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Mortality in Australia and the Rest of the World in 2024

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Mortality in Australia and the Rest of the World in 2024

November 2025

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Disclaimer

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Executive Summary

Australian mortality experience in 2024

Overall, mortality in 2024 in Australia was very close to our prediction of a slight improvement from 2023 experience. The overall Standardised Death rate (SDR) for the Australian population was slightly lower than in 2023 but still higher than the long-term trend since 2015.

In previous Research Papers, we have attempted to measure the number of additional deaths that have occurred each year, compared to if there had been no COVID-19 pandemic. From 2024 onwards, we measure mortality against a new baseline that takes into account expected COVID-19 mortality and other changes in mortality patterns since the pandemic. For 2024, that baseline was largely based on actual 2023 experience, extrapolating from 2023 to 2024 for an expectation that there would be a significant decline in COVID-19 mortality and such improvements in deaths from some non-respiratory conditions as had been evident before the pandemic. Our previous analysis showed that 2023 had excess mortality of around 5% against the previous baseline based on predicted mortality in the absence of the pandemic, and our 2024 baseline "bakes in" much of this increase.

Note that the expected COVID-19 mortality included in our 2024 baseline (which implies a significant decrease from 2023) is more approximate and judgement-based than other potential causes of death as experience of the timing and severity of waves of COVID-19 is still sparse.

Against this new baseline, we estimate that there were around 700 (0.4%) more deaths in Australia in 2024 than we predicted. We do not consider this overall excess to be statistically significant.

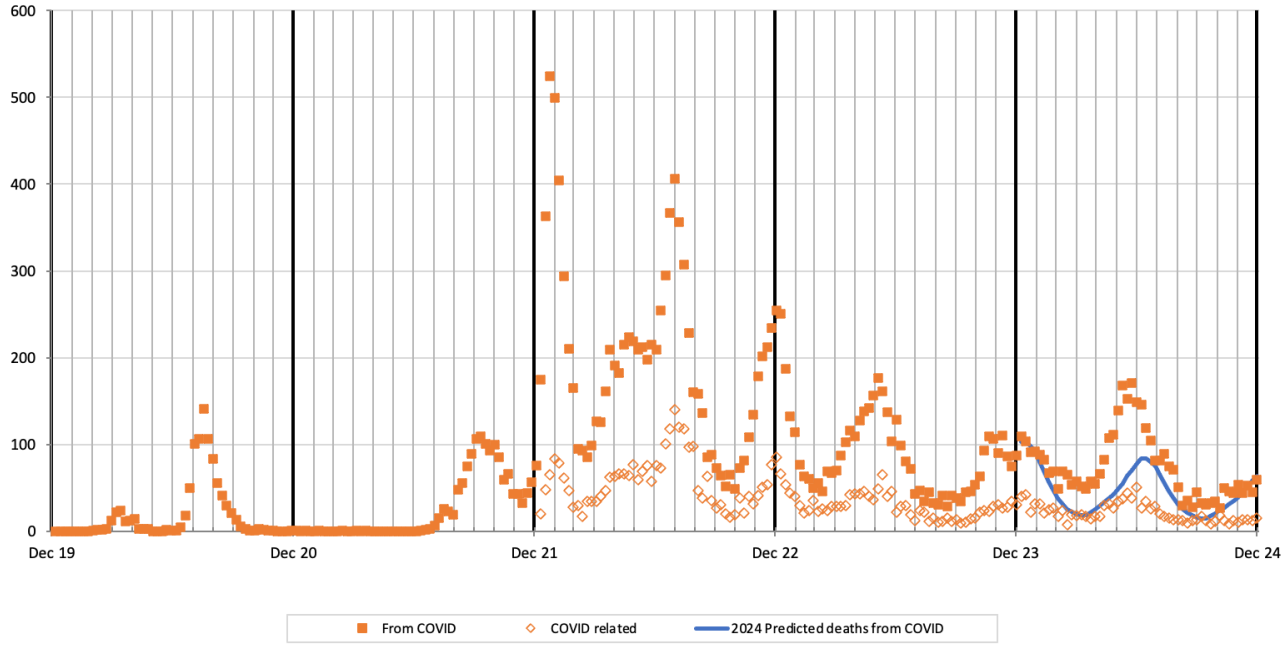
Notwithstanding our conclusion that overall excess mortality was insignificant in 2024, there were statistically significant deviations from our prediction for several causes of death. In particular, deaths from COVID-19 (+62%), pneumonia (+10%) and lower respiratory conditions (+5%) were higher than expected, and deaths from cancer (-2%) and ischaemic heart disease (-3%) were lower than expected. For these latter two causes, the favourable experience is against a baseline that already anticipated some improvement from 2023.

Deaths *from* COVID-19 are those where COVID-19 is given as the underlying cause of death on the death certificate. We estimate that deaths *from* COVID-19 were the tenth leading cause of death in Australia in 2024, down from ninth in 2023 and third in 2022. COVID-19 *related* deaths are those where COVID-19 was a contributing factor mentioned on the death certificate.

For 2024, we estimate 3,900 people died *from* COVID-19 in Australia, and a further 1,100 died *with* COVID-19. This compares to 4,800 *from* and 1,600 *with* COVID-19 in 2023 and 10,100 *from* and 2,900 *with* COVID-19 in 2022, the peak of the epidemic in Australia. Deaths *from* COVID-19 represented 2.1% of all mortality in 2024, compared to 2.6% in 2023 and 5.3% in 2022.

Figure 1 shows weekly deaths *from* and *with* COVID-19 each year since the global pandemic began in 2020, along with our prediction for 2024.

Figure 1 – COVID-19 mortality in Australia 2020-24



COVID-19 mortality was at a similar level in 2024 as 2023, contrary to our prediction of a reduction.

A pattern of two COVID-19 waves per year, one in summer and one in winter, has been consistently observed since travel restrictions were lifted in the summer of 2021-22. The size of these waves progressively decreased during 2022 and 2023, but this pattern changed in 2024. The winter wave of 2024 was higher than the summer wave that commenced at the end of 2023, and similar in magnitude to the winter wave of 2023. However, the summer wave that commenced at the end of 2024 appears to have been smaller than any previous wave.

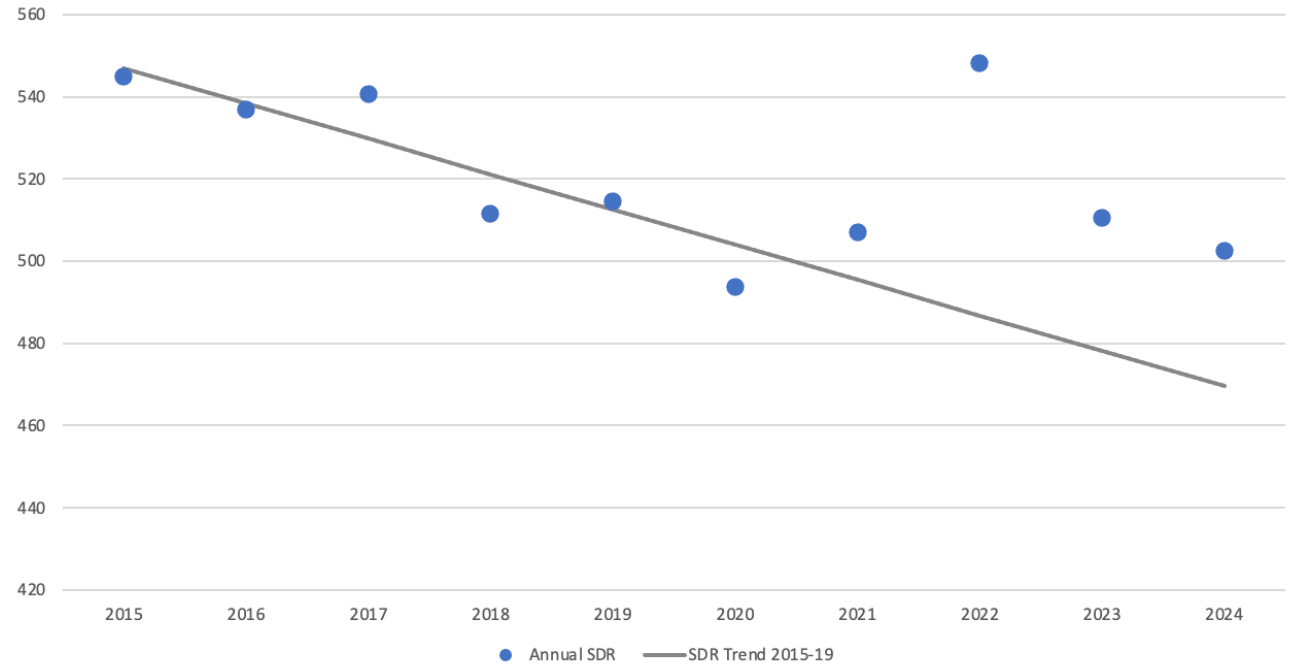
It remains unclear how close we are to reaching an endemic state, when the impact of COVID-19 on mortality will become (more) predictable. Although the pattern of fluctuating COVID-19 mortality waves bears some similarities to influenza, it should be noted that COVID-19 resulted in five times as many deaths (3,900) in 2024 as influenza did (740).

COVID-19 mortality in 2024 exceeded our prediction for every age band and both genders, with the deviations in relative terms being broadly consistent across all age / gender categories. 57% of deaths *from* COVID-19 in 2024 occurred in people aged 85 and over, which is 3.0% of all deaths in that age category. A further 27% of COVID-19 deaths occurred in people aged between 75 and 84, which is 2.1% of all deaths in that age category. COVID-19 caused 1.4% of all deaths in the 65-74 category, and 0.7% of all deaths in those aged under 65.

2024 experience in context

As noted above, from 2024 we have changed the basis of our baseline mortality prediction to one that explicitly allows for COVID-19 and other changes that have occurred since the pandemic. While this is appropriate for making a forecast, we acknowledge it makes it harder to put 2024 experience in its historical context. As a further point of reference (*not* a prediction), in Figure 2, we have compared annual Standardised Death Rates (SDRs) since 2015 to the trend observed in the period 2015-2019, i.e. the five years before the COVID-19 pandemic commenced. SDRs measure the actual annual number of deaths per 100,000 population, after standardising for changes in the demographic mix.

Figure 2 – Annual SDRs



The chart shows that 2024 saw an overall improvement in mortality versus 2023 but remained above the pre-pandemic trend. This is consistent with our view that 2024 mortality was in line with our prediction, noting that the baseline is based on 2023 experience with some allowance for improvement.

Public Health Service

Previous hypotheses for the drivers of excess mortality in Australia have included the impact of the COVID-19 pandemic on public health services.

Our analysis shows that delays in emergency care worsened across several major states during the pandemic. Ambulance response times deteriorated during the pandemic and have yet to return to pre-pandemic levels. Meanwhile, the proportion of patients receiving timely emergency treatment has declined. Incidents of "ambulance ramping", where patients wait in ambulances due to unavailable beds, and "bed block", where emergency beds remain occupied because of limited capacity elsewhere, have both increased.

These pressures on emergency care systems contribute to poorer patient outcomes and are likely to persist without targeted intervention. While we do not yet have sufficient data to quantify the impact on mortality, it is reasonable to infer that these delays and constraints have had some effect.

Cancer Screening

Another hypothesis suggested that reduced cancer screening during the COVID-19 lockdowns may have contributed to excess mortality. Our 2023 analysis confirmed a decline in screening activity during that period. However, cancer mortality data from 2015 to 2024 shows that outcomes in 2024 remain broadly consistent with the 2015–2019 trend, with no evident deterioration.

Death by Suicide

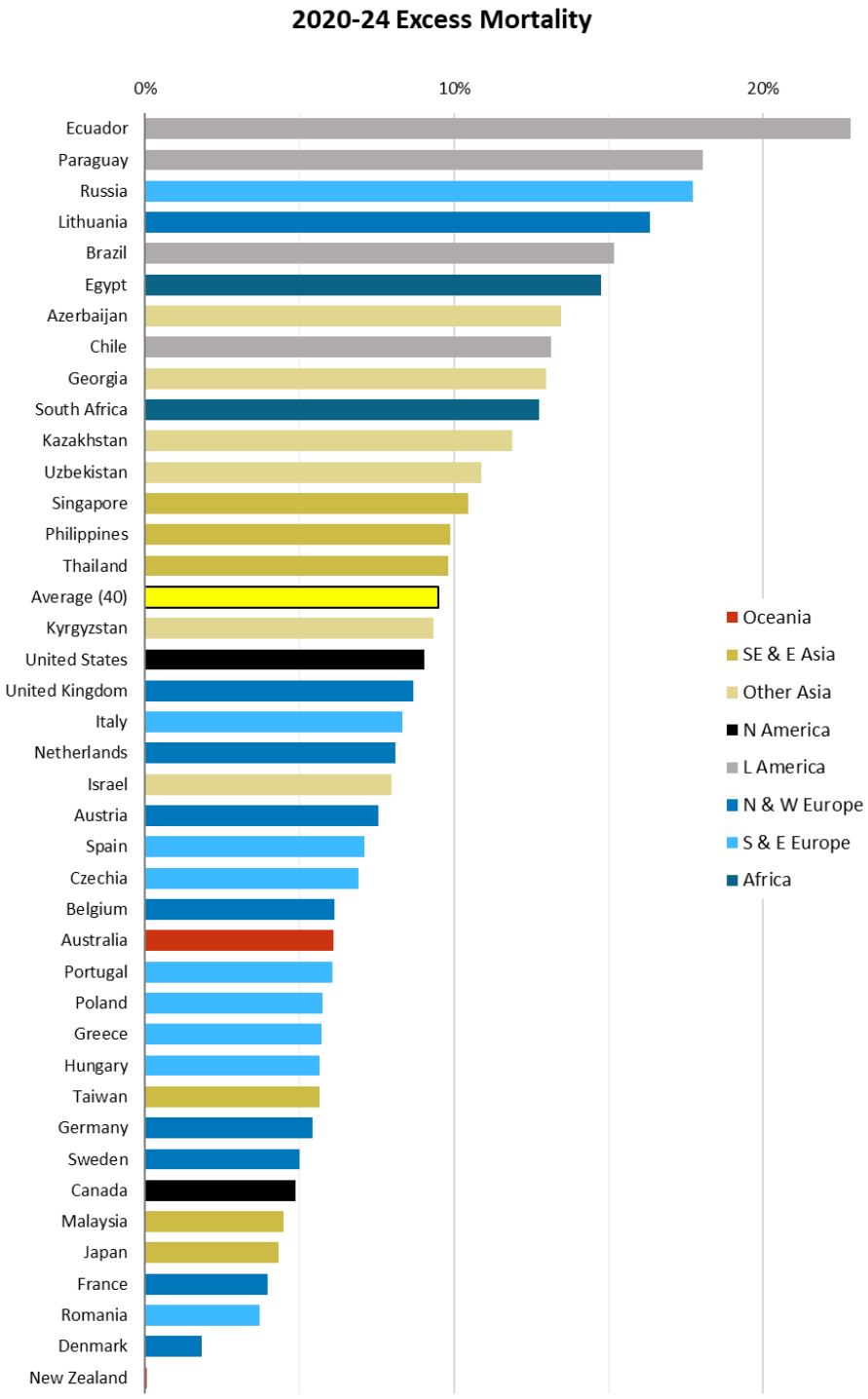
A further hypothesis was that the mental health impacts of pandemic lockdowns and financial hardship may have led to an increase in suicide rates. However, available data shows that suicide

deaths remain below pre-pandemic levels and suicide deaths continue to account for a very small proportion of total mortality.

World-wide experience

To set Australia in a global context, it is still useful to consider excess mortality relative to the pre-pandemic trend. In doing so, we acknowledge that there is increasing uncertainty around the baseline as we get further from the pre-pandemic years.

Figure 3 – Excess mortality for 40 countries over five years ending 31/12/24, as a percentage of expected deaths



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

All 40 countries[1] shown here had positive total excess mortality, with a weighted average[2] of 10%.

Excess mortality has been very high in Latin America, averaging about 15% over the five years.

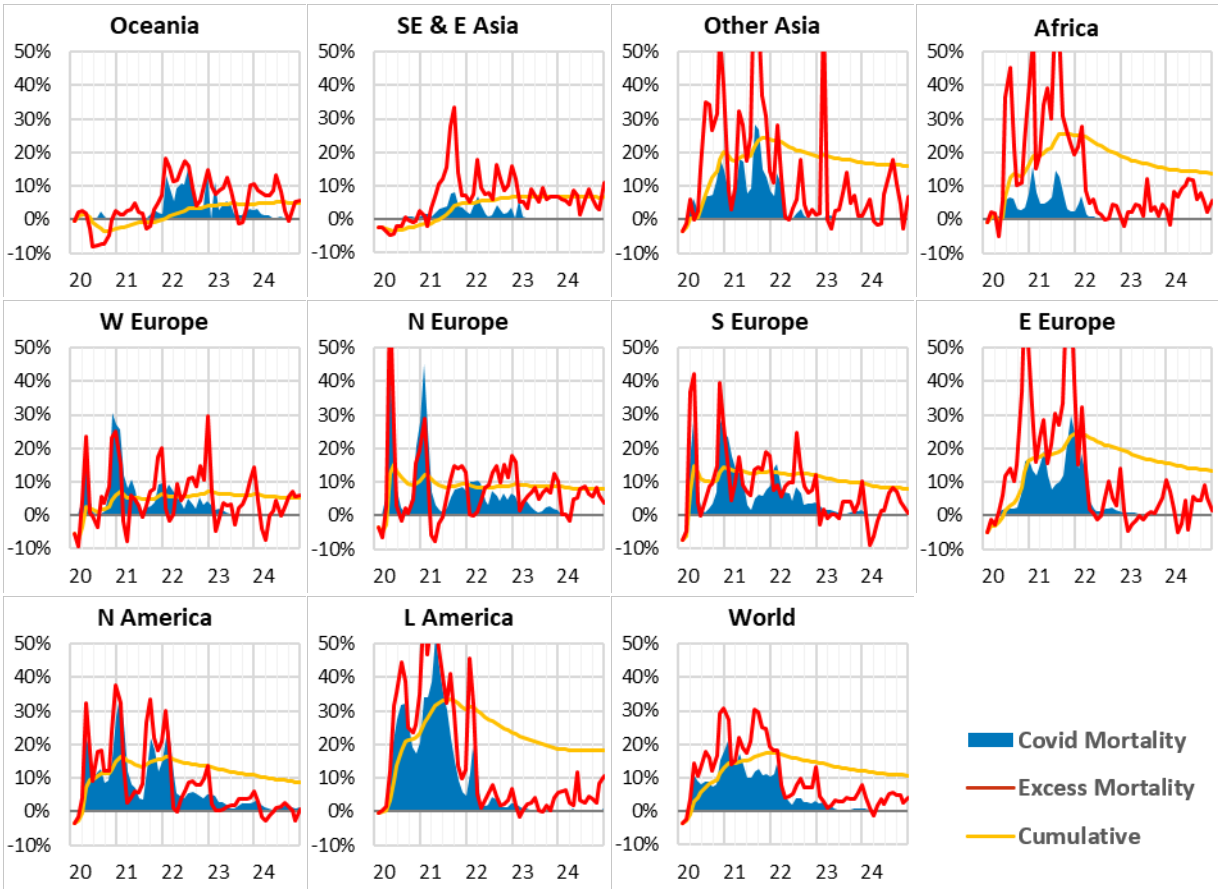
South-East and East Asia (7%) has generally fared much better than Other Asia (12%). Similarly, Northern and Western Europe (6%) has generally had lower excess mortality than Southern and Eastern Europe (11%).

The United States has experienced 9% excess mortality across the five years, substantially higher than Canada (5%). The difference is mostly due to reported COVID-19, with excess mortality from other causes at 1% in both countries.

Despite high excess mortality since borders opened in 2022, Australian excess mortality over the five years (6%) was towards the low end of the countries included in our selection – at 26th out of 40.

Looking at the monthly mortality experience in each region (see Figure 4Figure 4), we can see that excess mortality was driven by COVID-19 waves. The timing of peaks and troughs shows some common ground and some differences between regions. After allowing for the first Omicron wave in early 2022, most regions have experienced generally lower excess mortality in 2022-24[3], suggesting that a degree of "herd immunity[4]" has been achieved, through a combination of infection and vaccination. Sadly, it is clear that some regions have paid a high price in lives lost.

