality in a post-pandemic world, the Royal Dutch Actuarial Association developed a methodology that applies an explicit pandemic overlay on top of pre-pandemic mortality trends. Their approach is structured as follows:

Pre-Pandemic Mortality Trend Estimation:

- A force of mortality model was fitted to pre-2020 Dutch and broader European mortality data, capturing long-term trends that existed before COVID-19.
- The model accounts for historical mortality improvements while isolating age- and sex-specific cohort effects.

Overlay to Capture COVID-19 Excess Mortality:

- An uplift factor was applied to reflect excess deaths observed during the pandemic, estimated using Dutch weekly mortality data from 2016-2019 as a baseline.
- The overlay assumes a gradual return to pre-pandemic trends, with excess mortality reducing by 25% per year from 2023 onwards (equivalent to a half-life of approximately 2.4 years).
- This means that by 2030, excess mortality would be largely absorbed, and mortality rates would converge back to pre-pandemic expectations.

Due to the assumed rapid reduction in excess deaths, the overlay has a very small impact on projected life expectancies—typically less than 0.5% for younger retirees. This suggests a return to pre-pandemic longevity trends, with little expectation of long-term health deterioration.

d. The Institute and Faculty of Actuaries (UK)

The key distinction between the Institute and Faculty of Actuaries (IFoA) and its North American counterparts lies in their approach to mortality projections. Unlike the North American actuarial bodies, which provide a standardized set of improvements, the IFoA—through its Continuous Mortality Investigation (CMI)—offers a flexible framework with core parameters, allowing users to tailor their own versions of the model.

While the North American professional bodies have not yet released an updated set of mortality improvements incorporating experience beyond 2019, the IFoA's CMI has actively engaged with users and provided guidance on handling pandemic-era data to refine post-pandemic mortality projections.

A significant modification introduced in the CMI model post-pandemic has allowed users to assign different weights to each calendar year. In the successive core models until CMI_2023, 2020 and 2021 were assigned a 0% weight, effectively excluding them from influencing future mortality trends.

Beyond this, the CMI engaged with users to determine the appropriate weighting for post-pandemic years, acknowledging that 2022 and 2023 continued to exhibit excess mortality. Despite this consultative approach, the CMI_2023 model released in early 2024 ultimately took a more pessimistic stance than actual experience warranted. By 2024, observed mortality had already returned to near the historic lows of 2019—several years earlier than the core model had projected.

The latest consultation shows that the CMI recognises minor adjustments to the core APCI model were inadequate, in particular the use of different weighting to target a specific outcome made the parametrisation non-intuitive. The weighting approach has been dropped and the latest proposal is a "fitted overlay" on an APCI model (APCOI, with the O for Overlay) with full weighting on all years, and an exponential decay of the overlay.

The APCOI model is an upgrade of the previous model that allows for a mortality shock. The half-life of the overlay is a key parameter that determines the time it takes for temporary COVID-19 effects to fade out, and at which point the model considers mortality rates have landed on a stable trajectory. The half-life parameter determines the speed of return to baseline.

The main differences compared to the Dutch approach are:

- The overlay is an external excess mortality factor in the Dutch model, but is fitted within the model in the CMI model (the user inputs the year of the mortality shock);
- The Dutch baseline is fitted using pre-pandemic years only, but the CMI model uses all years.

This "overlay" approach effectively allows for a temporary mortality shock in the projection and reduces the reliance on expert judgement involved in the CMI_2023 weighting (Though the choice of half-life for the overlay is in itself an expert judgement that determines the post-pandemic baseline, and we'll come back to this issue).

e. The Actuaries Institute (Australia)

The Actuaries Institute of Australia, like many of its international counterparts, currently lacks a formal framework for forward-looking mortality improvements. However, the Australian Government Actuary (AGA) provides valuable retrospective analysis, examining mortality trends over the past 25 and 125 years. The most recent analysis was published in December 2024 and follows the established methodology, with no adjustment for the pandemic in the published tables. The Australian Government Actuary has repeated, through Actuaries Digital and elsewhere, that mortality improvement assumptions are matters of actuarial judgement and actuaries are expected to continue using judgement for mortality improvements.

5. In-depth analysis of ALT Mortality Improvements

a. Presentation of the ALT 2020-2022 Mortality improvements

Mortality improvements are published by the Australian Government Actuary (AGA) as part of the Australian Life Tables (ALT). The ALT include both 125-year and 25-year historic mortality improvement rates for males and females. While the 125-year average provides long-term historical context, it incorporates periods that are no longer representative of the current environment. Consequently, the 25-year average is often used for calculating cohort life expectancy, as it better reflects contemporary trends and more relevant conditions for today's population.

Below are the mortality improvements' curves by age provided with the Australian Life Tables 2020-2022:

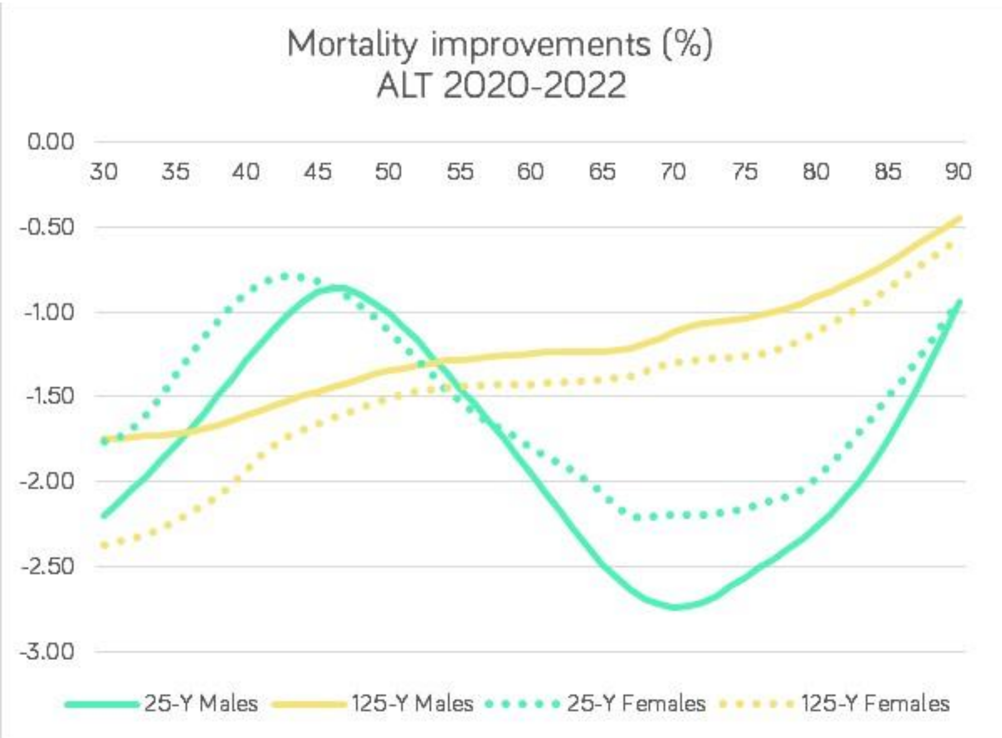


Fig 1. ALT Mortality improvements

The general shape of the curves have been discussed in the previous paper (Clark, 2024), with the high absolute improvements around ages 70-75 corresponding to the Golden Cohorts (people born in the 1930's) and the low absolute improvements around ages 40-50 corresponding to the Late Baby-Boomers (people born in the 1960's).

The general shape shifts by 5 years every time the Australian Government Actuary moves the observation period by 5 years.

Also note that mortality improvements are less smooth below age 30 due to being mostly driven by sudden deaths, as opposed to chronic conditions. For the purposes of assessing life expectancy at retirement and evaluating longevity risk for a retirement solution provider, this paper will mostly focus on individuals aged 65 and older.

b. Limitations of the ALT Mortality improvements

As pointed out already, the ALT mortality improvements are retrospective.

One key finding is that mortality rates in the ALT 2020-2022 base death rates tend to be higher than what the previous ALT would have predicted using the previous 25-year average mortality improvements. The ALT 2015-2017 also showed a similar pattern, where death rates were higher than projected using the retrospective 25-year average mortality improvements.

This pattern occurs because the 25-year average mortality improvements don't account for the full convexity of mortality rates over time. In other words, the speed at which mortality rates are decreasing is slowing, which the 25-year average provided with the ALT doesn't reflect.

Below is an illustration of this pattern using the age-standardised death rates of males and females, and showing a 3-5% gap between projected and actual ALT 2020-2022 death rates:

Fig 2. ALT Projected death rates

The ALT mortality improvements, while very useful for retrospective use, do not capture the shape of death rates and hence are not forward-looking.

c. Breakdown of retirees' death rates by cause

Below are the Age-Standardised Death Rates for the 65 and over (Australian Standard Population 2001) at the beginning and at the end of the observation period for the 25-year average mortality improvements provided by the AGA, broken down by main causes of death. Note again that our focus is on retirement ages for the purpose of retirement planning.

The breakdown by main causes of death is derived using the death rates by age group provided by the ABS in the GRIM files.

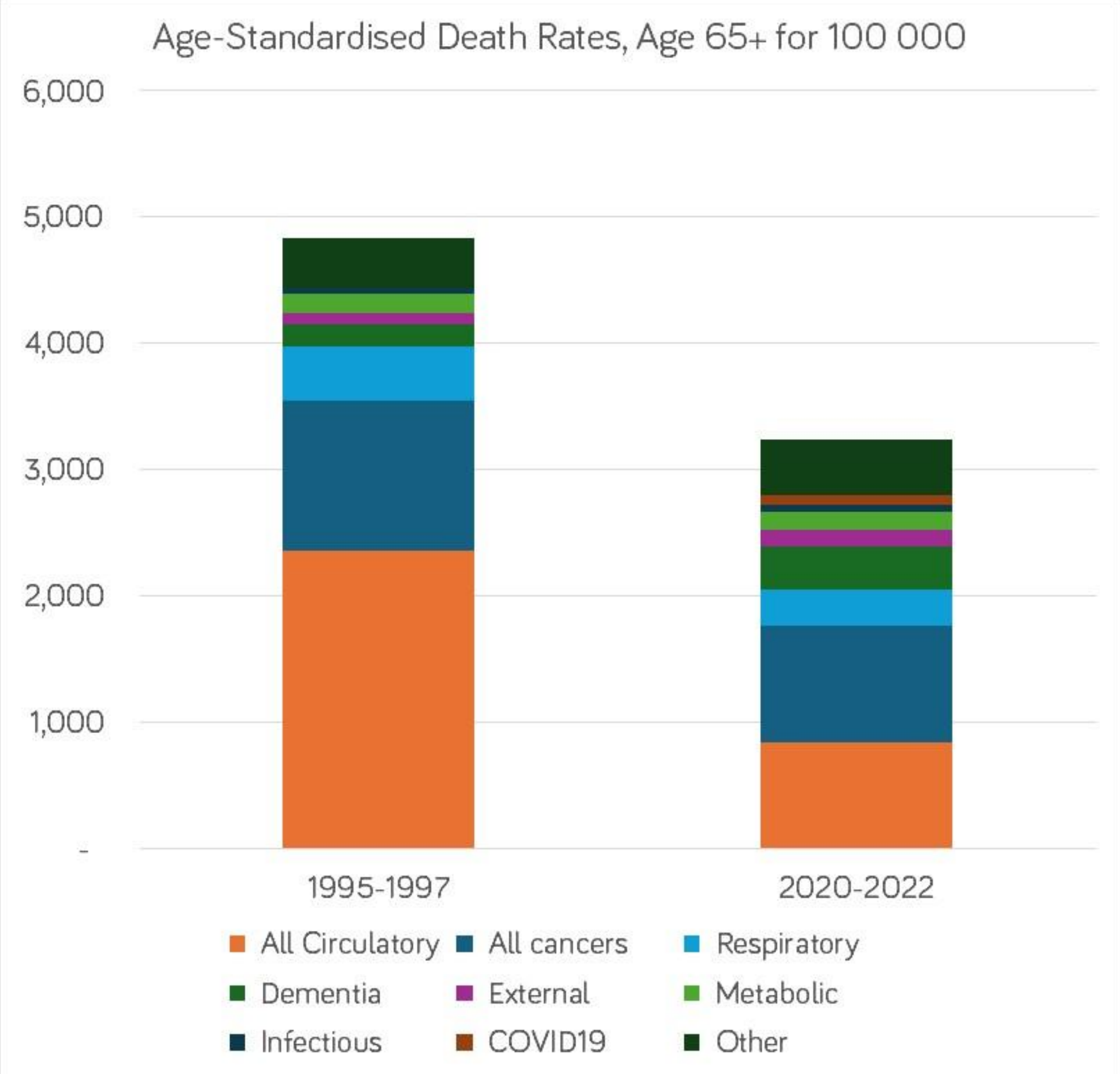


Fig 3. Breakdown of death rates by cause of death

One interesting finding is that over the 25-year period covering the ALT mortality improvements, the primary cause of death for the 65 and over has changed from being circulatory (heart disease) to cancer.

The following waterfall chart illustrates the contributions of the primary causes of death to the overall reduction in mortality between the 1995-1997s ALT and the 2020-2022 ALTs, males and females combined, covering 25 years of mortality improvements of the latest publication:

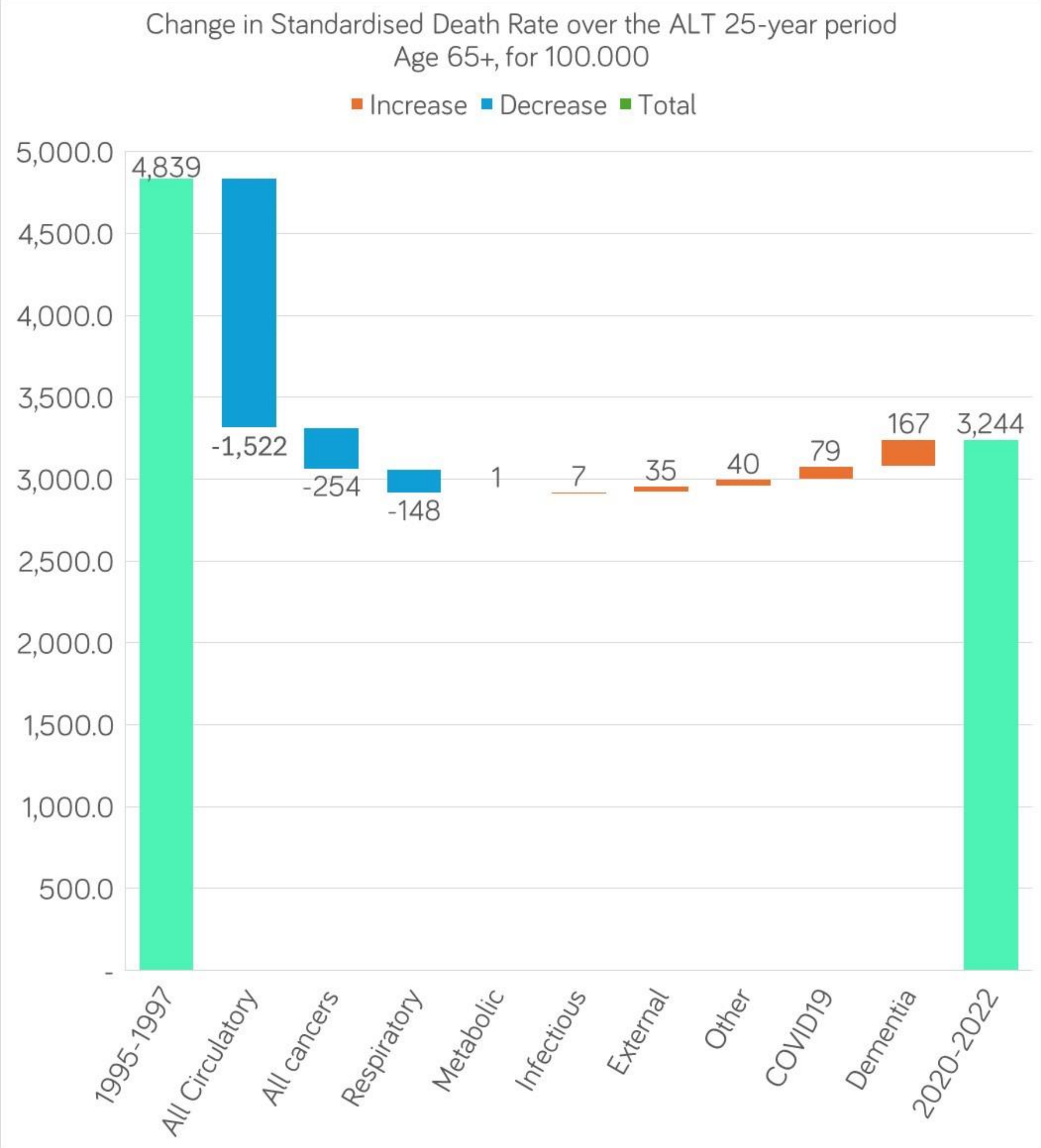


Fig 4. Contribution to change in death rates over the ALT 25-Year period

Over the 25 years preceding the reference period of the ALT 2020–2022, mortality improvements for individuals aged 65 and older averaged -1.6% per annum (males and females combined). Of this, approximately -1.5% could be attributed to the reduction in circulatory deaths (Heart disease).

While reductions in circulatory deaths account for the majority of mortality improvements overall, their impact is not uniform across all age groups, as shown in the graph below showing the contribution in percentage to mortality 25-year improvements of main causes by selected sub-groups. For each sub-group, the graph represents the make-up of mortality improvements adding up to the average annual mortality improvements by sub-group, with negatives where contributions were adverse.