Figure 4 – Monthly excess mortality compared with Covid mortality, by region

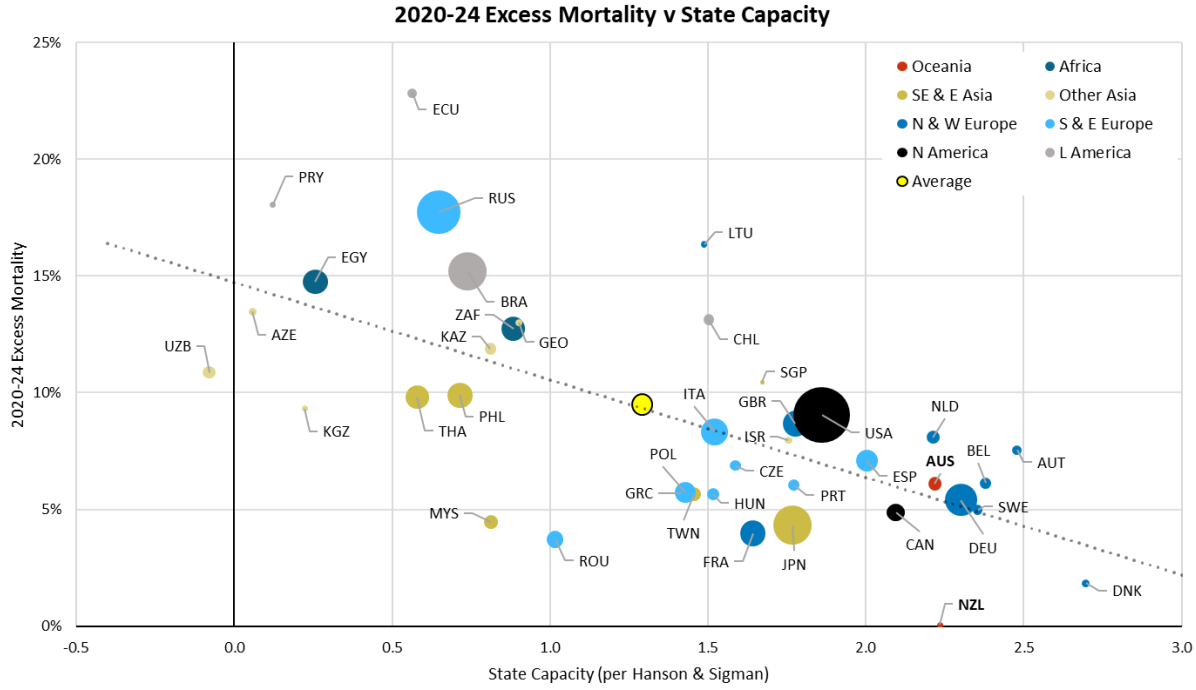


[1] See Section 4.4 and Appendix D Appendix D for a discussion of the selection of the 40 countries in Figure 3, including the unavailability of data for four of the five largest countries by population (China, India, Indonesia and Pakistan)
[2] The average shown is (total actual) / (total expected) – 1 for the 40 selected countries; the unweighted average is 9%
[3] The exceptions are Oceania and SE & E Asia, which experienced very low excess mortality in 2020-21
[4] We use the term "herd immunity" loosely here, to indicate that the net impact of the pandemic on current national mortality rates is low. We do not suggest that there is vastly reduced spread of COVID-19 or that it has become "safe" or "like flu".

Figure 4 also shows that, while regions with high excess mortality early in the pandemic now tend to be close to the pre-pandemic trend, that high early mortality was correlated with high cumulative mortality over the five-year period 2020-24. That is, actions taken to protect populations before vaccines were available have had at least a medium-term benefit for overall mortality. Those actions have saved lives, rather than simply deferring deaths for a year or two.

Figure 5 shows that there appears to have been an overall negative correlation between the measured capacity of a state to manage a crisis[5] and its excess mortality – wealthier countries (which tend to have higher capacity) generally had lower excess mortality than less wealthy countries.

Figure 5 – Comparison of 2020-24 excess mortality with state capacity, showing a clear (but somewhat weak) inverse relationship



Sources: Our World in Data (OWID), Worldometer and analysis. Excess mortality relative to projected deaths. Bubble size is projected deaths.

Mortality outlook

We have considered the factors influencing mortality in Australia in 2024 and how those factors may change in the near future.

In our view, the "new normal" level of mortality is likely to be higher in the short term than it would have been in the absence of the pandemic. Using a baseline extrapolated from pre-2020 experience, 2022 had 11% higher than predicted mortality and 2023 had 5% higher than predicted mortality. Our baseline for 2024 is largely extrapolated from 2023's experience, allowing for some improvement, and the experience was in line with that. Looking ahead, our view is that mortality will continue to improve, but we expect it to stay above the pre-pandemic trend for some time. Our baseline SDR prediction for 2025 is similar to the 2015-19 trend extrapolated to 2022, implying that the COVID-19 pandemic has resulted in a three-year pause in mortality improvement.

COVID-19 is expected to remain a persistent and significant contributor to overall mortality. From 2020 to 2023, many other causes of death saw elevated mortality relative to pre-pandemic trends. Cancer was the most notable exception, with mortality from 2020 to 2024 remaining broadly consistent with historical patterns. While the rate of change for non-COVID-19 causes appears to have normalised in

[5] Refer to Section 5.12 for discussion of state capacity, which is highly correlated to per-capita GDP

2024, we anticipate that their mortality will continue from the higher baseline established in 2023–2024, at least in the near term.

There has been a decades-long underlying trend of mortality improvement in Australia. Although the rate of improvement has gradually been slowing, our view is that, after a pause caused by the pandemic, the improvement will resume. 2024's experience was consistent with this. The underlying drivers of mortality improvement, such as medical advances, reduction in smoking rates, and other societal improvements are continuing (noting that improvements in many causes of death are "baked in" from population-wide changes years, or even decades, beforehand). In our previous report, we posed the question whether mortality will eventually return to the pre-pandemic trajectory, or whether there may be a permanent loss of a few years of mortality improvement. The 2024 experience does not categorically provide an answer but does give extra weight to the likelihood of a permanent loss of mortality improvement of a few years.

1 Introduction

This section discusses why we measure excess mortality and introduces terminology used throughout the Report.

1.1 Defining Excess Mortality

Excess mortality is defined as the difference between the actual number of deaths in a period and the predicted number.

The predicted number of deaths is an **estimate** based on certain assumptions, and therefore the calculated excess mortality is also an estimate. Excess mortality can only ever be an estimate – it is not, and cannot be, a known quantity.

The starting point for any estimate of predicted deaths for a population will be the number of deaths that have occurred in recent years (five years has become the accepted norm, but there are no established rules around this). Any reasonable estimate of the predicted number of deaths in a period should also take into account:

1. changes in the size of the population over time: the larger the population, the greater the predicted number of deaths (all else being equal);
2. changes in the demographics of the population over time, the most important of which is changes in the age structure of the population: the older the population, the greater the predicted number of deaths (all else being equal); and
3. trends in mortality rates over time: in Australia, mortality rates had improved for decades prior to the pandemic, and it is reasonable to assume that they will continue to do so in future.

Further, any estimate of predicted deaths needs to be supported by a clear explanation of what the predicted number represents. In this Report for the 2024 year, the predicted number of deaths is based on 2023 deaths, with a prediction of likely changes in specific causes of death. This is in contrast to our previous work for 2020-2023, where the predicted number of deaths was the predicted number had there been no pandemic.[6]

1.2 Why measure excess mortality?

It is important to compare mortality against a baseline, to capture any unexpected impacts over a year. During our earlier work, we explicitly used excess mortality as a key measure of the mortality impact of COVID-19. In the context of COVID-19, it captured:

- direct COVID-19 deaths, including those not reported as such;
- reduced deaths from defence measures, such as in Australia when border closures and lockdowns reduced the incidence of respiratory diseases; and
- increased deaths indirectly caused by the pandemic, such as those due to delayed medical attention.

Now that COVID-19 appears to be becoming an endemic cause of death in the Australian population, it is less useful to attempt to predict mortality in the absence of COVID-19. There are too many other influences for this particular counterfactual to be useful. Therefore, we have moved to a more normalised baseline, which will capture ongoing trends in mortality, including from COVID-19.

1.3 Terminology for COVID-19 deaths

As per previous Research Papers, we separate COVID-19 deaths into:

[6] The estimate of excess deaths would also include any excess (positive or negative) that is not related to the pandemic at all. However, in the absence of any reason to suppose otherwise, this is taken to be zero.

- deaths "from COVID-19", namely deaths where COVID-19 is listed as the primary/underlying cause of death; and
- deaths that were "COVID-19 related", namely deaths where the underlying cause of death has been determined as something other than COVID-19, but COVID-19 was a contributing factor mentioned on the death certificate.

The above COVID-19 deaths are distinct from "incidental COVID-19" deaths, namely deaths where the person was COVID-19 positive at the time of death, but COVID-19 was not recorded on the death certificate. These deaths are sometimes included in surveillance reporting where identified (other than where there is a clear alternative cause of death, such as trauma) but are not separately identified in the ABS statistics.

We have used the same definition of a week/year as the ABS, namely that weeks are based on the ISO (International Organization for Standardisation) week date system.

1.4 Mortality displacement

Mortality displacement is an important concept in the discussion of excess mortality over a period of time. Excess mortality, by its nature, represents the deaths of a number of people sooner than would have been expected. To the extent that this excess mortality has occurred among the frail (including, but not limited to, the elderly), there will be correspondingly fewer deaths in the next year or two (all else being equal).

Likewise, to the extent that frail lives have been saved by reduced exposure to a pathogen (negative mortality displacement), there will be correspondingly more deaths in the next year or two (all else being equal).

1.5 Content warning

This Report includes discussion of suicide deaths in several places, notably in Section 4.4.

2 Excess deaths in Australia in 2024

This section includes analysis focusing exclusively on excess deaths in Australia in 2024. The updated methodology for measuring excess mortality adopted in 2024 prevents us from making direct comparisons with earlier years.

Section 0 consolidates research from this Report and previous Research Papers[7], covering mortality experience for the five years from 2020 to 2024.

Section 0 discusses the possible causes of excess mortality in Australia.

2.1 Available data

There have traditionally been significant delays in releasing information on deaths in Australia given the sometimes lengthy delays between the time of death and the time the death is registered, with these delays further exacerbated if a death is referred to the coroner. Given the heightened interest in death statistics since the start of the COVID-19 pandemic, the ABS released a subset of the death statistics each month from June 2020 to December 2024[8] in order to provide more timely information to the public.

The information used in this section in respect of Australian deaths is predominantly based on the ABS *Provisional Mortality Statistics*[9] publication, including:

- Deaths occurring in each week from the start of 2015 until the end of 2024, provided that the death had been registered by 28 February 2025. Due to delays in registration of deaths, most weeks of 2024 will be missing a small number of deaths (minimal for the first half of 2024 increasing to around 2.9% for the last week of the year). Deaths are broken down by:
  - cause of death for doctor-certified deaths, for eleven selected causes (including COVID-19), plus coroner-referred deaths for all causes combined. The ABS has worked around the significant delays introduced by coronial investigations by including deaths once they have been reported to the coroner but not waiting for the outcome of cause of death. As such, the coroner-referred deaths are not broken down by cause;
  - age band and gender, summarised into five age bands for each gender; and
  - state/territory.

  Note that, due to confidentiality restrictions placed on the data the ABS is able to release, combinations of cause/age band/state are not available. Thus, for example, we are unable to examine cancer mortality for older females in NSW only.
- Standardised death rates. Weekly figures are available for all-cause mortality and broken down by cause of death (but not by age band/gender or state/territory).
- The number of deaths registered and received by the ABS by 28 February 2025 that included COVID-19 on the death certificate. Monthly data is supplied on whether deaths were *from* COVID-19 or were COVID-19 *related* deaths.

We were also supplied with additional data by the ABS in a customised report in relation to COVID-19 deaths registered by 28 February 2025, namely the total number of deaths each week (doctor-certified and coroner-referred) both *from* COVID-19 and COVID-19 *related*. Breakdowns were provided by age band/gender and by state/territory (where confidentiality provisions allowed it).

[7] Equivalent to this year's Report, see previous 'Research Paper' publications : *Impact of COVID-19 on Mortality and Morbidity in 2020, Impact of COVID-19 on Mortality and Morbidity in 2020 and 2021, How COVID-19 has affected Mortality in 2020 to 2022, and How COVID-19 has Affected Mortality in 2020 to 2023*

[8] The first release covered mortality from January to March 2020

[9] https://www.abs.gov.au/statistics/health/causes-death/provisional-mortality-statistics/latest-release

The analysis by state/territory included in this Report relies on analysis included in the most recent ABS excess mortality article *Measuring Australia's excess mortality during the COVID-19 pandemic until December 2023*[10] ("the ABS excess mortality calculations").

2.2 Measuring excess deaths – approach

Measuring excess deaths is not straightforward. In its simplest form, excess deaths are calculated as the difference between actual deaths occurring in a particular period less a "baseline" level of deaths. But what to use for the baseline?

Early in the pandemic, most measures of excess deaths compared 2020 actual deaths to a simple average of deaths in 2015 to 2019. However, this approach does not allow for changes in either the size or the age structure of the population, or for the continuation of any trends in mortality that may have been expected in the absence of the pandemic.

In their June 2021 paper[11], Karlinsky and Kobak took a different approach, fitting a trend to the 2015 to 2019 years to get their baseline. This approach, while allowing for past changes in size of population, age structure of the population and mortality trends, intermingles these three effects and assumes that their aggregate impact will continue on the same trend into 2020 and beyond.

Unlike Karlinsky and Kobak, who were projecting a baseline for each of 84 countries, we are focusing on Australia only, so we have taken the opportunity to apply a more detailed approach. We have explicitly allowed for changes in population size and age structure. Any modelled trends are the residual, being the improvement in the overall mortality rate over time[12].

As we do not have the data in three-way breakdowns (i.e. cause x age band/gender x state) we have built separate models for each of the breakdowns that are available. We have the most information for the breakdown by cause of death, due to the ABS provision of standardised death rates (SDRs) by cause. We have necessarily used a more approximate approach to allow for changes in population size and age demographic for the model by age band/gender. As a result, our models of excess deaths broken down by cause of death are our primary models. For the analysis by state/territory, we have adopted the ABS excess mortality calculations. Our approach for each model is discussed further below.

2.2.1 2024 Baseline

As set out in our April 2024 Actuaries Digital article[13], for measuring excess mortality in 2024, the Mortality Subcommittee changed its approach to setting the baseline (or expected deaths). We moved away from answering the question "how has the pandemic affected mortality?" to instead ask "how is current mortality tracking relative to last year?". This shift reflects our transition from pandemic-era analysis to ongoing mortality monitoring.

More completely, our estimate of excess deaths measures how 2024 mortality compares to the expected level based on 2023, after allowing for one year's expected mortality improvement.

In adopting a 2024 baseline based on 2023 mortality (adjusted as discussed above), we note that:

- the baseline includes any temporary pandemic impacts affecting 2023 mortality;
- any such temporary pandemic impacts are impossible to quantify;
- we assume that underlying non-COVID-19 mortality will continue to improve, which it has done for decades prior to the pandemic;

[10] https://www.abs.gov.au/articles/measuring-australias-excess-mortality-during-covid-19-pandemic-until-december-2023
[11] Karlinsky & Kobak, 2021, *Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset*
[12] We identified this trend for each separate cause of death, age/gender and state/territory combination for which we have data
[13] Excess Mortality: Considerations in Moving Away from a Pre-pandemic Baseline, published 24 April 2024

- it is unclear whether – and to what extent – the underlying mortality improvement rate would be higher or lower than the pre-pandemic trend; and
- therefore, there is more than usual uncertainty around the appropriate baseline for expected mortality.

2.2.2 Deaths broken down by cause

As noted above, we used different sets of years as the basis for our 2024 projections for different causes.

The methodology incorporated three cause-specific approaches:

- for deaths due to COVID-19, we adopted the 2023 seasonal pattern for the 2024 baseline;
- for other respiratory causes, we adopted the 2023 SDRs for 2024, since it seemed reasonable not to allow for any year-to-year mortality trend;
- for all other causes of death, we adopted the 2023 SDRs plus an allowance for the pre-pandemic rate of mortality improvement to continue into 2024;
- converted predicted SDRs to predicted numbers of deaths for ease of communication;
- compared predicted deaths to the actual deaths (after including a small allowance in the actual numbers for late-reported deaths).

It is important to note that predicted death *numbers* are increasing faster due to demographic changes (ageing and population size) than they are reducing due to mortality improvement, even though age-standardised death *rates* are reducing. Therefore, all other things being equal, we expect numbers of deaths to increase in each successive year.

2.2.3 Deaths broken down by age/gender

Our models of excess deaths broken down by age band/gender are supplementary to our cause of death models. As SDRs are not available by age band/gender, we used a modified version of the above approach by cause of death. For each age band/gender combination we:

- scaled actual weekly deaths from 2015 to 2023 so that they are representative of the number of deaths in those years if they had the 2024 population size and age mix;
- fitted a linear regression model to the scaled deaths from 2015 to 2019. As we know that some causes of death were more impacted by the pandemic than others, but have no information by cause and age/gender, we are unable to use any data other than the 2015-19 years to obtain baselines representative of pre-pandemic expectations;
- adopted the 2023 crude death rates and assumed the pre-pandemic rate of mortality improvement continued into 2024;
- adjusted the predicted deaths to align to overall cause-specific predictions for a like-for-like comparison; and
- compared adjusted predicted deaths to the actual deaths in 2024 (after a small allowance for late-reported deaths).

Details of our approach and the adjustments made are included in Appendix A .

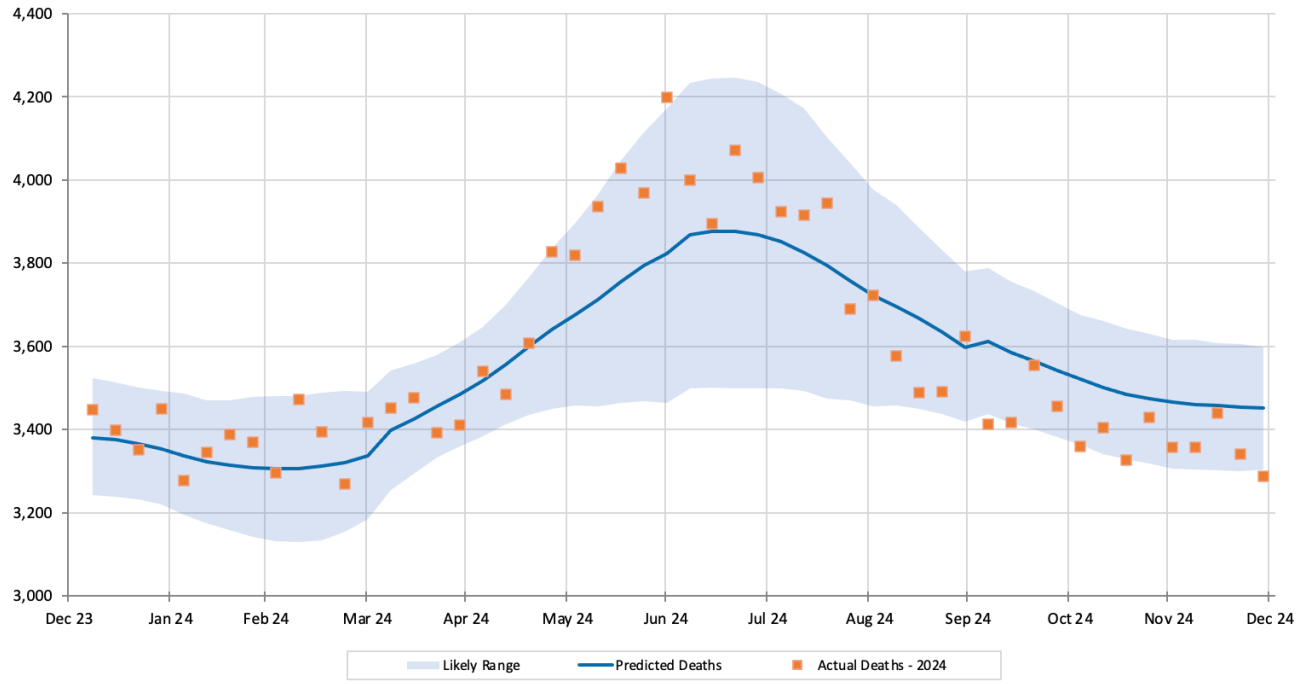
2.3 2024 Excess mortality

Our model predicted 185,800 deaths in 2024 (including 2,400 COVID-19 deaths), around 1.1% more than actually occurred in 2023. The predicted increase reflects demographic effects outpacing mortality improvements.

Our analysis shows that in 2024, after making an estimated allowance for deaths reported after 28 February 2025, 186,500 people died in Australia in 2024. This gives an excess of 700 or 0.4%. Although the overall figure is small, the excess mortality by cause and by age and gender group was more varied. This is discussed in Sections 2.5 and 2.7.

Figure 6 shows the results of our analysis, comparing actual deaths each week in 2024 to our predicted values and the 95% prediction interval.

Figure 6 – Weekly actual and predicted deaths 2024 – All Causes



The chart shows that mortality was largely in line with our 2024 prediction until May. From June to August, mortality was higher than the prediction in almost every week, largely driven by a deadlier-than-predicted winter COVID-19 wave. During this period, weekly mortality mostly remained within our likely range, which is based on a 95% confidence interval derived from past weekly patterns of volatility. However, the consistent pattern of higher than predicted weekly figures is itself significant. From September to December, mortality was lighter than expected in most weeks, and this is also significant, despite individual weeks largely falling within the likely range.

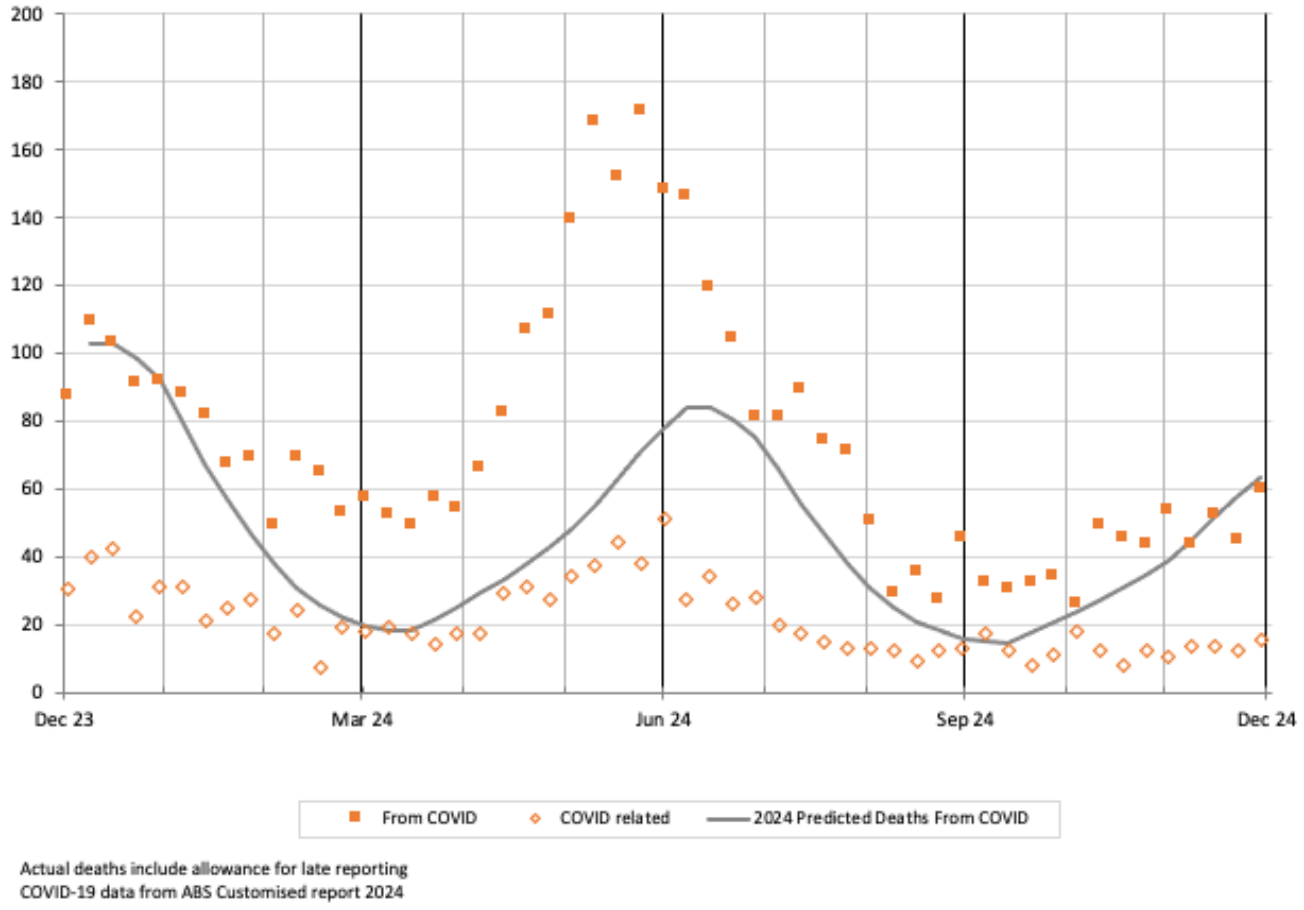
The 95% prediction intervals shown are based on 2023 baseline analysis, representing pre-pandemic variance that excludes COVID-19 variability. Consequently, Figure 6 displays narrower intervals than 95% prediction intervals that incorporate COVID-19 death variance.

2.4 COVID-19 Mortality Analysis

2.4.1 Comparison to prediction

Figure 7 shows, for 2024, actual deaths from COVID-19 along with our 2024 prediction. It also shows COVID-19-related deaths. Our prediction was based an assumption of two annual waves with gradually decreasing magnitude.

Figure 7 – 2024 weekly deaths from COVID-19 and COVID-19 related deaths



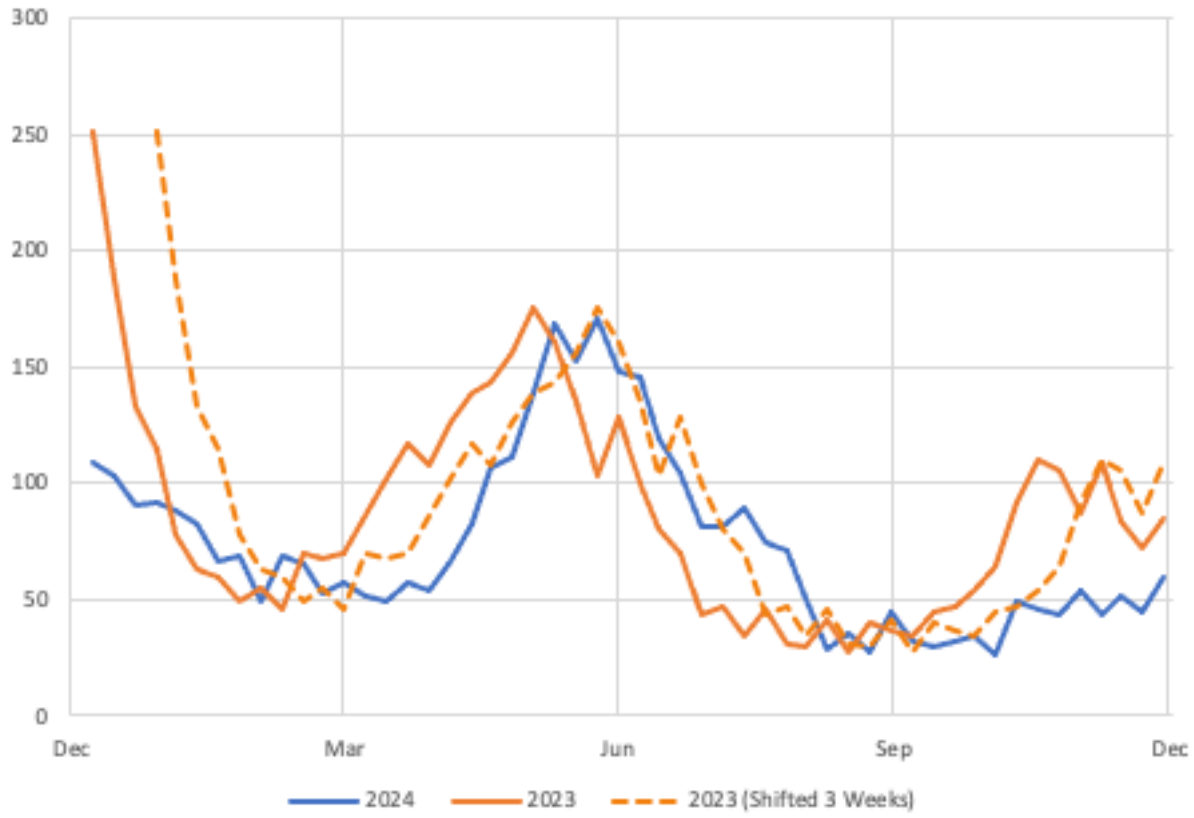
COVID-19 mortality in 2024 largely followed our basic predicted pattern, though with slightly different timing than anticipated. The late-2023 wave subsided early in the year, followed by a winter wave that subsequently abated before deaths again began to rise towards the end of the year.

However, COVID-19 deaths significantly exceeded the magnitude of our 2024 prediction. The winter wave rose more sharply and reached much higher levels than forecast. Contrary to our wave-reduction hypothesis, this peak exceeded the previous wave's magnitude. Additionally, inter-wave COVID-19 mortality remained higher than anticipated.

2.4.2 Comparison to 2023

Figure 8 demonstrates that, after allowing for a timing difference of roughly three weeks in the winter wave, COVID-19 mortality levels were similar between 2023 and 2024 for much of the year.

Figure 8 – Comparing 2024 to 2023 deaths from COVID-19



Our prediction that 2024 waves would follow the previous pattern of getting progressively smaller turned out to be incorrect. The mid-2024 wave, rather than being smaller than the late-2023 wave, was similar in size to the larger mid-2023 wave in magnitude. The late-2024 wave does appear to have been smaller than previous waves.

Overall, 2024 COVID-19 deaths decreased by 16% compared to 2023. This can largely be explained by

- 2023 beginning with a high mortality peak, carried over from 2022, that was not repeated at the start of 2024; and
- the wave that started in October 2024 being smaller than the 2023 equivalent.

2.4.3 Implications and lessons learned

COVID-19 remains a novel disease with difficult-to-predict mortality impacts. The 2024 experience proved materially worse than anticipated across multiple dimensions:

- peak mortality levels exceeded predictions for individual waves;
- baseline mortality between waves remained elevated beyond expectations; and
- the assumption of gradually decreasing wave intensity did not hold.

These findings highlight the ongoing challenges in modelling endemic COVID-19 patterns and suggest the need for continued refinement of our predictive approaches as more data becomes available.

The 2024 experience reinforces the importance of maintaining wide confidence intervals and conservative assumptions when projecting COVID-19 mortality in an evolving epidemiological landscape.

2.5 Excess mortality by cause of death

Table 1Table 1 – Excess deaths by cause 2024

shows our estimate of 2024 excess deaths broken down by cause.

Note that we have formed an estimate of the number of coroner-referred deaths that were *from* COVID-19 as discussed in Appendix B . We have assumed that coroner-referred deaths *from* COVID-19 will be 4.5% of all deaths *from* COVID-19 for each month of 2024, based on the experience from late 2021 to 2023. We have deducted these estimated coroner-referred deaths *from* COVID-19 from other coroner-referred deaths. If our estimate of coroner-referred COVID-19 deaths is too high (or low), this will not affect the total level of excess deaths measured; it will just mean that our estimate of non-COVID-19 coroner-referred deaths will be too low (or high) by the same amount.

Table 1 – Excess deaths by cause 2024

	2024 Year to Date			
	Actual	Predicted	Excess	% Excess
From COVID-19				
Doctor-certified	3,733			
Coroner-referred	176			
All From COVID-19	**3,909**	**2,418**	**1,491**	**62%**
Doctor-certified other respiratory disease				
Influenza	740	443	297	67%
Pneumonia	2,650	2,420	230	**10%**
Lower respiratory	8,520	8,130	390	**5%**
Other respiratory	4,040	4,020	20	1%
All doctor-certified respiratory	**15,960**	**15,010**	**940**	**6%**
Doctor-certified other diseases				
Cancer	51,310	52,510	(1,200)	**-2%**
Ischaemic heart disease	12,450	12,900	(450)	**-3%**
Other cardiac conditions	10,370	10,450	(80)	-1%
Cerebrovascular disease	8,620	8,710	(80)	-1%
Diabetes	5,350	5,550	(200)	-4%
Dementia	17,900	18,120	(220)	-1%
Other unspecified diseases	37,010	36,890	120	0%
All other doctor-certified disease	**143,030**	**145,130**	**(2,100)**	**-1%**
Coroner-referred excl. From COVID-19	**23,580**	**23,220**	**360**	**2%**
Total	**186,500**	**185,800**	**700**	**0%**

* Figures shaded green indicate that the observed values are below the 95% prediction interval while figures shaded red are above the 95% prediction interval. COVID-19 data from ABS customised report 2024 and analysis

When broken down by cause of death, in 2024:

- total deaths were 700 (or 0.4%) higher than predicted, noting that this is against a baseline **that includes COVID-19**;
- (We again note that our excess death estimates for years up to 2023 were measured against a baseline that did not include COVID-19 and are therefore not directly comparable to the 2024 number. This is discussed further in Section 0);
- there were 3,909 deaths *from* COVID-19, significantly more than the prediction of 2,418. This difference alone is more than double the overall excess mortality for the year;
- deaths *from* COVID-19 are estimated to have constituted over 2% of all mortality in Australia in 2024.
- non-COVID-19 respiratory causes contributed a further 940 excess deaths;
- while influenza deaths were materially higher than in 2023 (and indeed at any time during the pandemic), it remains the case that COVID-19 is a far more deadly disease, with more than five COVID-19 deaths in Australia in 2024 for every influenza death;

- doctor-certified deaths from non-respiratory causes were 2,100 (or 1%) lower than expected. While this number is small in percentage terms, it is statistically significant and almost sufficient to offset the excess respiratory deaths;
- lower than expected doctor-certified deaths from cancer (2% lower) and Ischaemic heart disease (3% lower), which are both statistically significant;
- doctor-certified deaths from other cardiac conditions, cerebrovascular disease, diabetes, dementia and other unspecified diseases were lower than predicted, although not statistically significant; and
- coroner-referred deaths, excluding an estimate for those *from* COVID-19, were 2% higher than predicted.

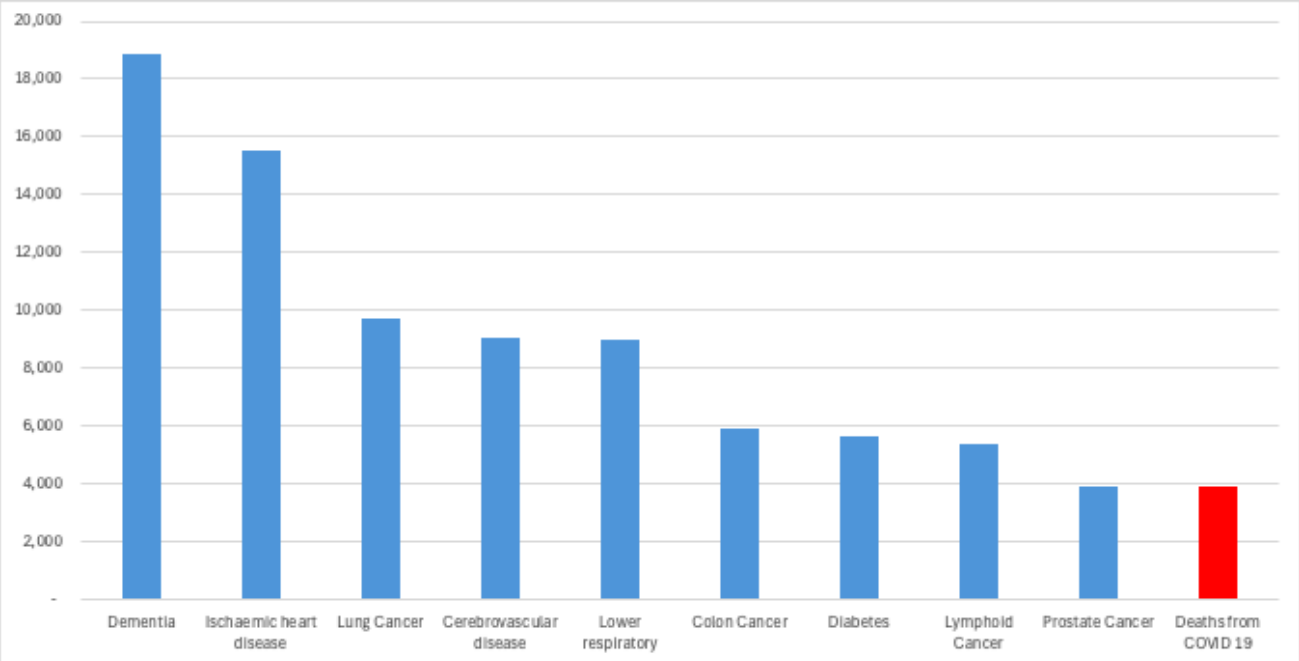
2.6 Leading causes of death

The ABS reports on the top 20 leading causes of death by grouping deaths based on their ICD-10 code. Unlike the *Provisional Mortality Statistics*, cancers are grouped based on the region of the body rather than being classed as a single cause of death. In this section, we assess where COVID-19 sits in terms of leading causes of death in Australia in 2024 and have followed the ABS classification system.

We have estimated deaths for the leading causes for 2024 by:

- taking doctor-certified deaths by cause to 31 December 2024 as shown in Table 1 – Excess deaths by cause 2024
- ;
- including an allowance for coroner-referred deaths (using the historical ratio of doctor-certified to coroner-referred deaths)[14]; and
- for the leading cancer causes, estimating deaths from all cancers and then assuming that lung, colon, lymphoid and prostate cancers make up 18%, 11%, 10% and 7% respectively of all cancer deaths, in line with the stable proportions seen over the recent past.

Figure 9 – Estimated leading causes of death – Australia in 2024



[14] We have taken all deaths from the ABS *Cause of Death*, and doctor-certified deaths from the ABS *Provisional Mortality Statistics*, with the difference assumed to be coroner-referred deaths. For almost all causes of death shown, around 95% or more deaths have historically been doctor-certified. The exception to this is ischaemic heart disease where around 80% of deaths have historically been doctor-certified. With significantly higher numbers of deaths in Australia in 2022, particularly for doctor-certified ischaemic heart disease deaths, there is uncertainty over these assumptions.

With around 4,000 deaths *from* COVID-19, we estimate that this puts COVID-19 as the tenth leading cause of death in Australia in 2024. This is down from being the ninth leading cause in 2023 (having been narrowly overtaken by prostate cancer) and the third leading cause in 2022. We estimate that around 2.1% of all deaths in Australia in 2024 were from COVID-19. Before COVID-19, 1970 was the last time an infectious disease was in the top 10 causes of death in Australia.[15] Despite dropping one place, it appears that COVID-19 is stabilising as a major endemic cause of mortality in Australia. Its high placing emphasises the ongoing public health significance of the disease.

Dementia continued to be the leading cause of death in Australia in 2024. This reflects ongoing demographic trends toward an aging population and the significant mortality impact of neurodegenerative diseases. Dementia's position as the primary cause of death underscores the significant impact of population aging on mortality patterns and healthcare system demands.

2.7 Excess deaths by age and gender

Table 2 summarises the results of the analysis by age band and gender in 2024.

The approach to setting the baseline by age/gender was approximate in nature and uses the same methodology as our cause of death models. The baseline was calibrated using crude death rates from ABS data and scaled to achieve the same totals as our cause of death analysis. We remind the reader that our models by cause of death are our preferred models, but we provide the age band/gender models for indicative purposes. In particular, we note that the numbers of deaths in the 0-44 and 45-64 age bands are small and hence subject to considerable natural variation. Therefore, the results for these younger age bands are less reliable than for older age bands.

We have shown the results by all non-COVID-19 related deaths and by COVID-19 related deaths.

Table 2 – Excess deaths by age band and gender - 2024

Age Band and Gender	2024 Year to Date (52 weeks)											
	Actual ex-COVID	Predicted ex-COVID	Excess ex-COVID	% Contribution to Excess ex-COVID	Covid-19 Actual	Covid-19 Predicted	Covid-19 Excess	% Contribution to Excess from COVID	Actual Total	Predicted Total	Excess Total	% Excess Total
Males, 0-44	5,200	5,200	0	0%	30	10	20	1%	5,230	5,210	20	0%
Males, 45-64	13,580	13,460	120	1%	90	70	20	1%	13,680	13,520	160	1%
Males, 65-74	17,120	17,090	30	0%	240	150	90	1%	17,360	17,240	120	1%
Males, 75-84	28,140	28,760	-620	-2%	640	410	230	2%	28,780	29,170	-390	-1%
Males, 85 and over	31,710	31,950	-240	-1%	1,090	620	470	3%	32,800	32,570	230	1%
Males, All ages	**95,700**	**96,400**	**-700**	**-1%**	**2,100**	**1,300**	**800**	**2%**	**97,800**	**97,700**	**100**	**0%**
Females, 0-44	2,710	2,820	-110	-4%	30	20	10	1%	2,740	2,840	-100	-4%
Females, 45-64	8,290	8,350	-60	-1%	70	60	10	1%	8,350	8,410	-60	-1%
Females, 65-74	11,250	11,300	-50	0%	160	100	60	1%	11,410	11,390	20	0%
Females, 75-84	22,080	22,470	-390	-2%	410	290	120	2%	22,500	22,760	-260	-1%
Females, 85 and ove	42,230	41,980	250	1%	1,140	700	440	3%	43,370	42,670	700	2%
Females, All ages	**86,600**	**86,900**	**-400**	**0%**	**1,800**	**1,200**	**600**	**2%**	**88,400**	**88,100**	**300**	**0%**
Person, 0-44	7,910	8,020	-110	-1%	60	40	20	1%	7,970	8,050	-80	-1%
Person, 45-64	21,870	21,810	60	0%	160	120	40	1%	22,030	21,930	100	0%
Person, 65-74	28,370	28,380	-10	0%	400	250	150	1%	28,770	28,630	140	0%
Person, 75-84	50,220	51,230	-1,010	-2%	1,050	700	350	2%	51,280	51,930	-650	-1%
Person, 85 and over	73,940	73,930	10	0%	2,240	1,320	920	3%	76,170	75,240	930	1%
Person, All ages	**182,300**	**183,400**	**-1,100**	**-1%**	**3,900**	**2,400**	**1,500**	**2%**	**186,200**	**185,800**	**400**	**0%**

A significant portion of the non-COVID-19 *negative* excess mortality is driven by the 75-84 age band across both genders. Although we do not have data by both age / gender and cause, we expect that the favourable experience in this age group is linked to the lower than predicted number of cancer deaths in 2024.