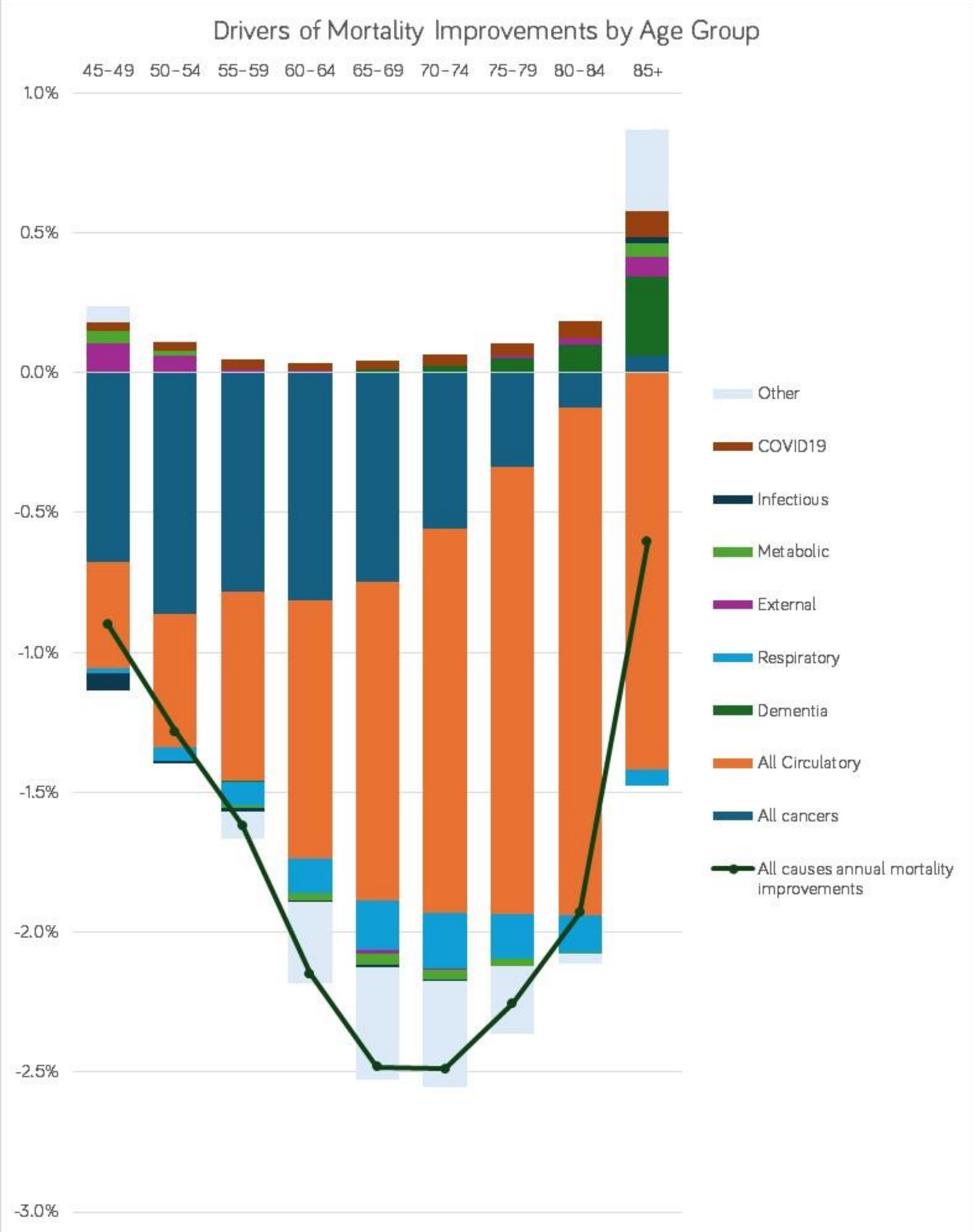


Fig 5.a Drivers of mortality improvements by age group

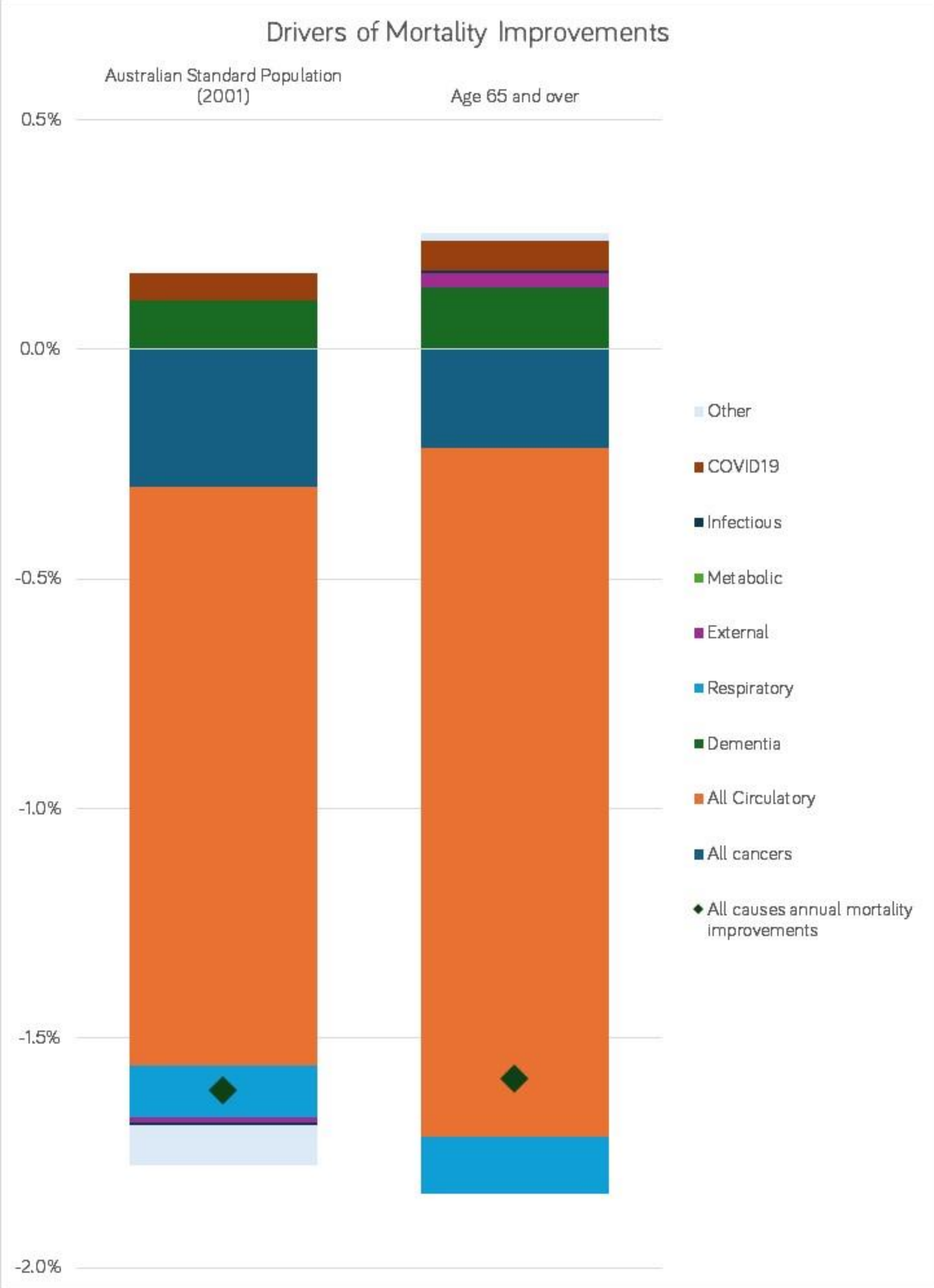


Fig 5.b Drivers of mortality improvements by age group (Cont.)

At younger ages, where all-cause mortality is less significant, the reduction in cancer deaths has played a more prominent role in driving mortality improvements, accounting for ¾ of the total improvements below age 55. As individuals get older, cancer becomes less significant in its contribution to mortality improvements and becomes adverse at 85 and over.

For individuals aged 85 and older, cancer deaths have increased over the 25-year period. Improvements in cardiovascular mortality account for more than 100% of the total mortality improvements. This pattern suggests that many individuals who would have succumbed to cardiovascular disease 25 years ago are now surviving longer, only to face increased mortality from other conditions such as cancer and dementia. This constitutes a mortality displacement from cardiovascular causes to cancer and dementia. This effect downplays the real progress made in cancer mortality.

Progress in cardiovascular deaths has meant individuals aged 85 and older have seen an increase in cancer and dementia deaths due to displacement effect.

Overall for both the general population and the 65 and over, the reduction in circulatory diseases constitutes the primary driver of mortality improvements. Advances in medical interventions, public health measures, and lifestyle changes have significantly reduced deaths from cardiovascular conditions, making this the dominant factor in increased life expectancy. In contrast, cancer deaths have declined at a slower but steady rate. Despite substantial progress in cancer treatments, such as targeted therapies and immunotherapies, the prevalence of cancer has increased. This rise is partly attributable to a growing risk from factors like obesity, which has emerged as a significant driver of cancer incidence. Additionally, improvements in cardiovascular health have allowed more individuals to survive to ages where cancer becomes a more prominent risk, effectively shifting the burden of disease from circulatory conditions to cancer. This highlights the interconnected nature of mortality trends and the complex interplay of risk factors and medical advancements.

Finally, it is important to note the contrasting trends in the reduction of cancer and cardiovascular deaths over the past 25 years.

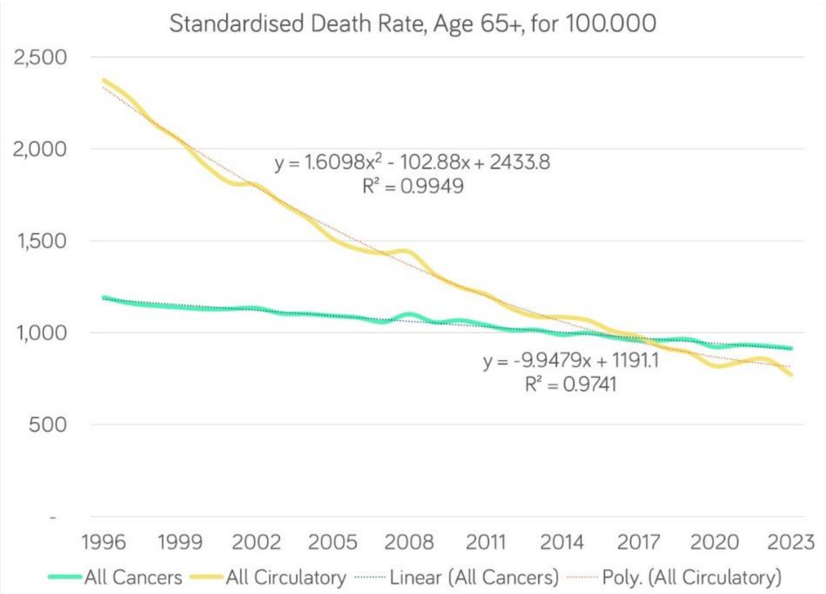


Fig 6. Death rates – main causes of death

Cancer deaths have declined at a relatively stable and linear rate, reflecting consistent progress in early detection and treatment advancements.

In contrast, reductions in cardiovascular deaths have followed a convex trendline evidenced by a quadratic fit, indicating that the rate of improvement has gradually slowed over time.

This pattern suggests that while earlier years saw significant gains in cardiovascular mortality due to widespread adoption of preventive measures, medical breakthroughs, and lifestyle changes (such as smoking cessation), the scope for further improvement is diminishing (Clark, 2024).

In the following section, we introduce a model designed to capture the shape of historical mortality improvements, with particular attention to preserving the observed convexity that is deeply embedded in the data and due to cohort effects. The model also addresses the 2022 mortality shock — a shock that, while milder in Australia compared to other parts of the world due to the population having had more time to be vaccinated, nevertheless resulted in a period of transient excess mortality.

6. Towards a prospective view of Australian mortality

a. Recent developments in Australian mortality

The data presented thus far cover the 25 years leading up to the ALT 2020–2022. While the ABS has released data for 2023, figures for 2024 remain provisional. Although 2024 provisional data lack the required granularity for direct use in modelling, they can provide qualitative insights and inform the prospective view.

Provisional ABS data for 2024 suggest an unexpected high level in both COVID-19 and non-COVID respiratory deaths, challenging previous expectations of declining mortality as the pandemic receded. As a result, 2024 did not see the return to pre-pandemic mortality levels.

The Mortality Working Group observed that COVID-19 remained a major cause of death throughout 2024, with mortality rates during both peak and inter-wave periods closely resembling those of the previous year. A key factor contributing to persistent COVID-19 mortality may have been the significant decline in vaccine uptake. Based on **COVID-19 vaccination rollout update,** over the course of 2024, the number of Australians aged 65 and over who had received a COVID-19 booster in the previous 12 months dropped from 3.6 million to 1.6 million – a decline of more than 50%**,** leading to a reduction in immunity – remember boosters only boost immunity for 6 months or so.

Non-COVID respiratory deaths also increased in 2024. However, when compared to 2019 baseline figures, they remain within historical norms. During the 2020 lockdowns, non-COVID respiratory deaths declined by 23%, only to rise sharply once restrictions were lifted. The 2024 surge only point to a bounce back of airborne diseases to their usual level.

In many regions outside Australia, COVID-19 had spread through the entire population by 2021, with other airborne diseases resurging by 2022, and COVID-19 being treated as endemic that same year. In contrast, Australia’s strict lockdown measures delayed the peak of COVID-19 until 2022, and by 2024, COVID-19 deaths still represented 38% of that peak. Strictly considering COVID-19 deaths and ignoring the indirect effects of the pandemic, this reduction from 2022 to 2024 represents a ~1.5-year half-life of the mortality shock, longer than the CMI’s 1-year half-life for the E&W population mortality.

Note that in 2024, mortality in E&W population had returned to its all-time low from 2019. With a shock in 2020 and a half-life of 1 year, 2024 mortality is effectively assumed to still include 6.25% of the initial shock.

This qualitative analysis is key in deriving plausible projections for the Australian population. It's somewhat premature to call Australia "post-pandemic" when COVID-19 deaths are still at 38% of peak levels per annum, and the country appears to be 2–3 years behind other nations in experiencing the tapering of the effects. This delayed trajectory should be a key consideration when assessing longevity trends and projecting future mortality rates.

Below is the ABS Age-Standardised Death Rates compared to the ALT 2020-2022 with 25-year retrospective mortality improvements (The ALT 2020-2022 central point is extrapolated backward and forward using the 25-year average improvements).

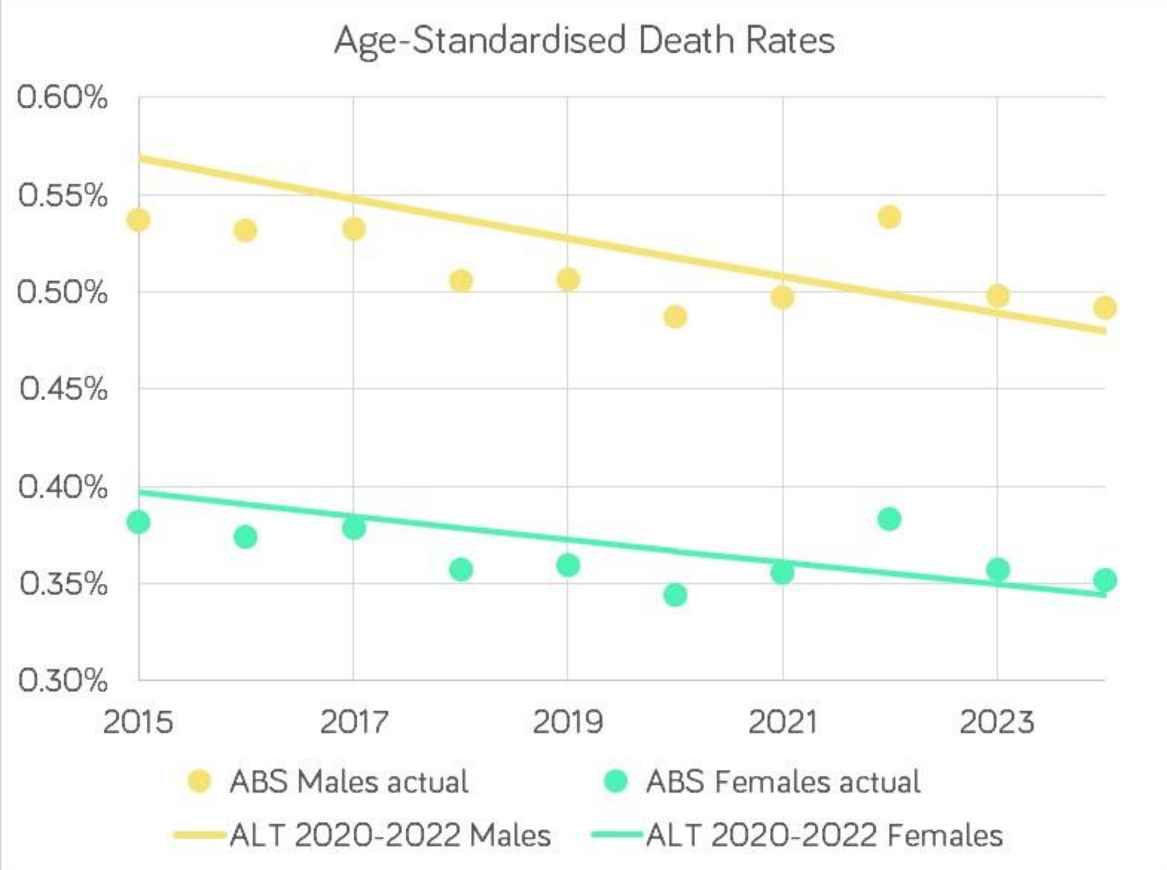


Fig 7.Death rates: ABS vs ALT 2020-2022 trajectory

It is important to note that ALT 2020–2022 include both a year of relatively low mortality in 2020—driven by a sharp reduction in airborne diseases—and a year of elevated mortality in 2022 due to COVID-19. As expected, after COVID-19 spread through the population in 2022, excess deaths in 2023 were significantly lower, but 2023/2024 death rates remained higher that the ALT 2020-2022 would have projected.