The high COVID-19 excess mortality discussed in Section 2.5 is observed across all age bands and genders. We do not see the percentage of excess deaths increasing in older age bands as we might have expected, given the steeper mortality curve that COVID-19 has. This is possibly due to higher

[15] https://www.abc.net.au/news/2023-09-27/covid-in-abs-leading-causes-of-death-data-heart-disease-/102906350

degrees of natural variation at lower ages where there are small numbers of deaths. We note that the over-85 band does have the highest percentage excess.

COVID-19 mortality in 2024 exceeded our prediction for every age band and both genders, with the deviations in relative terms being broadly consistent across all categories. 57% of deaths *from* COVID-19 in 2024 occurred in people aged 85 and over, which is 3.0% of all deaths in that age category. A further 27% of COVID-19 deaths occurred in people aged between 75 and 84, which is 2.1% of all deaths in that age category. COVID-19 caused 1.4% of all deaths in the 65-74 category, and 0.7% of all deaths in those aged under 65.

3 Review of Mortality in Australia 2020-24

3.1 Previous analysis

Our 2024 Research Paper looked at excess mortality experience between 2020 and 2023 with reference to our previous baseline, which was based on pre-pandemic experience. In summary, it noted that, in 2020, Australia had significant negative excess mortality due to its success in containing COVID-19; in 2021, mortality was close to the baseline for most of the year but started to rise sharply towards the end; in 2022, high excess mortality persisted throughout the year; and in 2023, excess mortality was observed for most of the year, although not as high as in 2022.

3.2 Approach for investigating 2020-24 experience

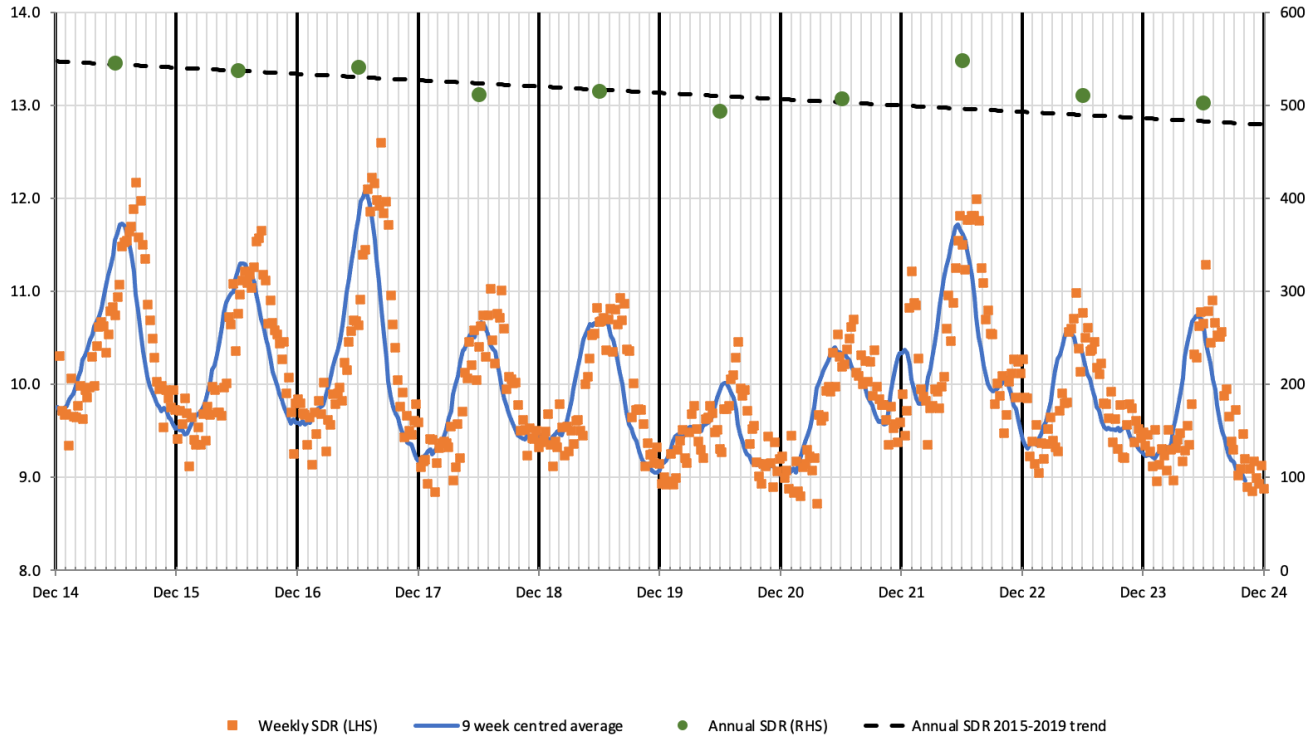
From 2024, we have adopted a different baseline largely based on experience since 2023, meaning that a comparison of our excess mortality measure across the full period 2020-24 is no longer valid. Instead, we have investigated Standardised Death Rates (SDRs) across this period and, as a point of reference (*not* a prediction), compared them to the trend observed in the period 2015-2019 – i.e. the five years before the COVID-19 pandemic commenced.

Standardised Death Rates measure the number of deaths per 100,000 population, after adjustment of raw figures to a standardised population base. For the analysis, we have used weekly SDRs (typically in the range 9 to 12 per deaths per 100,000 population per week) or annual SDRs (typically in the range 500 to 550 deaths per 100,000 population per year). SDRs are calculated by the ABS, using the population mix at 30 June 2001 as the standard. We note that Australia's demographics have changed significantly since that date, but we believe that the SDR remains more robust as a measure of changes in underlying mortality over time, compared to a non-standardised measure.

3.3 SDRs 2015-2024

Figure 10 shows the weekly SDRs since 2015 plotted on the left-hand axis, with a nine-week moving average. The annual SDRs are plotted on the right-hand axis, along with the 2015-2019 trend.

Figure 10 – Weekly and annual actual standardised death rates, nine-week moving average and 2015-19 trend – All Causes from 2015 to 2024



The chart shows the steadily improving trend in mortality rates before the pandemic. It also shows that the level of mortality since 2022 has been materially higher than this trend. In this context, it should be noted that above-trend years occurred before the COVID-19 pandemic, with 2017 (a bad influenza year) being the clearest example.

2020 mortality was considerably lower than 2019, as a result of the lower number of respiratory and respiratory-related deaths in that year due to measures introduced to curb COVID-19. 2021 had higher mortality higher than 2020, with deaths *from* COVID-19 during the Delta wave and excess mortality from other causes of death (other than from respiratory disease).

2022 was the year when travel restrictions were lifted and COVID-19 mortality peaked in Australia. Mortality in that year was higher than in any other year shown in the chart.

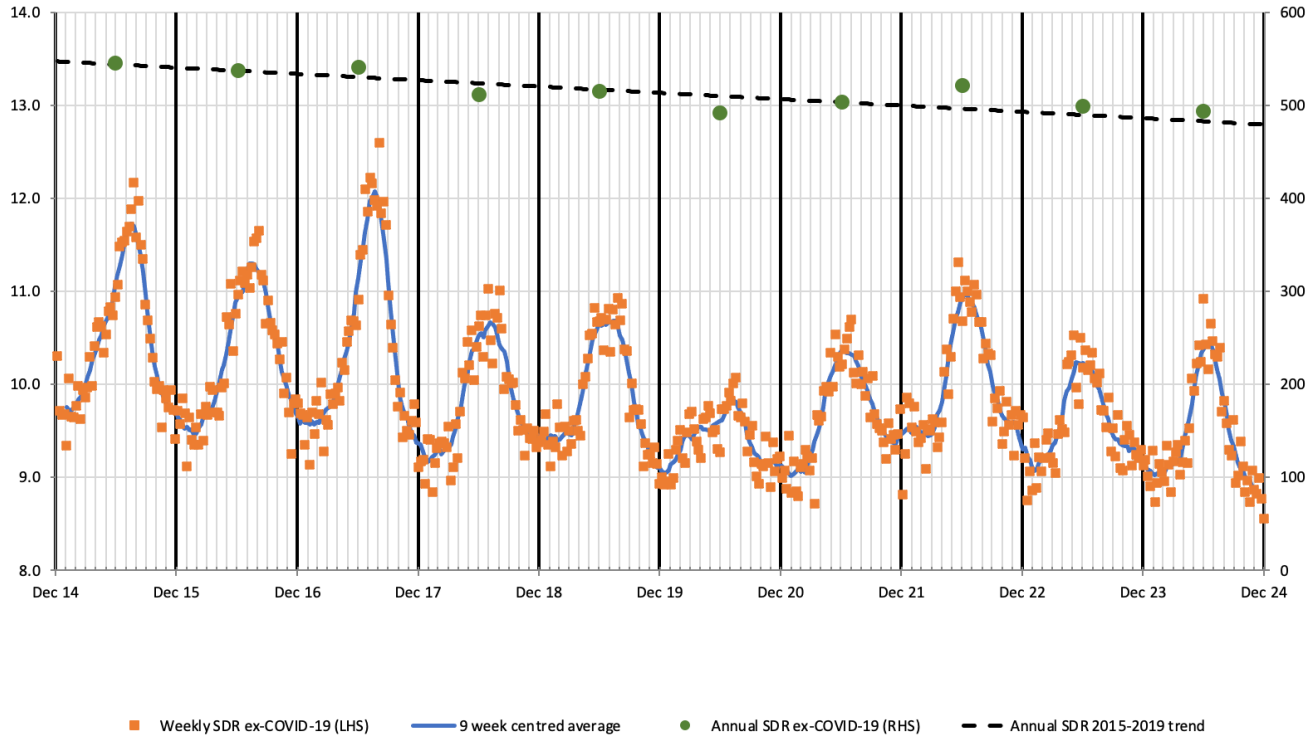
2023 mortality was materially lower than in 2022 but higher than the 2015-19 trend line. The SDR for 2023 is similar to that for 2018 and 2019. 2024 was lower than 2023, and also lower than any of the pre-pandemic years shown, but it remained above the 2015-19 trend line.

In 2022 and 2023, summer COVID-19 waves disrupted the usual patten of mortality peaking once a year in winter. However, the shape in 2024 was closer to the pre-pandemic norm.

3.4 Weekly SDRs 2015-2024 excluding COVID-19

Figure 11 shows the weekly SDRs since 2015, with deaths *from* COVID-19 removed, along with a nine-week moving average. The annual SDRs, also excluding deaths *from* COVID-19, are plotted on the right-hand axis, along with the 2015-2019 trend.

Figure 11 – Weekly and annual actual standardised death rates, nine-week moving average and 2015-19 trend – All Causes from 2015 to 2024, excluding deaths from COVID-19

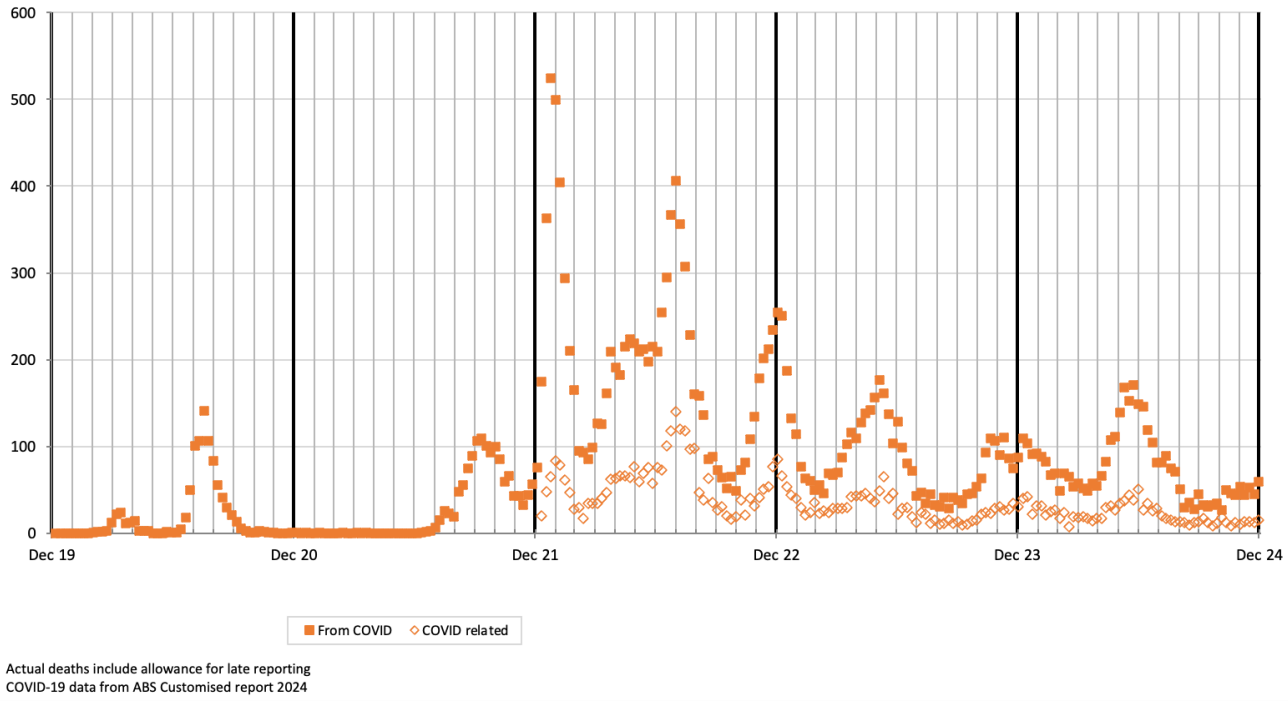


After removing all deaths *from* COVID-19, mortality in 2022 was still significantly above the 2015-19 trend. 2023 and 2024 are also above the trend, although arguably within the typical range.

3.5 COVID-19 mortality

Figure 12 shows deaths *from* COVID-19 and COVID-19 *related* deaths from 2020 to 2024, noting that, given small numbers, weekly data for COVID-19 *related* deaths is not available for 2020 or 2021.

*Figure 12 – Weekly deaths 2020-2024 – from COVID-19 and COVID-19 related**



** COVID-19 data from ABS customised report 2024.*

There were 900 COVID-19 deaths in 2020 (0.6% of all mortality that year) and 1,300 (0.8%) in 2021, the years in which the pandemic in Australia was largely contained. In 2022, the peak year for COVID-19 mortality in Australia, there were around 10,100 deaths *from* COVID-19 (5.3% of all mortality that year). There were another 2,900 deaths where COVID-19 was a contributory factor in the death. In 2023 these numbers fell substantially, with around 4,800 deaths (2.6%) *from* COVID-19 and around 1,600 COVID-19 *related* deaths. The 2024 figure was similar to 2023, with around 3,900 deaths (2.1%) *from* COVID-19 and around 1,100 COVID-19 *related* deaths.

The COVID-19 waves are very clear. By far the largest wave occurred early in 2022, immediately after travel restrictions were lifted. Subsequent waves were initially smaller than previous ones, but 2024 was comparable to 2023. The emerging pattern has been for waves to occur each winter and summer, with winter waves having been more deadly than the summer ones since mid-2023. Deaths *from* COVID-19 and COVID-19 *related* deaths are strongly correlated, following the same pattern of peak and troughs.

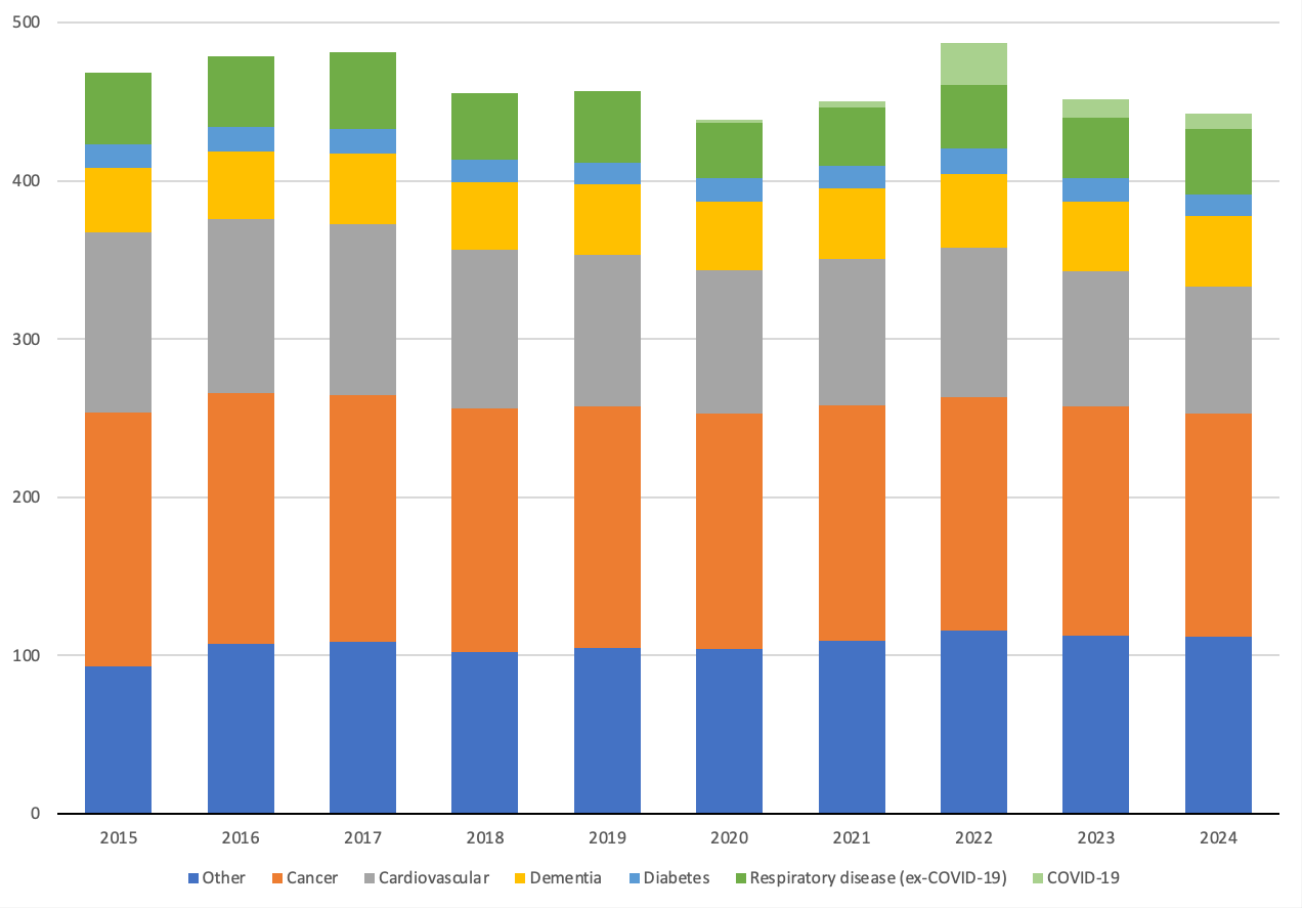
It is unclear how many people whose deaths were COVID-19 *related* would have died during this period if COVID-19 had not been a factor, and how many may have had their death hastened by COVID-19. Given that COVID-19 was considered to have contributed to the death, and that these deaths followed the same peaks and troughs as *from* COVID-19 deaths, it seems that COVID-19 was a catalyst in these deaths, rather than having been merely coincidental. We note that the same has traditionally happened with the winter peak of respiratory disease deaths.

There may be instances where it is difficult to determine whether a death is due to COVID-19 versus COVID-19 being a contributing cause, and an element of professional judgment by the certifier will necessarily need to be exercised. It is unclear to us how often such decisions may need to be made, and how much "blurring" there may be between deaths *from* COVID-19 and COVID-19 *related* deaths.

3.6 Annual SDRs by Cause

Figure 13 shows annual SDRs since 2015 split between the major causes of mortality.