Actual death rates fall below the pre-pandemic ALT line. This deviation arises from two key factors: the inclusion of 2022, a high-mortality year, in the base table and the greater convexity of actual death rates compared to ALT line. A new approach is needed to address the limitations of using retrospective improvements.

b. Introduction of the Cohort-Linked Australian Improvement Rates

To project a more realistic mortality trend, we introduce the **Cohort-Linked Australian Improvement Rates** (CLAIRs), defined as mortality improvements to be applied to the ALT 2020-2022 base table to target projected death rates based on an APCI projection model with mortality overlay that represents a 2022 mortality shock followed by an exponential decay.

Here is the proposed stochastic modelling for the calibration of death rates forward-looking projections:

$$\log m_{x,t} = \alpha_x + \beta_x(t - \bar{t}) + B_x\kappa_t + \gamma_{t-x} + I_{t \geq 2022} \times \delta \times 0.5^{(t-2022)/1.5}$$

Explanation of Terms in Mortality Projection Model:

- $\log m_{x,t}$ — Logarithm of the central mortality rate at age x in year t.
- α_x — Age-specific intercept term capturing the average mortality at each age.
- $\beta_x(t - \bar{t})$ — Period effect, representing how mortality evolves over time.
- γ_{t-x} — Cohort effect capturing generational influences on mortality.
- $I_{t \geq 2022}$ — An indicator variable equal to 1 for calendar years 2022 onwards
- δ — Size of the COVID-19 mortality shock applied in 2022.

Here are some key parameters used to derive the target mortality rates:

- Deaths and exposure by age rely on ABS data between 1983 and 2023 (40 Years observation period, with 2024 provisional data not useable as of April 2025)

- Long-term rate of improvements defined as the 125-year average improvements provided by the ALT 2020-2022.

- Mortality shock set in 2022 with exponential decay of 1.5-year half-life.

- Convergence to long-term rates and smoothing parameters unchanged since previous paper (Clark, 2024) and based on CMI core assumptions.

The 1-year half-life of the UK's CMI_2024 proposal is believed to be unfit for the Australian population due to issues discussed earlier. Indeed COVID-19 peaked in 2022 in a mostly vaccinated population, with vaccine uptake subsequently dropping in 2023 and 2024. Hence the initial mortality shock was milder, but with arguably a longer half-life as immunity wanes in the vulnerable population.

We retain 1.5-year half-life to fit with the Australian experience up to 2024 provisional ABS data – that is 2024 COVID-19 deaths still represent 38% of the peak. However, it should be noted that this parameter is heavily reliant on a qualitative view of the excess deaths runoff. One limitation of using a 1.5-year half-life is that it overlooks the other effects of COVID on mortality and 1.75 was seriously considered as a reasonable alternative.

The 1.5-year half-life should be seen as a rough guide, suitable while the lingering impacts of the pandemic continue to fade and until we can be confident mortality has truly reached the new baseline.

Below are the age-standardised (20-100 y-o) death rates projections using CLAIRs compared to the age-standardised deaths rates using the ALT 2020-2022 with 25-year retrospective improvements for reduction factors (Applied to the base ALT 2020-2022 rates backward and forward to draw the trajectory).

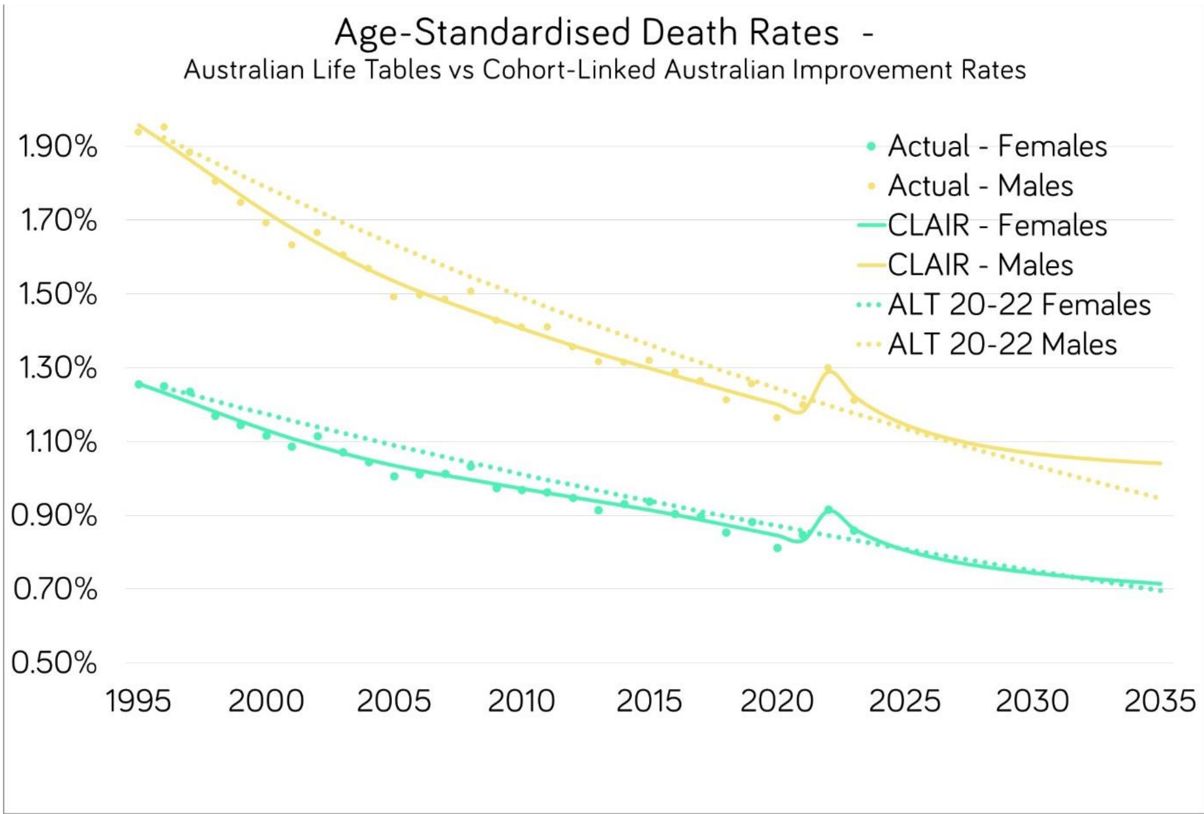


Fig 8. Mortality projections using CLAIRs

Below are the average age-standardised CLAIRs between ALT 2020-2022 and 2035 compared to the ALT 2020-2022 25-Year retrospective Age-Standardised improvements:

	ALT 2020-2022 25-Year retrospective Age-Standardised improvements (p.a.)	Average ALT 2020-2022 to 2035 Age-Standardised CLAIRs (p.a.)
Males	-1.8%	-1.1%
Females	-1.5%	-1.3%

Table A: ALT 25-Year vs CLAIRs

The CLAIRs trend captures the higher convexity of the actual death rates due to cohort effects and projects it into the future, leading to lower expected improvements from the central point of ALT 2020-2022 to 2035.

c. Impact on Cohort Life Expectancies

This section compares cohort life expectancies, firstly between the ALT 2020-2022 with 25-year average improvements and the CLAIRs, secondly between the pre-pandemic projections using a classic APCI model (Clark, 2024) applied to pre-pandemic data, and the CLAIRs.