Figure 13 – Annual SDRs 2015-2024 by Cause



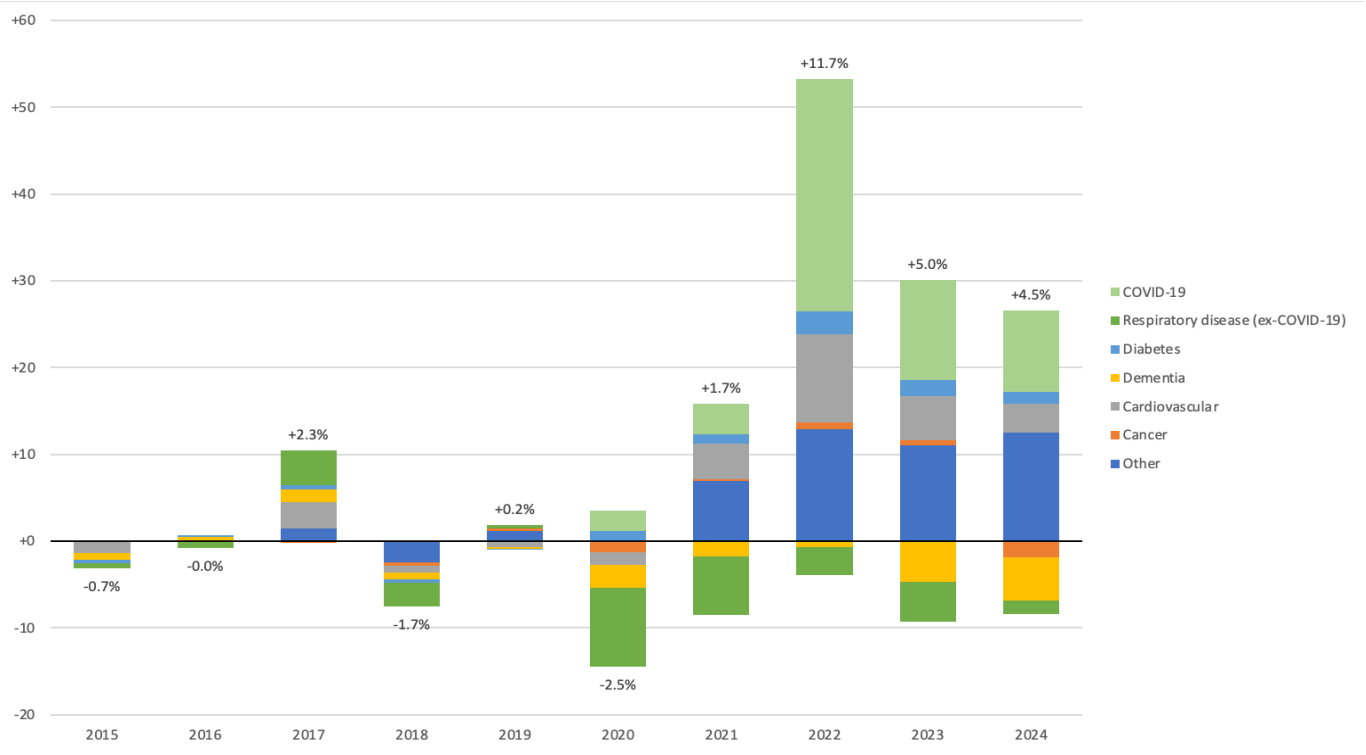
Reductions in cancer and cardiovascular deaths have been the primary contributors to improvements in mortality, offset by steady increases in dementia and "other" deaths. Several causes contributed to 2022's very high mortality, but the role of COVID-19 is clearly evident.

3.7 Variations in mortality

The basic principle underpinning our approach for measuring excess mortality changed in 2024. From 2020 to 2023, we used a baseline that attempted to estimate the number of deaths that would have occurred had there been no pandemic, and we measured the excess relative to that (meaning that all COVID-19 deaths were considered part of the excess). From 2024, we use a baseline that takes into account the impact of the pandemic by extrapolating from actual post-pandemic experience (meaning that a certain level of COVID-19 deaths is to be expected). This means that we do not have one consistent view of excess mortality across the whole period of our investigations.

However, for the purpose of investigating the drivers of change since the pandemic commenced, we can measure mortality against a simple trendline of 2015-19 experience. We have done this below, calculating the contribution of each cause of death to the overall difference from this trend. It is important to note that we do not claim that the trendline represents a scientific expectation of ex-pandemic mortality; it does, however, provide a useful point of reference.

Figure 14 – Contribution of each cause to the overall deviation from the 2015-2019 mortality trend (doctor-certified deaths only)



Between 2015 and 2019, the most notable features are the volatility of the "other" causes and the contribution of respiratory disease to the high 2017 outcome, and to the low outcome the following year. The correlation between the respiratory outcome and other causes is also notable in 2017 and 2018, and it is of interest when looking at subsequent experience and correlations with COVID-19.

In 2020, the largest contributor to the low overall SDR was respiratory disease, even allowing for COVID-19. The correlation of respiratory with several other causes was again evident. This was not the case in 2021, where respiratory disease, even allowing for COVID-19, was below the 2015-19 trend, but high cardiovascular and "other" mortality resulted in an overall result above the trend.

The dominant contributor to 2022's very high mortality was clearly COVID-19, and it remained a leading driver in 2023 and 2024. Cardiovascular and in particular "other" mortality have been significant secondary contributors since 2021. This may be indicative of a general slow-down in mortality improvement for these categories, or it could indicate a correlation with ongoing COVID-19 mortality (or both). In future work, the Subcommittee intends to further investigate the drivers of the contribution of "other" mortality.

Deaths from respiratory disease have been below the pre-pandemic trend since 2018. Partly, this is because the period used to set the trend includes the adverse flu season in 2017, but since 2020 it is also likely to been driven by pandemic-related factors. Measures taken to control the spread of COVID-19 in high-risk settings will also have reduced the spread of other respiratory diseases. And, to some extent, COVID-19 deaths will have substituted for what would otherwise have been other respiratory deaths for some individuals.

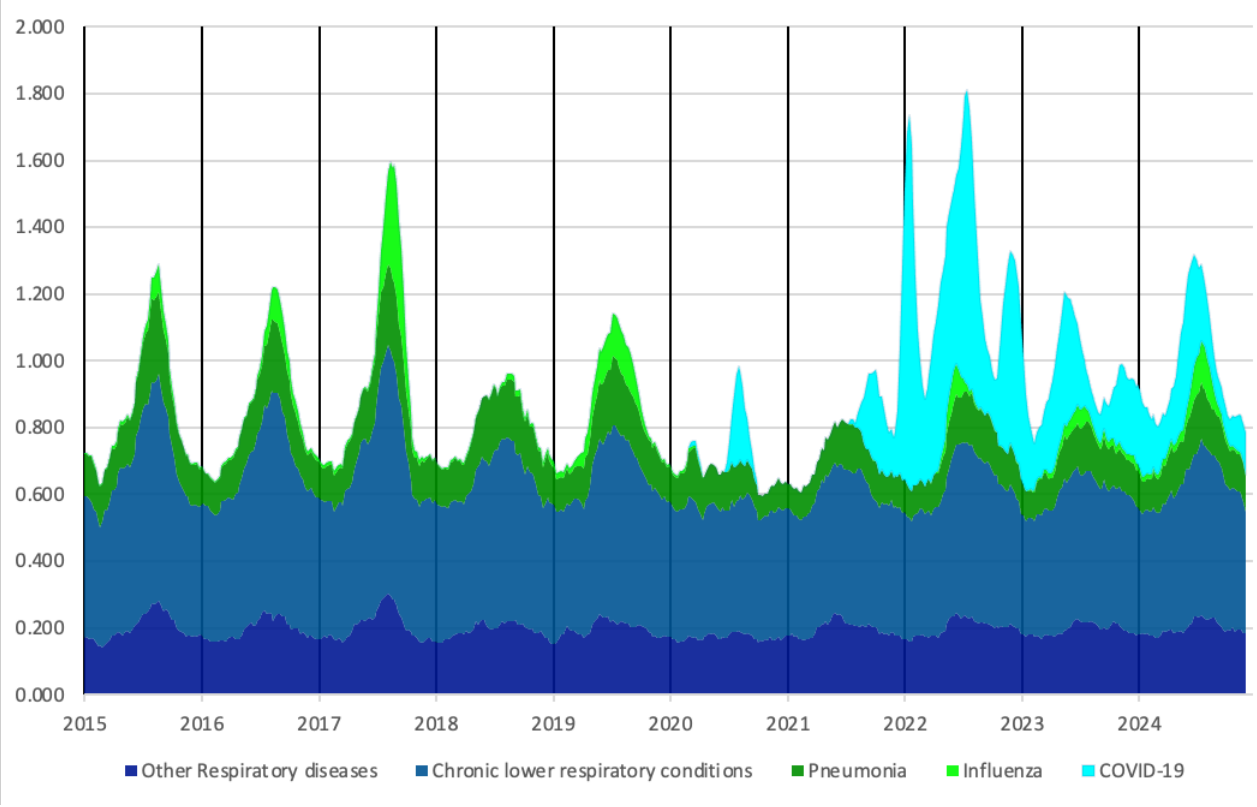
3.8 Correlations between causes

Analysis of the total mortality in each year, as well as the weekly pattern within each year, shows strong correlations between many of the main causal groups.

3.8.1 Correlations between respiratory causes

The ABS classifies respiratory deaths as being caused by Influenza, Pneumonia, Chronic Lower Respiratory Disease, Other Respiratory and, since 2020, COVID-19. There are significant correlations between several of these causes.

Figure 15 – Weekly SDRs for respiratory causes, 2015-2024



The chart of weekly SDRs for the respiratory causes shows, until the middle of 2021, an annual pattern of winter peaks and summer troughs. Influenza deaths vary widely between years, for example 2017 shows a bad influenza season, while 2018 is very light. Deaths from pneumonia and chronic lower respiratory conditions are highly correlated with the influenza pattern, as to a lesser extent are other respiratory diseases, showing winter spikes that follow the severity of that year's influenza season. Possible drivers for this correlation could be misclassified influenza deaths, influenza infection causing susceptibility to other respiratory causes, or the conditions that lead to a bad influenza season also leading to more respiratory deaths of other types.

With the arrival of COVID-19 as a major cause of mortality from late 2021, these correlations now include the new disease. 2022 was the worst year in Australia for COVID-19 and was also a bad year for all other respiratory causes. This may seem counterintuitive, since it might have been expected that with so many vulnerable people falling victim to COVID-19, fewer would have succumbed to other respiratory diseases. Possible causes are similar to the influenza correlations: misclassification of COVID-19 deaths or COVID-19 infection causing susceptibility to other causes.

The drivers of the correlations between respiratory causes, both before and since the introduction of COVID-19 to the mix, are a possible area for future research.

3.8.2 Correlation of respiratory causes with non-respiratory causes

Deaths from several other causes are also correlated with those from respiratory diseases. This was true before the COVID-19 pandemic and continues to be the case.

Figure 16 to Figure 21 show the weekly SDR patterns from 2015 to 2024 for ischaemic heart disease, other cardiac conditions, cerebrovascular disease, dementia, diabetes as well as other unspecified diseases.

Figure 16 – Weekly SDRs for Ischaemic Heart Disease, 2015-2024

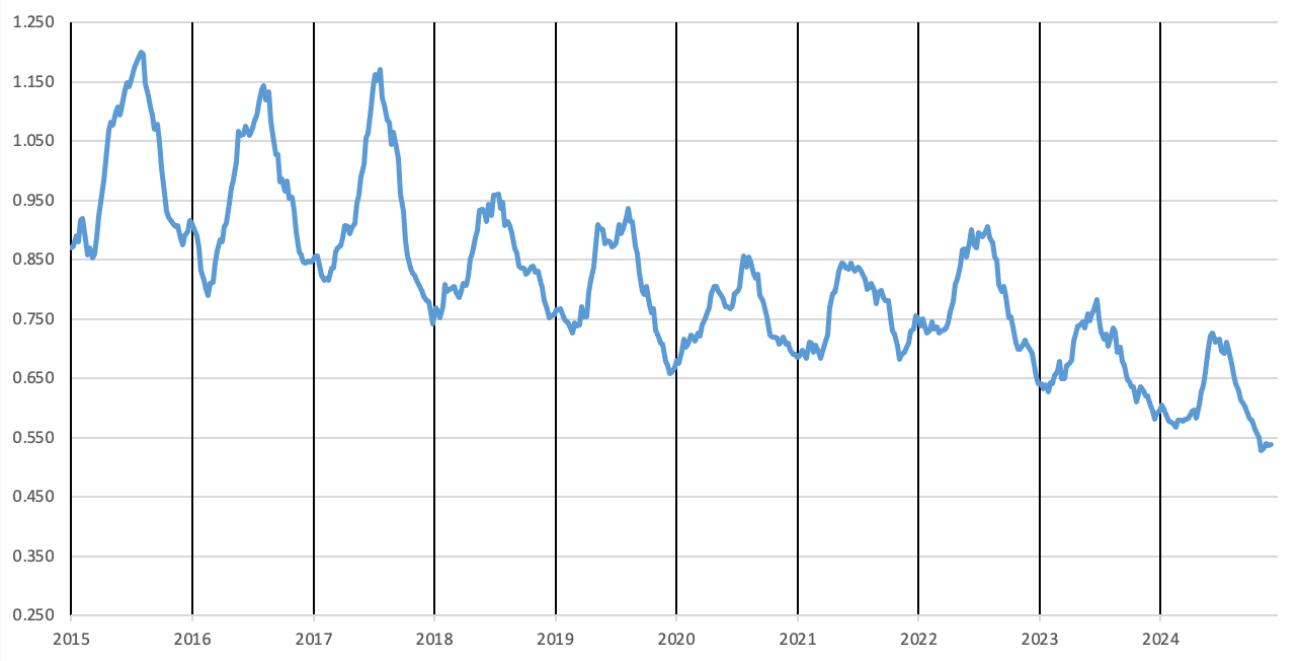


Figure 17 – Weekly SDRs for Other Cardiac Conditions, 2015-2024

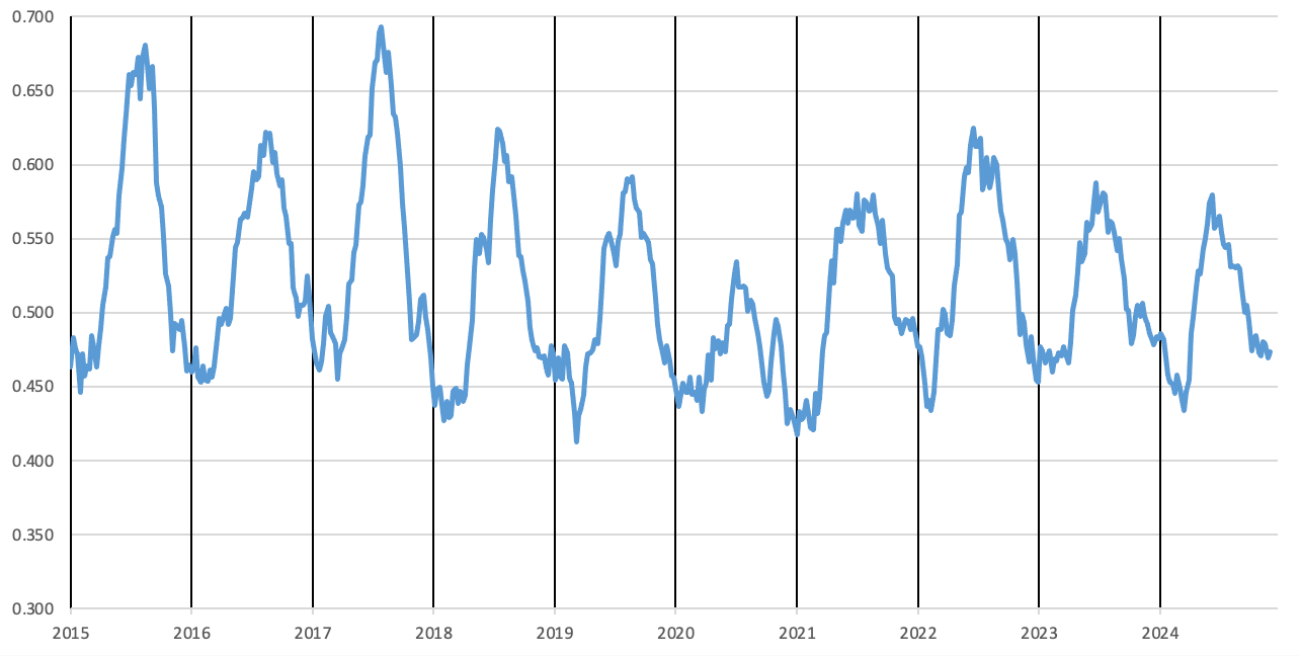


Figure 18 – Weekly SDRs for Cerebrovascular Disease, 2015-2024

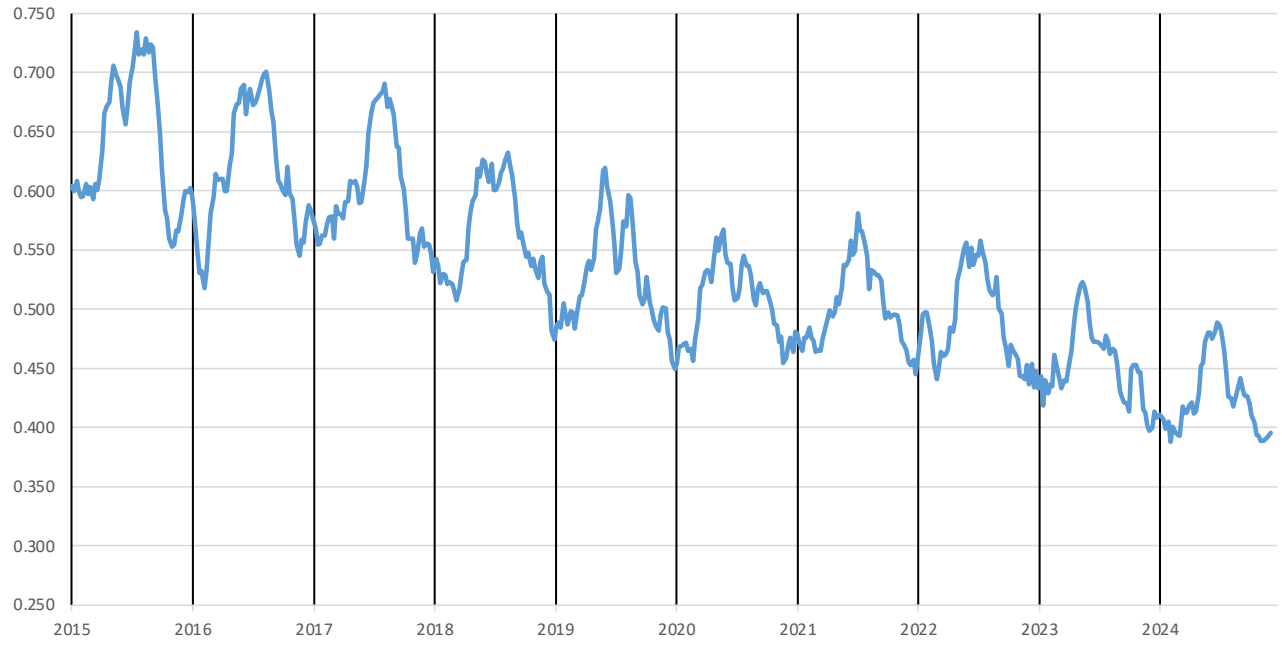


Figure 19 – Weekly SDRs for Dementia, 2015-2024

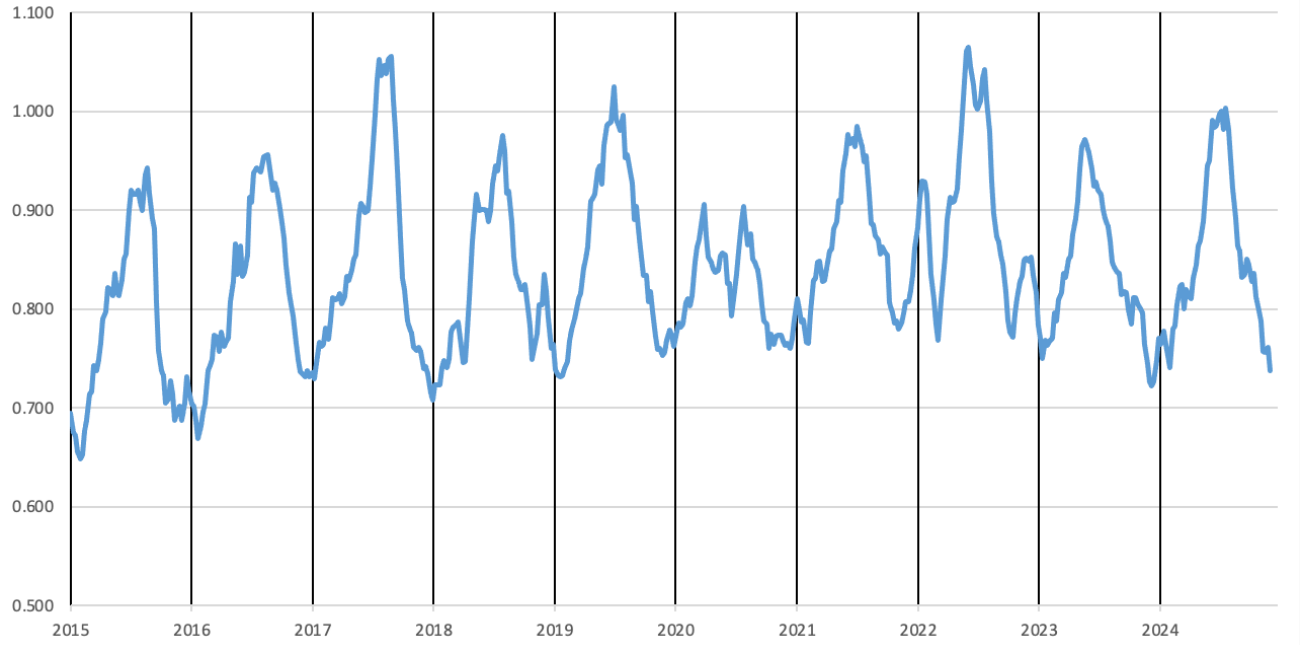


Figure 20 – Weekly SDRs for Diabetes, 2015-2024

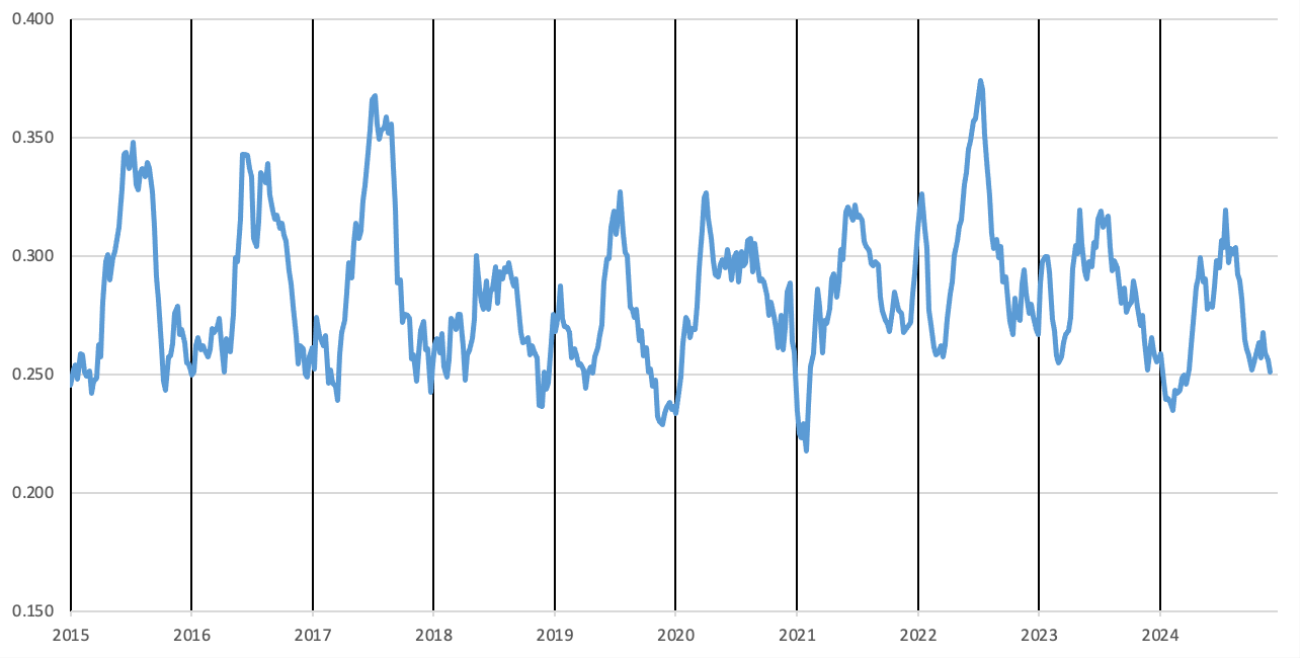
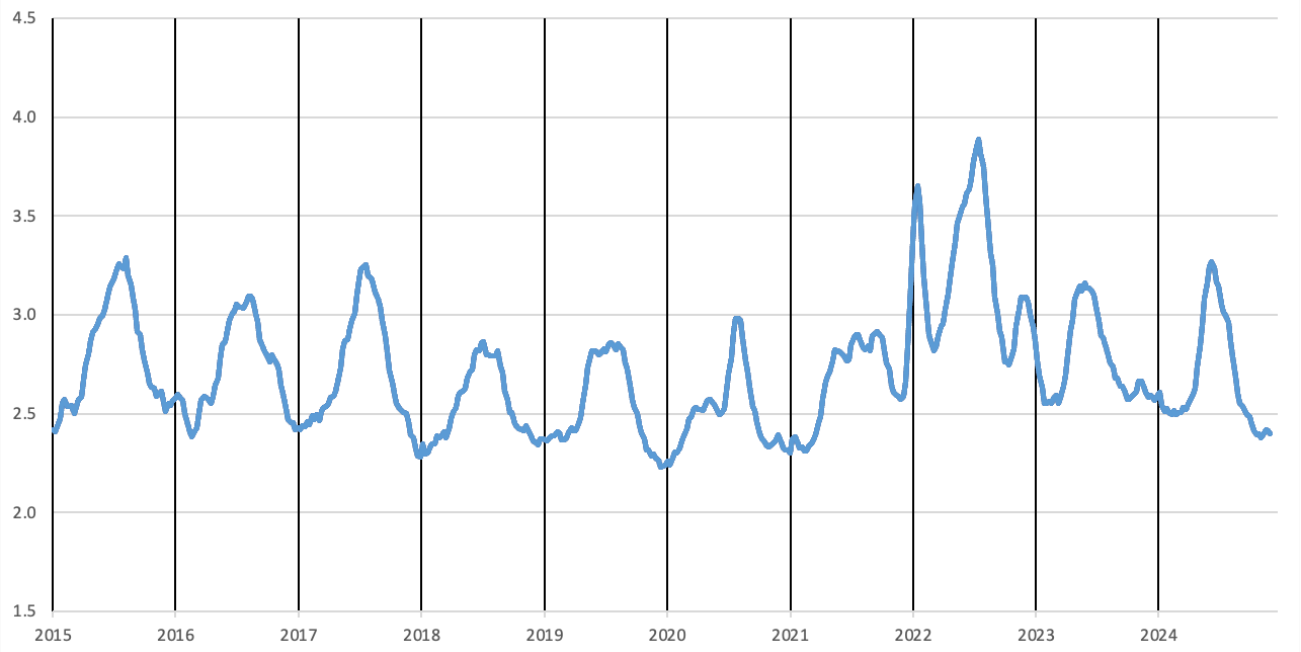


Figure 21 – Weekly SDRs for Other Unspecified Diseases, 2015-2024



All the charts show the same pattern of winter peaks and summer troughs as displayed by respiratory diseases, which is perhaps to be expected. More surprising is the often strong correlations with the larger or smaller peaks of respiratory deaths linked to the severity of influenza seasons, and, since 2022, with COVID-19 mortality. 2017, as well as having a severe influenza season and generally poor respiratory mortality, also had worse than usual mortality peaks for all of the non-respiratory causes listed above. 2018, which was a very favourable year for influenza and other respiratory causes, also had a better year for several of the non-respiratory causes. The correlation with other non-respiratory diseases is especially noteworthy, given this is made up of seemingly unrelated conditions, which in aggregate show the same pattern of mortality as the respiratory causes. This may suggest that respiratory causes in some way contribute to or accelerate deaths from other completely unrelated causes. This is an area for possible further investigation.

2022, the worst year for COVID-19, showed increased mortality for several other non-respiratory causes, including the catch-all "other unspecified diseases". At the time, this was an area of significant interest, and many hypotheses were suggested. Without refuting these hypotheses, what we can say is that the correlation of non-respiratory causes with COVID-19 is not unique to that disease but seems to be the case more generally with respiratory deaths since before the pandemic.

4 Possible explanations for non-COVID-19 excess mortality

The measurement of actual numbers of deaths compared to the predicted does not tell us why this is occurring. It is not possible to identify from death counts alone what is causing the variance from predicted in non-COVID-19 deaths. Multiple factors are likely in play, and different factors may be more or less pronounced at various times.

In our previous Research Paper, we listed a number of hypothesised reasons and commented on their likely significance. These included:

- post-COVID-19 sequelae or interactions with other causes of death;
- mortality displacement;
- delays in emergency care;
- delays in routine care;
- undiagnosed COVID-19;
- mental health issues leading to suicide deaths;
- increases in alcohol-induced deaths;
- increases in road accident deaths; and
- vaccine-related deaths.

The remainder of this section considers four hypotheses, namely mortality displacement, public health service issues, vaccine-related deaths and mental health issues. For the remainder of the hypotheses, little has changed since last year and our conclusions remain the same. We direct the reader to our previous Research Paper for more information.

4.1 Mortality displacement

In the first year or so of the pandemic, Australia had fewer deaths than would have been expected in the absence of the pandemic. The lower deaths than predicted from respiratory causes and dementia, particularly in 2020 and 2021, have implications for mortality displacement. People who die from influenza tend to be those who are frail, or in a weakened state, and so already would have been more likely to die from another cause within a short period of time. Excess mortality in 2021 from non-respiratory causes was likely higher than otherwise due to negative respiratory excess mortality in 2020 (i.e., a transfer of deaths from 2020 to 2021, compared with the expected pre-pandemic pattern of mortality). Similarly, part of the non-respiratory excess in 2022 is likely due to (negative) mortality displacement from 2020 and 2021.

While COVID-19 excess mortality remained high in 2024, there was a significant reduction in excess mortality from other causes. There potentially may be mortality displacement occurring between these two groupings of death in 2024.

4.2 Public health service impacts

4.2.1 Delays in emergency care

Pressure on the health, hospital and aged care systems, including ambulance ramping[16] and bed block[17], could lead to people not getting the care they require, either as they avoid seeking help, or their care is not as timely as it might have been in pre-pandemic times. The peaks in non-COVID-19 excess deaths at times of high COVID-19 and/or influenza deaths supports this hypothesis.

[16] Refers to the inability of ambulances to transfer patients to emergency departments on arrival due to the emergency department itself having reached capacity

[17] Refers to when patients in emergency departments cannot be moved to hospital beds because they are occupied, often by patients who could be discharged from hospital but, for various reasons, are not

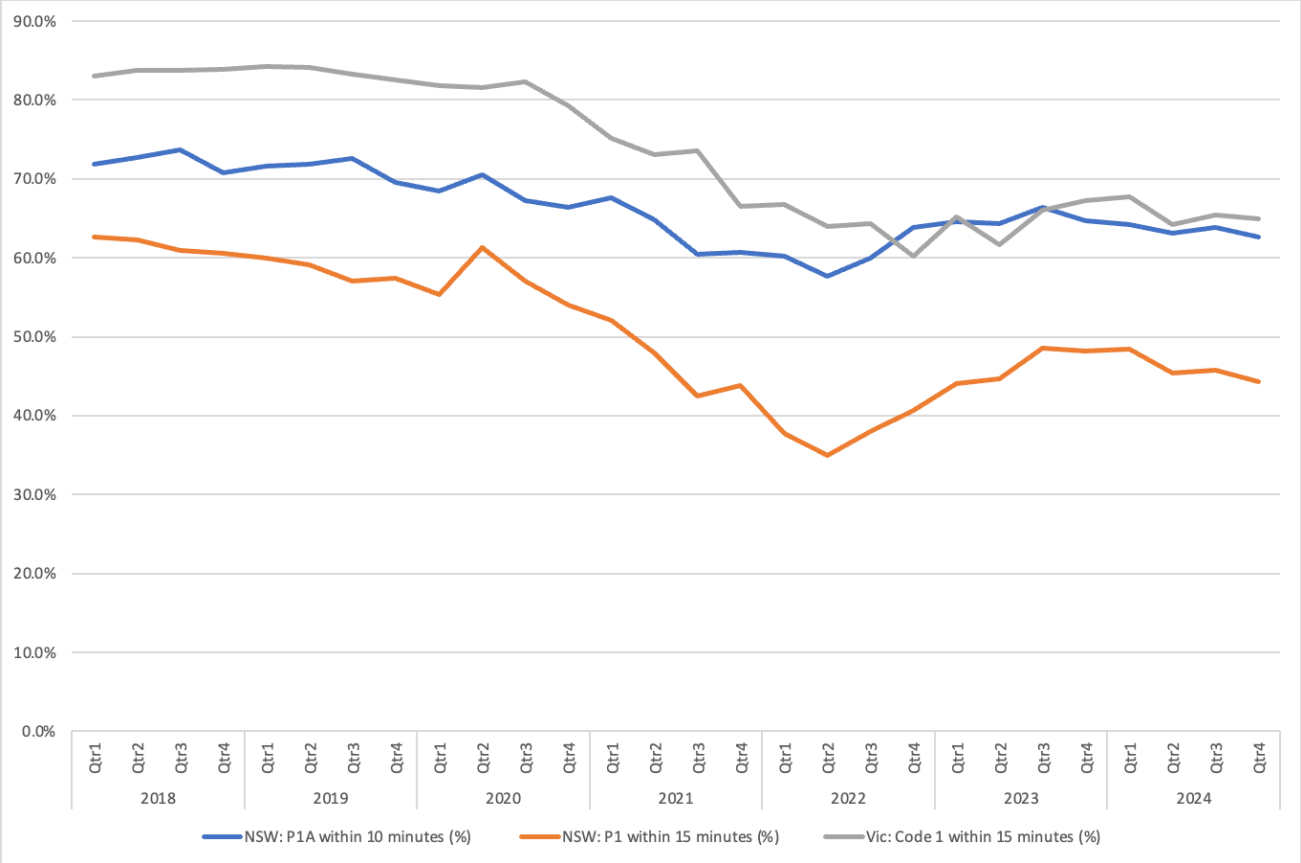
Note that the following sections show statistics for certain states that are readily publicly available. The absence of statistics for a particular state or territory does not imply the absence of similar issues.

4.2.2 Ambulance response times

Figure 22 shows ambulance response times for NSW[18], and Victoria[19], noting that the metrics shown are not directly comparable due to different definitions used. For NSW, we have shown the percentage of highest priority (P1A) responses reached within 10 minutes and the percentage of emergency priority (P1) responses reached within 15 minutes. For Victoria, we have shown the percentage of Code 1 responses that were reached within 15 minutes (Code 1 patients are those that require urgent paramedic and hospital care and receive a "lights and sirens" response).

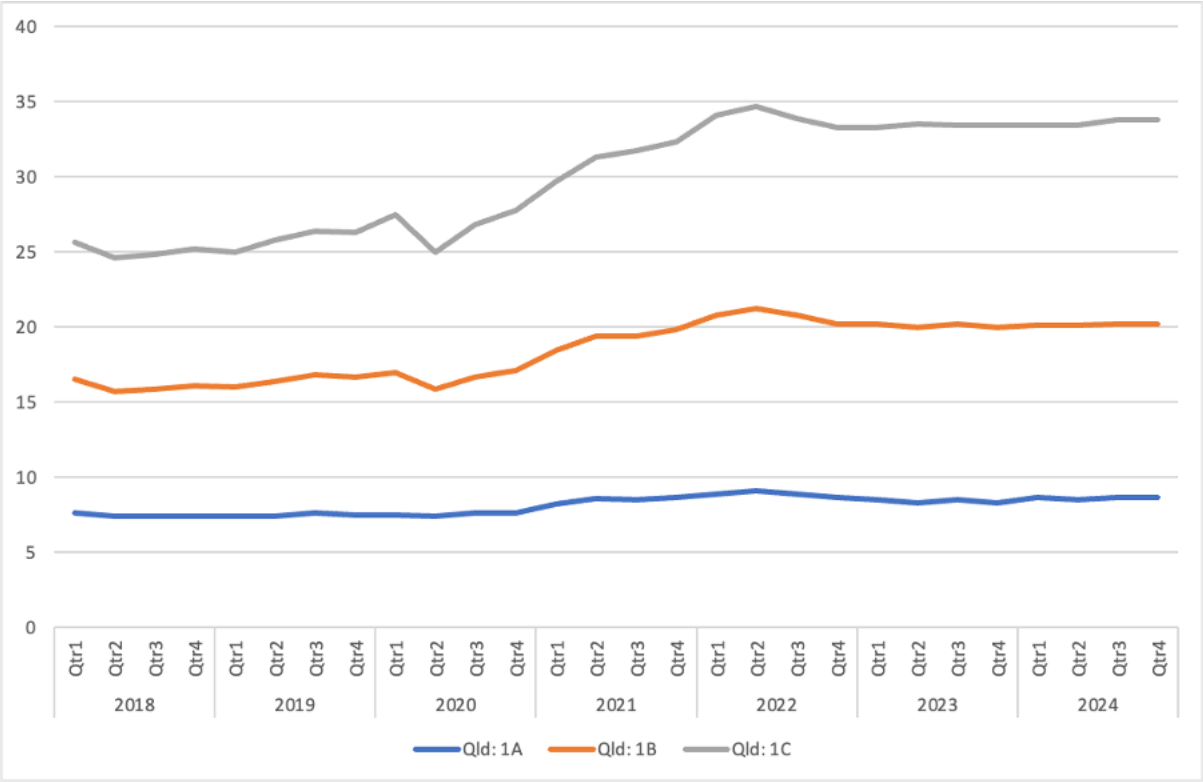
Figure 23 shows the median ambulance response times for Queensland[20] for responses designated 1A (actual time critical), 1B (emergent time critical) and 1C (potential time critical). While for NSW and Victoria a *reduction* in the metric suggests poorer outcomes, for the Queensland statistics, an *increase* in the metric suggest poorer outcomes.

Figure 22 – Percentage of ambulance responses within time in NSW and Victoria – 2018-2024



[18] Source: Bureau of Health Information, quarterly *Tracking public hospital and ambulance service activity and performance in NSW* reports
[19] Source: Ambulance Victoria, quarterly *Response Times* report
[20] Source: Queensland Ambulance Service, quarterly *Public Performance Indicators.* The reports show year-to-date figures each quarter, and we have derived the quarterly performance figure based on the number of daily emergency incidents also included in the reports.

Figure 23 – Median ambulance response time for Queensland – 2018-2024



For each of the metrics for each of the states shown, ambulance response times deteriorated from around the start of the pandemic until around mid-2022, before slowly improving. While the response times for both 2023 and 2024 are an improvement on 2022, all continue to be materially worse than pre-pandemic levels.

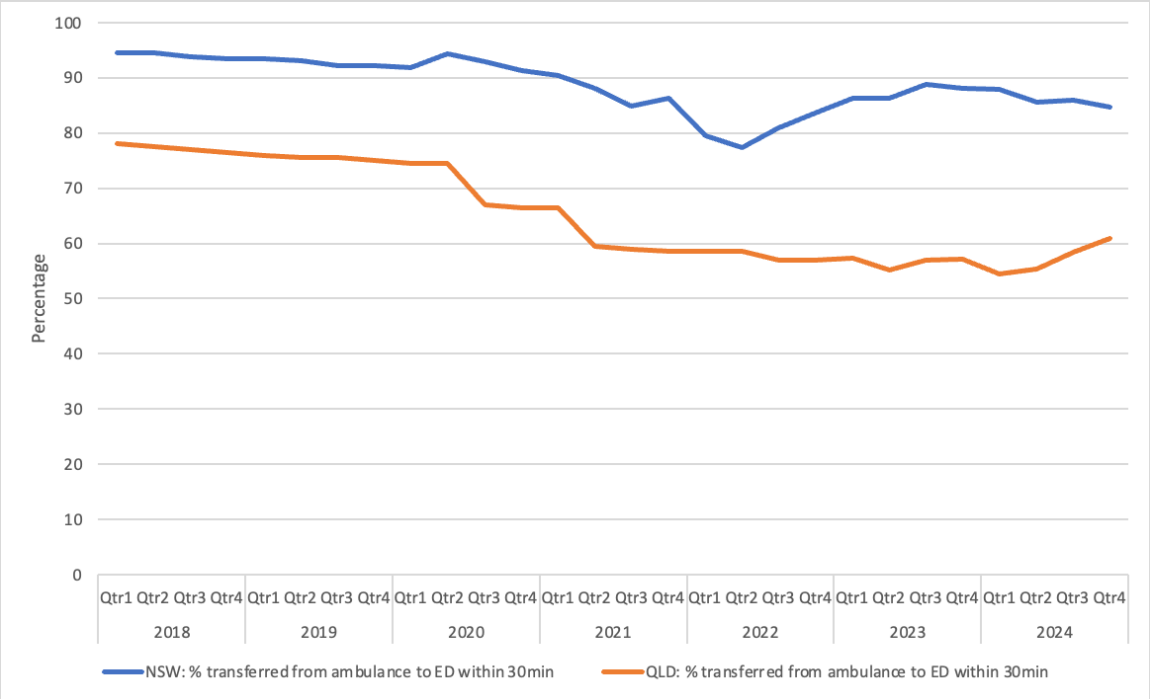
4.2.3 Ambulance "ramping"

In some instances paramedics are unable to transfer patient care to the emergency department within the appropriate timeframe, due to the lack of available space in the department. This is known as ambulance ramping.

Figure 24 shows the proportion of patients transferred to emergency departments within specified times for NSW[21] and Queensland[22], noting that the metrics shown are not directly comparable due to different definitions used.