Below are the cohort life expectancies corresponding to the different projections:

Cohort Life Expectancies in 2025	CLAIR with 1.5y Half-life	ALT2020-2022 with 25-Year improvements	Difference
65 y-o Male	21.2	22.4	1.2
65 y-o Female	24.3	24.6	0.4
75 y-o Male	13.6	13.6	- 0.0
75 y-o Female	15.6	15.3	- 0.3

Table B: ALT vs CLAIR Cohort Life Expectancies

To provide further context to the life expectancy figures above, the table below presents life expectancies calculated using pre-pandemic models—specifically:

- The ALT 2015–2017 with 25-year average improvements
- The APCI model incorporating data up to and including 2020 with a 125-year average long-term rate of improvements, as presented at the All Actuaries Summit 2024.

Cohort Life Expectancy	65 y-o Male in 2025	65 y-o Female in 2025
ALT 2015-2017 with 25-year improvements	22.7	24.7
ALT 2020-2022 with 25-year improvements	22.5	24.7
APCI up to 2020	21.3	24.3
CLAIR with 1.5y Half-life	21.2	24.3

Table C: ALT vs CLAIR Cohort Life Expectancies

The updated Cohort Life Expectancies based on the ALT 2020-2022 are slightly lower for males than what the ALT 2015-2017 would have projected. This gap is the direct consequence of the ALT undershooting themselves every 5 years particularly for males, and this has been discussed earlier.

The pre-pandemic APCI projections were presented and discussed at the 2024 All Actuaries Summit (Clark, 2024). Using the CLAIRs, cohort life expectancies are only mildly below the pre-pandemic projections at age 65 for males, and virtually the same for females.

As it turns out, the inclusion of 3 extra years of pandemic data using a forward-looking projection model allowing for a mortality shock with a half-life of 1.5 years doesn't fundamentally change the outcome of the forward-looking APCI pre-pandemic projection model for a 65 year-old in 2025. Given that the median age at death from COVID-19 is 86, it's not entirely surprising that the cohort life expectancy of a 65-year-old today is only marginally impacted if we assume excess mortality halves every 1.5 years. This could be because the model doesn't incorporate sufficient long-term effects of COVID-19 **(See model risk warning)**.

Media headlines—often sensational—claiming that life expectancy in Australia has declined are typically based on period life expectancy, which reflects mortality rates in a static time period rather than long-term trends. This measure can be heavily influenced by short-term shocks like the pandemic and does not account for future mortality improvements, making it a useful statistical snapshot, but a misleading indicator of what individuals—especially younger or healthier cohorts—can actually expect to live.

Warning on model risk

A note of caution around these projections and the corresponding cohort life expectancies.

There is still a level of uncertainty around the half-life parameter, which determines the time it takes to return to the new baseline. Moreover, while a post-pandemic mortality projection model has been developed, it's important to remember that the model simply follows the instructions it's given around the shock tapering—and that introduces model risk.

In this case, the model assumes that excess mortality halves every 1.5 years until it disappears (Similar to the UK and Dutch models). However, without the benefit of several more years of post-pandemic data, the CLAIRs cannot yet validate this assumption and the "landing" on the new baseline is entirely projected (The UK and the Dutch models face the same issue even with the 2 additional years post-pandemic peak).

There's a risk that the model is not capturing a potential shift in the mortality baseline but is instead treating the pandemic as a temporary deviation from the pre-COVID trend. If COVID-19 has caused a lasting step change rather than a medium-term shock, then the CLAIRs may be overly optimistic in estimating future life expectancy. The deviation in age-standardised death rates, when compared to the ALT 2020–2022 trajectory incorporating 25-year average improvements, would be even more pronounced.

d. What mortality scenario would be consistent with the ALT improvements?

Most mortality projection models, such as Lee-Carter, APCI or CBDX models do not incorporate specific causes of death, as isolating individual causes is inherently complex, a challenge discussed elsewhere. Statistical models that attempt to incorporate cause-specific mortality often struggle to explain underlying assumptions around interactions between different causes of death.

An example of this issue is the observed decline in cancer mortality across most age groups—except for those aged 85 and older, where cancer deaths tend to increase. This is not because older cohorts are becoming more susceptible to cancer but rather because they have survived cardiovascular disease, shifting the primary cause of death to cancer. In this way, eliminating a particular cause of death does not significantly reduce overall mortality but rather redistributes deaths to other causes.

This complexity makes it problematic to assess the impact any particular medical breakthrough that would address a specific cause of death. However, within **longevity risk management frameworks**, there is recognition of **event risk**, where transformative medical innovations—such as radical life-extension therapies—could significantly alter longevity trends predicted by a model. Hence effective longevity risk management requires testing scenarios beyond standard projection models, especially while the medical innovation is absent from past data.

One such scenario, unforeseen before the pandemic and potentially disruptive, is the widespread adoption of GLP-1 receptor agonist drugs. GLP-1 RA drugs, such as semaglutide and liraglutide, were initially developed and prescribed for Type 2 diabetes management but are now increasingly used to address obesity, a key driver of cardiovascular risk. These medications mimic the hormone glucagon-like peptide-1 (GLP-1), which regulates appetite and glucose metabolism.

Clinical trials have demonstrated their effectiveness in reducing body mass index (BMI) by 15–20% over time, leading to improved cardiovascular outcomes, including reduced risks of myocardial infarction and stroke (Wilding et al., 2021). Notably, by lowering BMI, these drugs also mitigate many health issues, including COVID-19 (Jiang et al., 2022).

In Australia, the use of GLP-1 RA drugs has anecdotally increased by 30% annually in recent years. Since 2022, these medications have been increasingly utilized for weight loss purposes, although specific data remains limited. In the United States, studies suggest that the widespread adoption of GLP-1 RAs may have contributed to a recent decline in obesity rates.

The Australian Institute of Health and Welfare (AIHW) attributes approximately 9% of the total disease burden in Australia to obesity, underscoring its significant impact on mortality (AIHW, 2021). This aligns with data indicating that one-third of the Australian population is classified as obese, and studies have demonstrated a 30% increase in mortality among individuals with a body mass index (BMI) ranging from 30 to 35 (Begg et al., 2019). These figures suggest that a drastic reduction in obesity rates could lead to up to 9% decrease in death rates in Australia.

We have scenario-tested the potential impact of GLP-1 RA drugs on obesity, exploring a range of outcomes—from a 25% reduction in obesity by 2035 to a (highly implausible) 100% elimination. Our findings indicate that, to fully close the gap between the CLAIRs model and the ALT 2020–2022 projections based on 25-year average improvements, we would need to see a 100% reduction in obesity among males and a 25% reduction among females by 2035.

Anything short of a dramatic shift in obesity prevalence is unlikely to reconcile the difference in projected life expectancy.