[21] Source: Bureau of Health Information, quarterly *Tracking public hospital and ambulance service activity and performance in NSW* reports
[22] Source: Queensland Audit Office, Health 2023, Report 6 2023-24

Figure 24 – Proportion of patients transferred from ambulance to ED within specified times – NSW and Queensland – 2018-2024



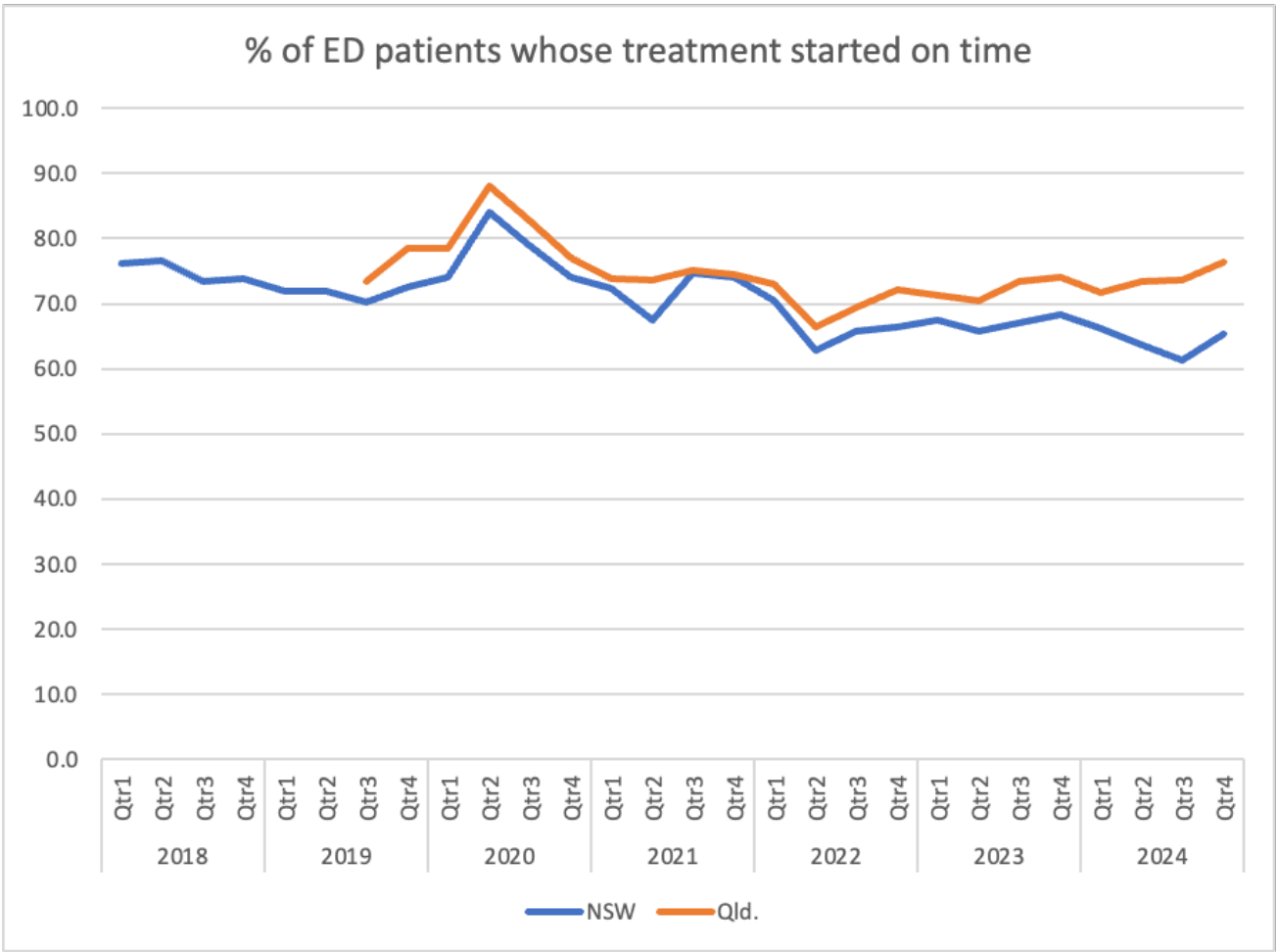
Queensland statistics show that transfer times from ambulances to emergency departments continue to be substantially worse than before the pandemic. NSW statistics improved substantially up until mid-2023, however, have since dropped off again, and in both cases, transfer times have not yet returned to pre-pandemic levels.

4.2.4 Emergency Department treatment times

Figure 25 shows the proportion of emergency department patients treated on time in NSW[23] and Qld public hospitals.

[23] Source: Bureau of Health Information, quarterly *Tracking public hospital and ambulance service activity and performance in NSW* reports

Figure 25 – Proportion of Emergency Department patients whose treatment started on time – NSW and Qld – 2018-2024



The proportion of NSW emergency department patients starting treatment on time has continued to deteriorate relative to pre-pandemic levels despite some improvement in 2020 and 2021. The Queensland statistics show some improvement over recent years, however, pre-pandemic figures are limited for a full comparison.

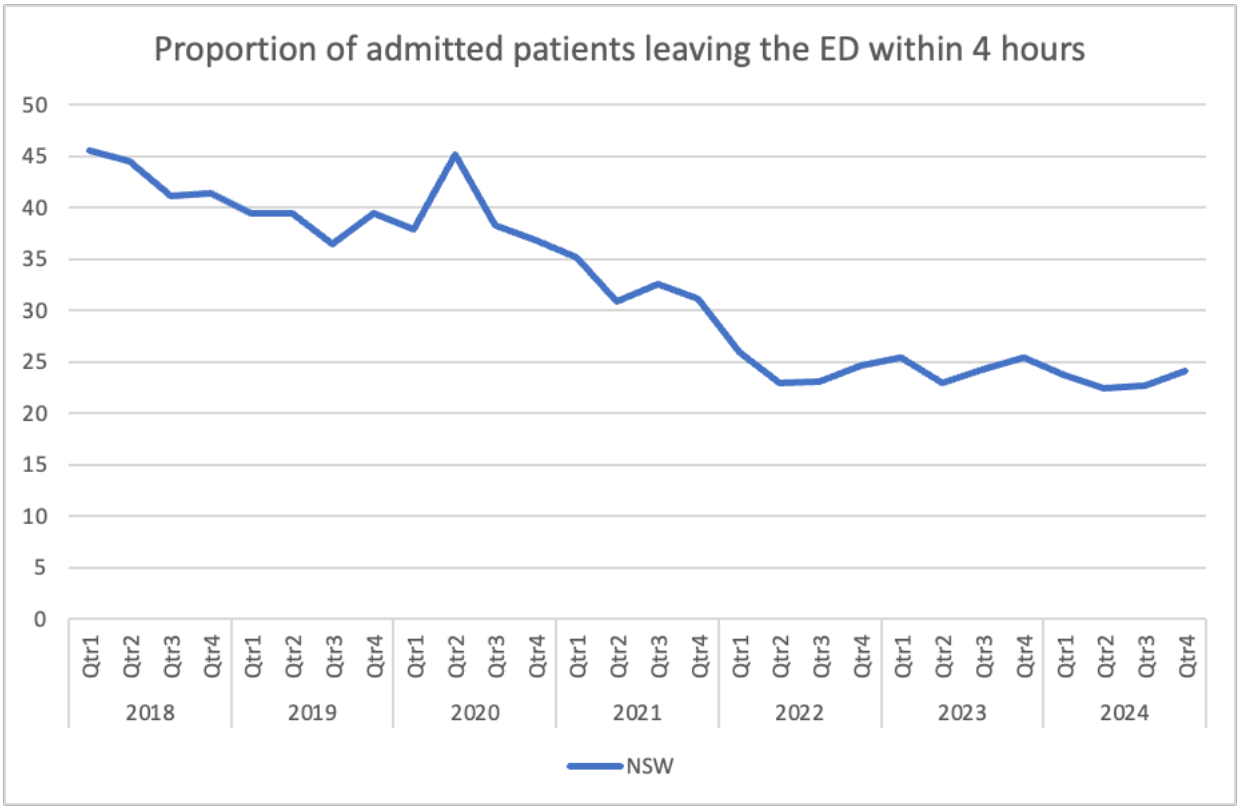
4.2.5 Bed block

In some instances patients in emergency departments cannot be moved to hospital beds because they are occupied, often by patients who could be discharged from hospital but, for various reasons, are not. This is known as bed block.

Figure 26 shows the proportion of patients who were subsequently admitted to hospital (rather than going home) who left the emergency department within four hours for NSW[24]. This statistic provides an indication of the level of "bed block" but will also reflect any changes in waiting times before being seen in the emergency department.

[24] Source: Bureau of Health Information, quarterly *Tracking public hospital and ambulance service activity and performance in NSW* reports

Figure 26 – Proportion of admitted patients leaving the ED within 4 hours – NSW – 2018-2024



These statistics show that wait times in emergency departments for those who are subsequently admitted to hospital are significantly longer now than before the pandemic. They have levelled out from 2022, however, are not showing any improvement now that the pandemic is over.

These statistics on ambulance and emergency department performance for NSW, Victoria and Queensland all suggest that performance now remains substantially worse that for pre-pandemic years. The trends from 2022 are mixed with some areas where there has been an improvement and some areas where there has been a deterioration. Unfortunately, detailed statistics (e.g. monthly) are difficult to obtain making it hard to compare the figures directly to our excess non-COVID-19 deaths and to be conclusive about their impact on non-COVID-19 mortality.

4.2.6 AMA analysis

The AMA (Australian Medical Association), the peak body for Australian doctors, carries out its own detailed analysis of both ambulance ramping and public hospital performance (including bed block). This section provides a summary of their findings.

The 2025 AMA *Ambulance Ramping Report Card* highlights concerns with ambulance handover delays, with ramping times significantly worse than five years ago across all jurisdictions. In 2023–24, an increased number of patients arriving at emergency departments by ambulance faced significant delays in transfer to hospital care. The report states "Australia is facing alarming levels of ramping," and claims paramedics are often left treating patients in corridors or in ambulances because emergency departments are full. The authors explain this not only compromises patient care but also leaves ambulances unavailable for new emergencies. The report notes that while some jurisdictions showed minor improvements in 2023–24, overall, "ambulances are spending far more hours ramped outside hospitals than they were just five years ago". The report recommended urgent systemic reform and capacity investment.

The 2025 AMA *Public Hospital Report Card* identifies bed block as a major contributor to emergency department overcrowding and delayed care. The report warns that despite the addition of over 1,600

beds in 2022–23, the number of beds per 1,000 Australians has continued to decline, particularly for those over 65. The report states, "without sustained investment into the capacity of our public hospital system, this long-term decline will continue, risking the ability of hospitals to deliver care and surgeries other than in emergencies."

It is likely that this deterioration in emergency care metrics since the COVID-19 pandemic has had some impact on excess mortality. Although we do not attempt to quantify this, we estimate this impact is high during COVID-19 and influenza peaks when emergency departments are most stressed, and was therefore of a lesser impact in 2023 and 2024 compared with 2022.

4.2.7 Delays in routine care

During the pandemic, particularly during the 2020 and 2021 years, opportunities to diagnose or treat non-COVID-19 diseases have been missed for various reasons including fear and lack of opportunity. There is some evidence in Figure 16 that disruptions to prescribing heart medications may be impacting on chronic ischaemic heart disease deaths. It may also be a factor in higher deaths from other causes, such as diabetes, and the large "other" category.

4.2.8 Screening program statistics

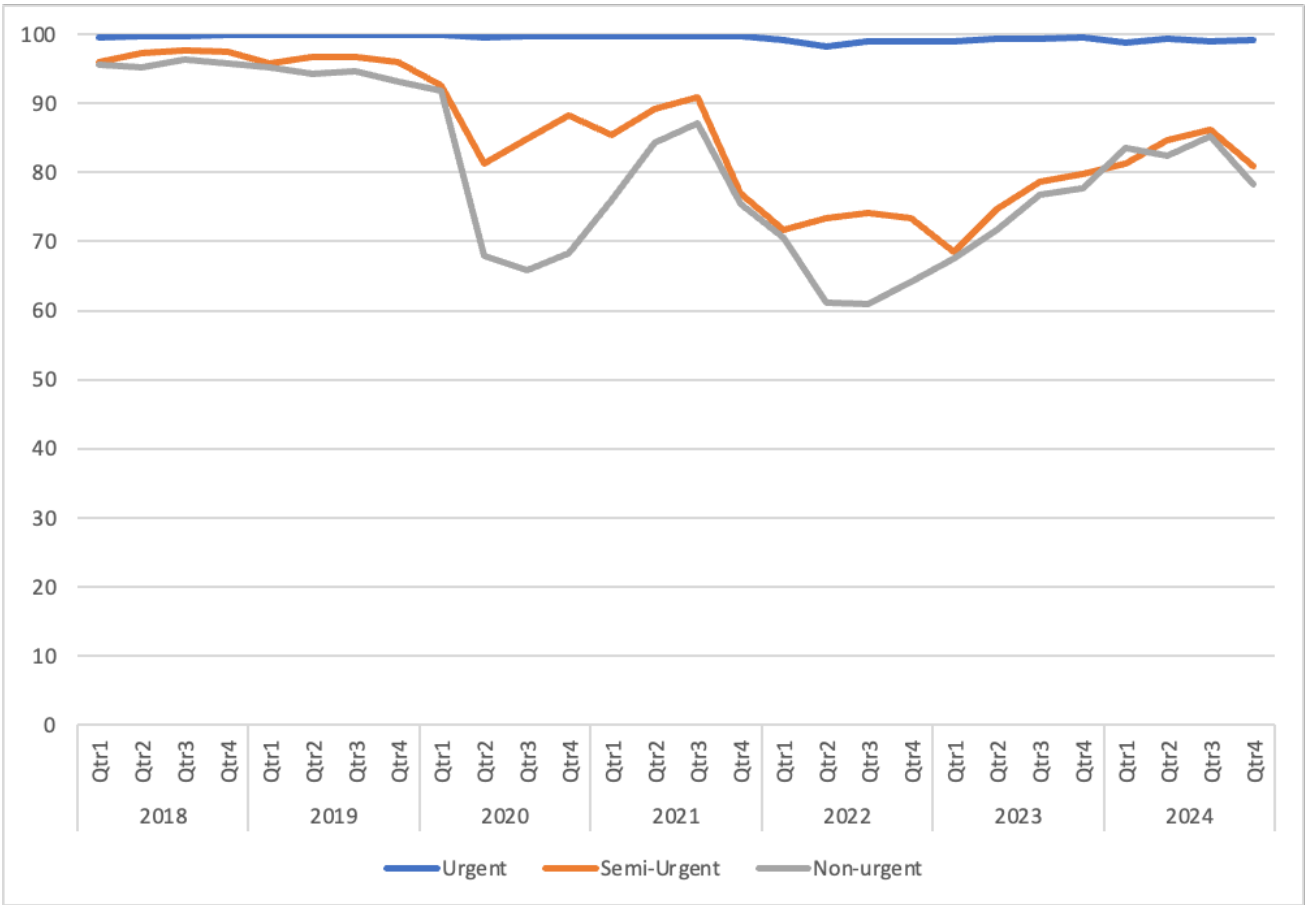
In our July 2023 Research Paper we included statistics on Australia's three national cancer screening programmes for Bowel Cancer, Breast Cancer, and Cervical Cancer. This analysis showed that while there did appear to have been a reduction in cancer screening during the lockdown period, this was quite short lived and was not expected to be a material driver of any non-COVID-19 excess mortality. We refer the reader to that Paper for that analysis. Supporting this view is the fact that our analysis of cancer mortality from 2015 to 2024 shows 2024 in line with the 2015-19 trend, with no deterioration evident.

4.2.9 Elective surgery statistics

During the pandemic lockdowns, hospitals across Australia experienced suspensions in elective surgeries at various times. Figure 27 shows the percentage of elective surgeries performed on time in NSW[25].

[25] Source: Bureau of Health Information, quarterly *Tracking public hospital and ambulance service activity and performance in NSW* reports

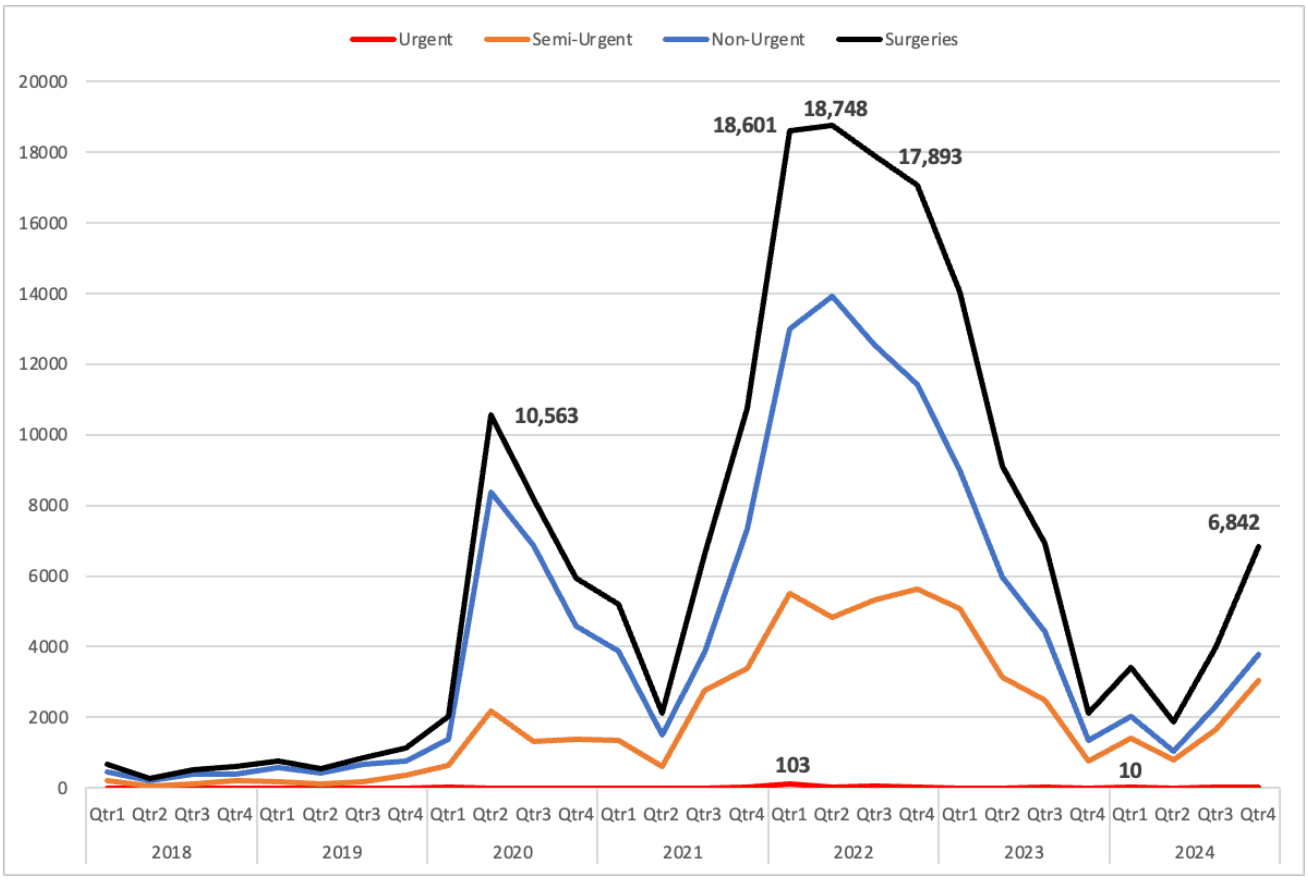
Figure 27 – Percentage of elective surgeries performed on time in NSW – 2018-2024



Similar to the hospital emergency department statistics shown in Section 4.2.1, the proportion of elective surgeries performed on time continues to improve in 2024 relative to 2022 and 2023 but still remains substantially worse than pre-pandemic years.

Figure 28 shows the number of NSW patients on the waiting list who have waited beyond clinically recommended times.

Figure 28 – Numbers of patients on the waiting list for surgery in NSW beyond clinically recommended times – 2018-2024



The statistics showed a substantial improvement at the end of 2023; however, recent quarters are now showing a marked deterioration.

These elective surgery statistics represent only one aspect of the impact of delayed access to routine care. Other statistics of relevance would include, for example, trends in the number of prescriptions for heart and/or hypertension medications, the number of "heart health checks" conducted[26], etc. We have been unable to source such statistics and can therefore only speculate about other aspects of delays to routine care.

The 2025 *AMA Public Hospital Report Card* paints a mixed picture for elective — or planned — surgery wait times in Australia, with modest gains in the most recent reporting period failing to reverse a long-term decline. Nationally, the median wait time for planned surgery decreased slightly in 2023–24, but Australians are still waiting 58% longer than they were two decades ago. Although there was an improvement in the proportion of Category 2 patients (those requiring treatment within 90 days) admitted on time — from 65% to 71% — this remains well below pre-COVID level of over 85%. The report stresses that these procedures are far from cosmetic, citing examples like "heart valve replacements" and "surgery of fractures that won't heal," and warns that delays cause "serious pain and increased risks to patients." For the 29% of Category 2 patients not seen on time, the wait can be dangerously long — exceeding 200 days on average in several states.