	ALT 2020-2022 25-Year retrospective Age-Standardised improvements (p.a.)	Average age-standardised improvements (p.a.) applied to ALT 2020-2022 up to 2035			
		Central CLAIR	CLAIR + 25% reduction in obesity level	CLAIR + 50% reduction in obesity level	CLAIR + 100% reduction in obesity level
Males	-1.8%	-1.1%	-1.3%	-1.5%	-1.8%
Females	-1.5%	-1.3%	-1.5%	-1.6%	-2.0%

Table D: Scenarios of mortality improvements

While a range of medical advances, such as cancer vaccines and dementia treatments, hold promise for improving mortality outcomes, this paper focuses specifically on GLP-1 receptor agonists (GLP-1 RAs) for several reasons:

1. **Clear Evidence of Rapid Adoption:** GLP-1 RAs are already seeing widespread clinical uptake and have demonstrated measurable benefits in reducing major causes of mortality, such as cardiovascular disease and diabetes-related complications.
2. **Impact Across Multiple Mortality Risks:** Unlike many emerging treatments that target specific diseases, GLP-1 RAs address multiple interconnected risk factors, including obesity, hypertension, and metabolic syndrome—factors that influence a wide range of causes of death.
3. **Recognition as an Imminent Disruptor:** The life and health insurance industry, particularly reinsurers, has identified GLP-1 RAs as one of the most immediate and credible disruptors to existing mortality and morbidity assumptions, warranting focused attention at this stage.
4. **Absence from Existing Data:** The currently available data do not have sufficient hindsight to capture the potential trend disruption that GLP-1 RAs could create.

As pointed out earlier, the CLAIRs inherently contain a degree of optimism, due to a key limitation: Australian mortality data remains inconclusive in establishing a stable post-pandemic baseline. As a result, the model may prematurely assume that excess mortality will fully dissipate, ultimately projecting a long-term baseline that closely aligns with pre-pandemic trends.

At the same time, bridging the gap between these prospective improvements and the retrospective 25-year improvements published in the Australian Life Tables (ALT) 2020–2022 would require an unrealistically large reduction in obesity prevalence.

Given these considerations, the author concludes that using the 25-year retrospective improvements embedded in the ALT 2020–2022 for the purpose of longevity pricing or setting forward-looking assumptions is not tenable even in a best-case scenario. Using both a forward-looking approach and expert judgement to establish the level of disruption in obesity level, would be preferable and could improve the value of retirement income for today's new retirees.

7. Conclusion

The landscape of mortality modelling is continuously evolving, shaped by emerging health trends, medical advancements, and shifting population dynamics. The COVID-19 pandemic introduced unprecedented shocks to mortality, while the rise of GLP-1 receptor agonist (RA) drugs presents a potential inflection point in chronic disease management. These factors add complexity to the modelling of long-term mortality projections, requiring actuaries and policymakers to remain adaptive in their assumptions and methodologies.

Ultimately, post-pandemic mortality trends continue to be part of an ongoing discussion with inherent uncertainty, as both the long-term effects of COVID-19 and the future impact of GLP-1 drugs on population health continue to evolve. However, this paper presents a structured framework for incorporating these factors into mortality projections, enabling a more informed assessment of future trends while explicitly accounting for the latest experience. This should give actuaries more confidence when adjusting the ALT 2020-2022 to reflect current mortality.

8. Key takeaways on Australian long-term mortality trends

- The Australian Government Actuary has released the Australian Life Tables (ALT) 2020–2022, which we welcome. However, the tables reflect unusual year-to-year variations, shaped by pandemic-related disruptions.
- The published mortality improvements are not forward-looking and fail to reflect the convex shape in long-term mortality trends for males in particular.
- A cause-of-death analysis reveals that the convex shape of mortality improvements over the past 25 years is largely driven by slowing gains in circulatory disease mortality, which can be understood using cohort effects (Clark, 2024).
- This paper introduces the CLAIRs (Cohort-linked Australian Improvement Rates) to better capture the curvature in improvement trends while incorporating a mortality shock that gradually dissipates over time.
- While this modelling approach is valuable, it carries a risk of overestimating life expectancy, as it assumes that excess mortality fully fades—an assumption that may not hold as the pandemic unfolds. Australian data to date remains inconclusive in establishing a clear post-pandemic mortality baseline.
- The CLAIRs lead to lower cohort life expectancies for new retirees in 2025 compared to the ALT 2020–2022 using 25-year retrospective trend.
- Closing this gap between the ALT approach and the CLAIRs would require a dramatic reduction in obesity levels—the kind potentially achieved by widespread use of GLP-1 receptor agonists. Our modelling suggests a 25% drop in obesity among females and 100% among males would be needed to bridge the difference between historical and forward-looking improvements.
- GLP-1 receptor agonists may prove to be disruptive because their effects are not yet visible in the available mortality data. However based on current evidence, we do not believe their impact will be dramatic enough to fully close the gap between the ALT 2020-2022 retrospective improvements and forward-looking projections.
- As such, we suggest that using the ALT 2020-2022 retrospective improvements for longevity pricing may not offer the best value when designing retirement products and the forward-looking modelling will deliver better outcomes for retirees.

9. Appendix A: Reinsurers' views on post-pandemic mortality trends

Reinsurers are significantly exposed to longevity trend risk through various transactions designed to manage the financial uncertainty resulting from changes in mortality rates. This makes it crucial for reinsurers to monitor mortality patterns and adjust their models and pricing strategies accordingly. As part of this, global reinsurers have been focusing on post-pandemic mortality trends to better understand the ongoing impacts of COVID-19.

SCOR (Newsletter, 2024) explores the long-term effects of COVID-19 on mortality. It highlights that excess mortality includes both deaths directly caused by the virus and those caused by delayed healthcare and other societal disruptions. Accurately calculating excess mortality is challenging, as varying baseline assumptions and mortality rate weighting methods can lead to different conclusions. This is especially important for insured portfolios, which often focus on younger, healthier populations. By studying historical mortality trends, SCOR aims to provide insights for future mortality forecasting.

Andrew Hunt, Research Director at Pacific Life Re, has analyzed post-pandemic mortality trends in the UK and Netherlands (Hunt, 2024). His research points to the challenges in forecasting mortality, noting that the COVID-19 pandemic caused significant shifts in mortality patterns globally. Hunt emphasizes that traditional models, which rely on pre-pandemic data, may no longer be effective in predicting future mortality. He advocates for a more comprehensive approach that combines data analysis with insights from public health and medical experts.

Swiss Re (SwissRe, 2024) underscores the enduring impact of COVID-19 on global mortality, highlighting both respiratory and cardiovascular deaths. While excess mortality is expected to persist, advances in healthcare may help mitigate the long-term effects.

The general takeaway from these reports is that global reinsurers are highly focused on the continuing impact of COVID-19 on mortality and risk management. The pandemic's effects are expected to persist, particularly due to the increased cardiovascular risks linked to COVID-19 infections.

Research shows that recovery from COVID-19 doesn't offer immunity to its long-term consequences, and repeated infections may exacerbate cardiovascular vulnerabilities. Reinsurers advocate for scenario-based approaches in mortality modelling, where various plausible future scenarios are considered, each representing a different trajectory for mortality rates. These models should rely on the latest data and expert opinions to capture both quantitative trends and informed judgments about the pandemic's evolving nature. Fully data-driven approaches fail to provide appropriate post-pandemic mortality trajectories.

> In a scenario-based approach, less emphasis is placed on traditional data-driven projection models, while greater focus is given to defining a plausible range of trajectories, consistent with the data. The model is then parameterised to reflect the chosen scenario.

Reinsurers have primarily concentrated their efforts on regions with high longevity exposure, such as Europe and North America, due to the significant insurance portfolios and extensive data availability in these areas. In contrast, Australia, with its unique pandemic trajectory and lower initial mortality rates, has received comparatively little attention in the context of post-pandemic mortality risk.

10. Appendix B: Bibliography

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