[26] A heart health check is a 20-minute check-up with a GP that assesses the risk of having a heart attack or stroke in the next five years. The GP or nurse will set a plan to lower the risk of heart attack or stroke which may involve: ways to make heart-healthy lifestyle changes; referrals to programs or other health professionals for more support e.g. dietitians; and/or prescribing blood pressure or cholesterol lowering medicines.

4.3 Vaccine related deaths

4.3.1 TGA and ABS reporting

We are aware that excess mortality has been attributed to COVID-19 vaccines by some, but our view is that adverse impacts of COVID-19 vaccines are unlikely to be a significant contributing factor.

While there have been deaths in Australia known to have been caused by the administration of COVID-19 vaccines, the reported number of such deaths has been small:

- Australia's vaccine approval and safety monitoring processes are administered by the Therapeutic Goods Administration (TGA). The final TGA COVID-19 Vaccine Safety Report issued on 2 November 2023 identified 14 deaths where the cause of death was linked to COVID-19 vaccination (from 1,004 reports received). All but one of these deaths were linked to the AstraZeneca vaccine which is no longer in use in Australia. There have been no new vaccine-related deaths identified since 2022, even though COVID 19 vaccines have continued to be administered.

- The TGA does not make formal determinations of cause of death for individuals; that is the role of treating medical practitioners and coroners. The ABS reporting of death certificate data shows that there have been 16 deaths registered to the end of 2022 where the certified underlying cause of death was the use of COVID-19 vaccines, very similar to the 14 deaths identified by the TGA.

It is widely acknowledged that the mRNA COVID-19 vaccines may result in myocarditis and/or pericarditis, and that the AstraZeneca COVID-19 vaccines may result in Guillain-Barre syndrome as rare side-effects. As discussed in our previous Research Papers, deaths from these conditions are small and not any higher than earlier (pre-vaccination) years. It is extremely unlikely that there remains a significant unidentified risk of death from the COVID-19 vaccines currently administered in Australia.

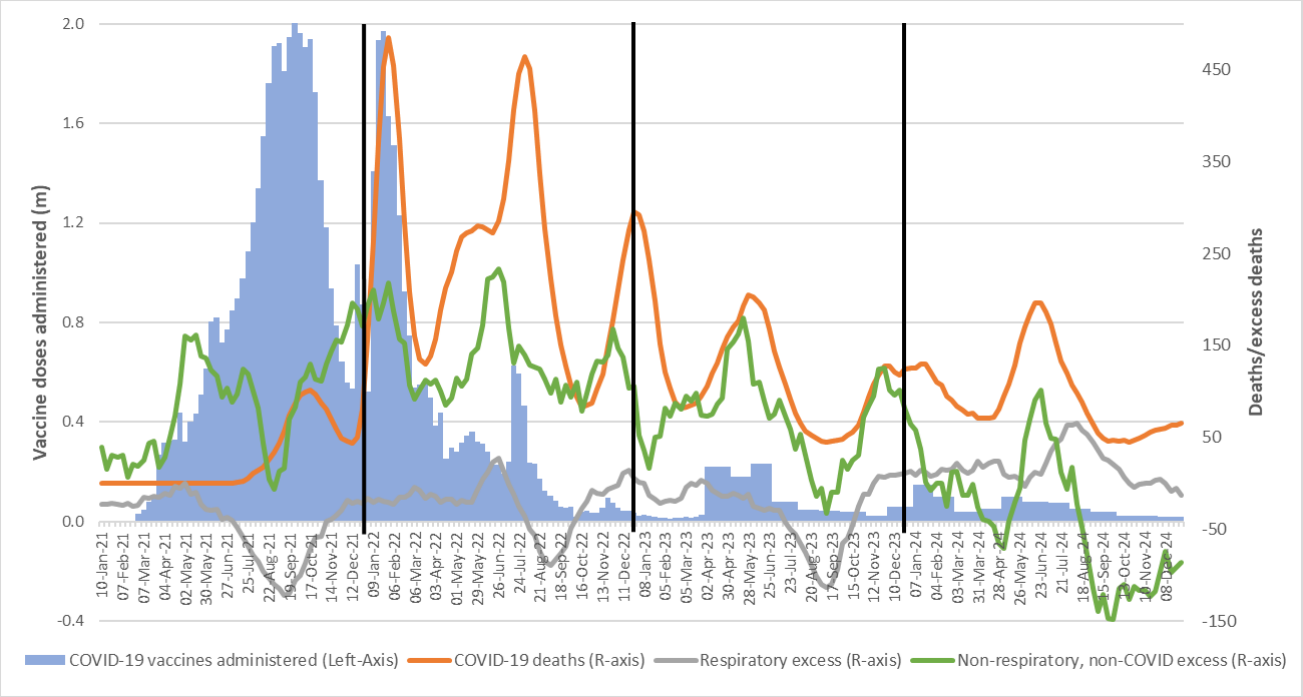
In relation to ischaemic heart disease, the TGA has previously advised that neither they, nor any other international medicines regulator, has established a causal link between COVID-19 vaccines and ischaemic heart disease (unlike myocarditis and pericarditis). Excess deaths seen from this cause are likely related to the after-effects of COVID-19 infection, mortality displacement, a lack of routine medical care earlier in the pandemic, and delayed access to emergency care.

4.3.2 Timing of excess mortality

Some proponents of the view that COVID-19 vaccines have contributed significantly to excess mortality have based this view on their observation that peak periods of excess mortality occur soon after the peak of COVID-19 vaccination rollouts, drawing the conclusion that the high vaccination rates have contributed significantly to the high subsequent excess mortality rates. In Australia, this view was largely based on the period in Q4 2021 when there was a large push to achieve over 90% of the population vaccinated, which was then followed by a large peak in excess mortality in Q1 2022 and again mid-2022.

In our view, the timing of when COVID-19 vaccinations were administered does not correspond with the timing or shape of excess mortality when the causes of excess mortality are analysed further. Figure 29 shows a comparison of the vaccine rollout in Australia compared with excess deaths. The graph compares the number of COVID-19 vaccines administered (blue columns) to COVID-19 deaths (orange line), excess deaths from respiratory causes (grey line) and excess deaths from non-respiratory, non-COVID-19 causes (green line). Note that the COVID-19 deaths, respiratory excess and non-respiratory, non-COVID-19 excess are all shown as five-week averages to reduce the week-to-week volatility.

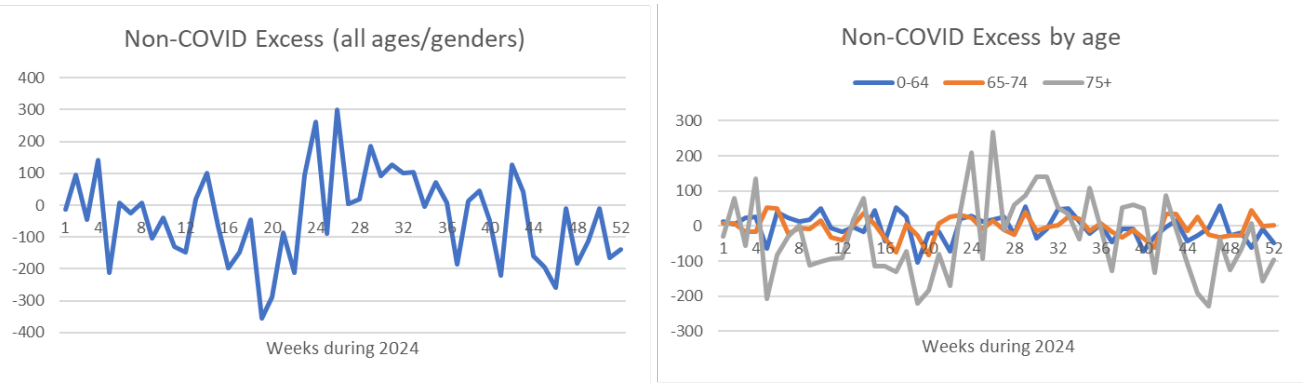
Figure 29 – Vaccine rollout versus excess deaths[27]



High rates of vaccination were achieved in Australia from August to October 2021 and again in January 2022, but vaccination rates have been low for most of 2022 and 2023 and quite minimal in 2024. This does not fit with the timing or shape of the excess mortality. The majority of the excess in 2022, 2023 and 2024 can be explained either directly by deaths *from* COVID-19 or by the indirect impacts of high prevalence of COVID-19 and influenza (i.e., the timing of excess mortality in these years corresponds more closely to the timing of high COVID-19/influenza prevalence, not vaccinations).

Figure 30 shows excess non-COVID mortality by age group in 2024. The majority of excess mortality in Australia is in people over the age of 75, occurring mostly during the winter months of the year corresponding to the periods when the prevalence of respiratory conditions is high.

Figure 30 – Excess non-COVID mortality by age group in 2024



While we have not conducted an exhaustive analysis, we have not been able to find an obvious statistical relationship suggesting that COVID-19 vaccinations caused excess mortality in any other country.

[27] Source: Federal Health Departments statistics on the number of doses administered

4.3.3 Conclusion

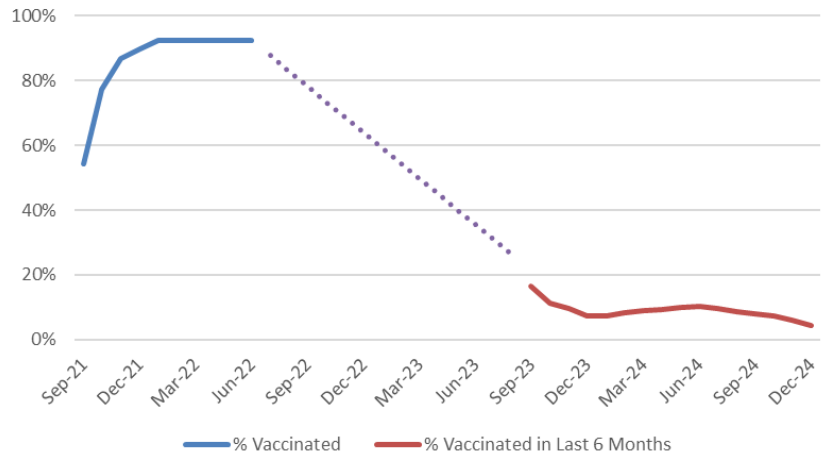
We cannot conclusively disprove that adverse impacts of COVID-19 vaccines are a substantial driver of excess mortality. However, the overwhelming weight of the available evidence does not point to COVID-19 vaccines as a cause of significant numbers of additional deaths. Over the period 2020-2024 approximately 21,000 deaths have been identified as being caused from COVID-19, while fewer than 20 deaths have been identified as being caused by COVID-19 vaccination. And if the number of COVID-19 vaccine deaths is very small in relation to COVID-19 deaths, it is an even smaller fraction when compared to the number of COVID-19 deaths that the vaccines have prevented in Australia – a conservative minimum of 50,000 based on this 2024 NSW study[28].

Our considered view is that, while there could be COVID-19 vaccine-related deaths that have not been identified as such, the number of such deaths is likely to be small, especially in the context of the estimated numbers of excess deaths and the lives saved by vaccination. There are other, more plausible, reasons that explain excess mortality in Australia.

The percentage of the Australian population continuing to receive COVID-19 vaccine boosters has dropped from the high levels in 2022 when over 90% of the population received two doses of the vaccine, to around 5% in April 2025 who have received a booster in the last 6 months.

Figure 31 shows the proportion of the population who have received a COVID-19 vaccine in the last 6 month rolling period. The solid blue line represents the proportion of the population vaccinated during the initial vaccine rollout, the solid red line shows the proportion who have continued to receive vaccine boosters over the last 6 month rolling period, and as there was no accurate data collected on the number of boosters administered prior to April 2023, the dotted purple line is a straight-line extrapolation between the two solid lines.

Figure 31 – Proportion of population who have received a COVID-19 vaccine in the previous 6-month rolling period



As fewer and fewer people are continuing to be vaccinated, it is likely that vaccine-related deaths will be even less significant going forward.

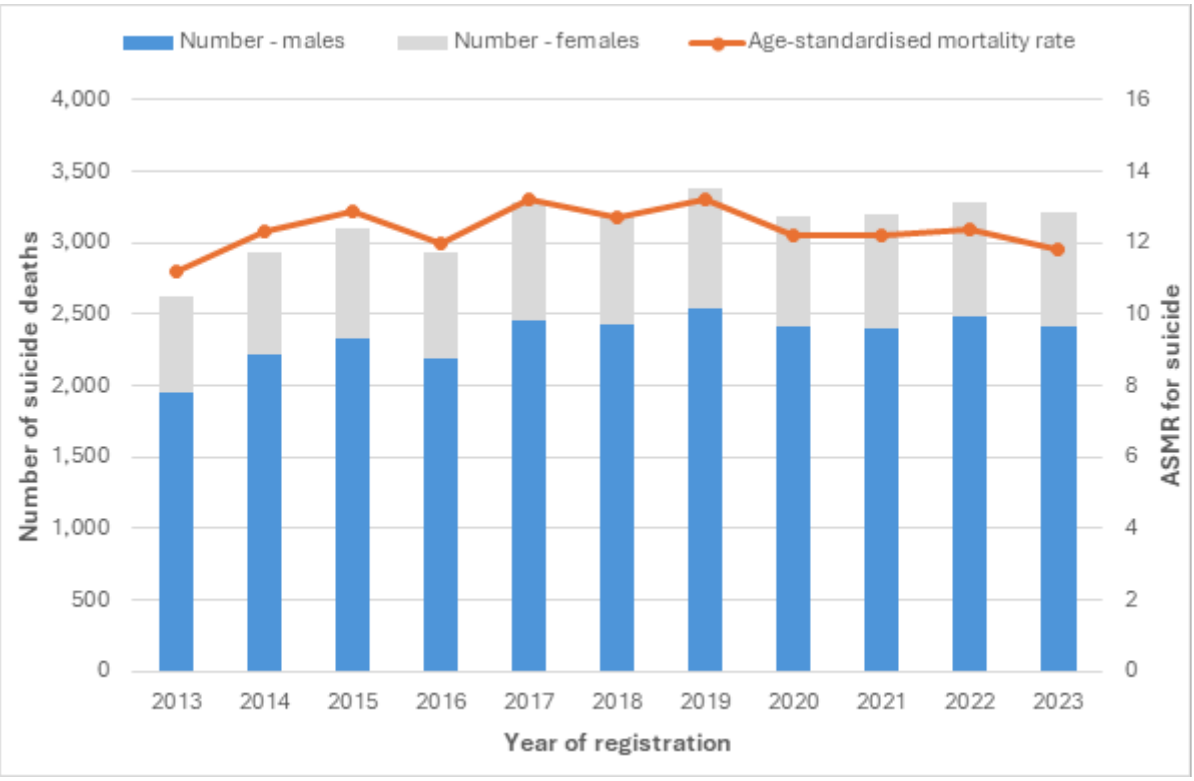
[28] Assessing the impact of Australia's mass vaccination campaigns over the Delta and Omicron outbreaks | PLOS ONE

4.4 Mental health issues

The lasting impacts of pandemic lockdowns and financial hardship on mental health has not been evident on suicide numbers as they remain below pre-pandemic levels. Figure 32 uses data from the ABS and shows the number of suicides in Australia for both males and females from 2013 to 2023 by year of registration (rather than year of occurrence). The age-standardised mortality rate is also shown. It should be noted that small revisions of registered suicide deaths may lead to updates to the numbers recorded.

Suicide deaths and age-standardised mortality rates have continued to decrease relative to pre-pandemic levels for both males and females.

Figure 32 – Suicide deaths and age-standardised mortality rates



Death rates from suicide for males are around three times those for females, as can be observed in Figure 32. The differential between genders is most acutely observed in NSW although the NSW death rates are the lowest overall. Victoria has one of the lowest suicide death rates (slightly higher than NSW) but has seen a slight increase in suicides over the last 2 years as evidenced in Figure 33 albeit that the average number of suicides post the pandemic is still lower than the pre-pandemic period.[29]

Figure 33 – Standardised death rates from suicide for Australia and by state

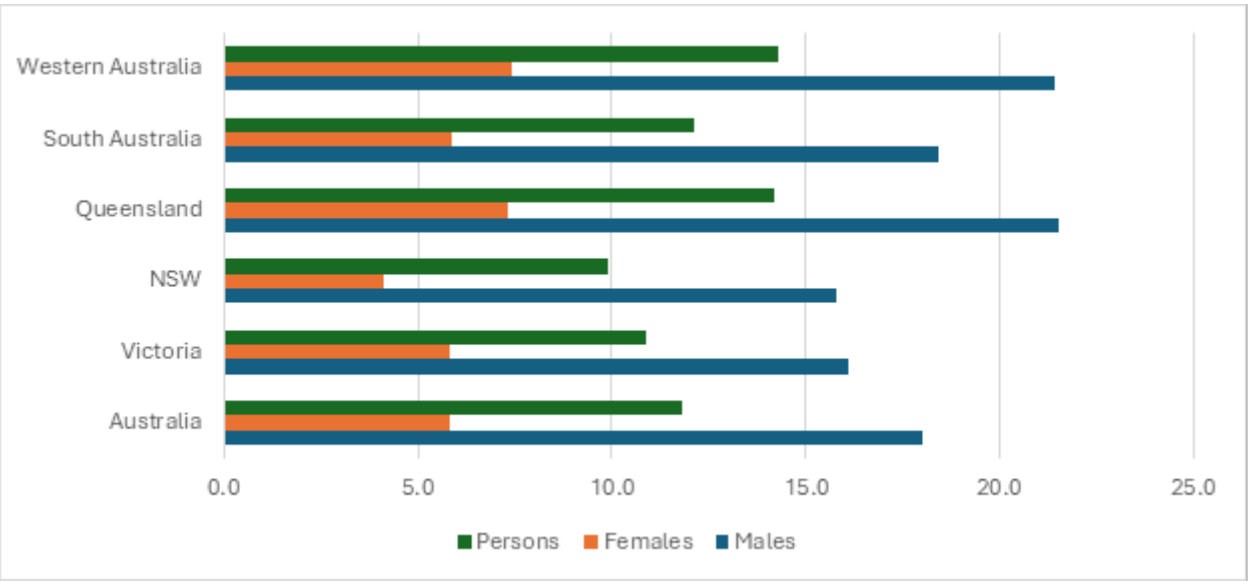


Figure 34 – Yearly suicide deaths, adjusted for 2023 population size – five largest states

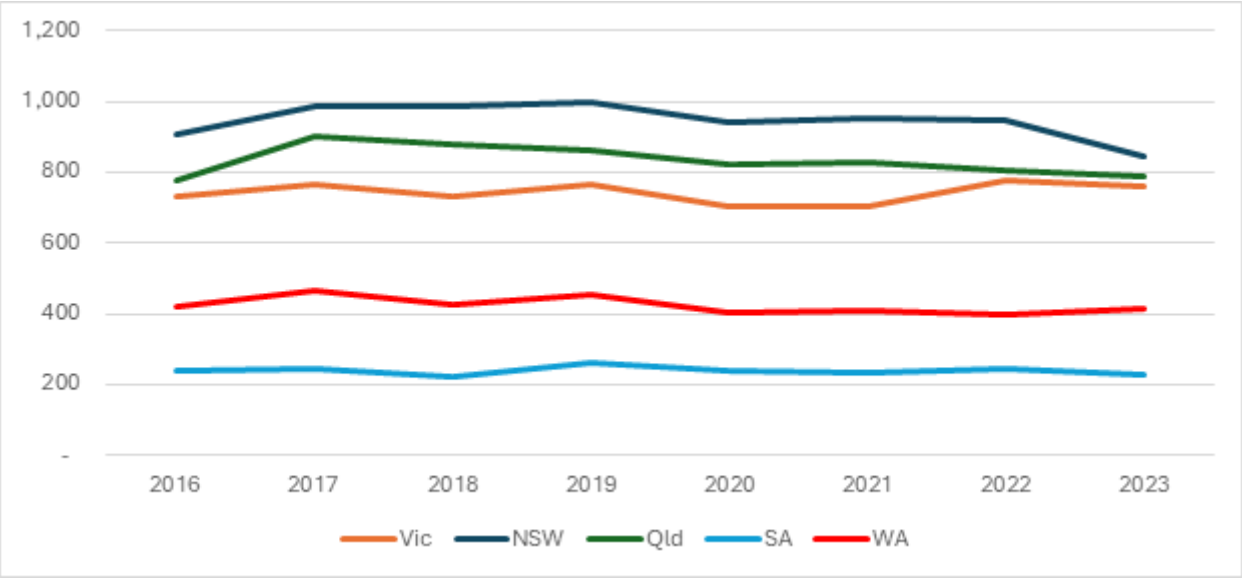
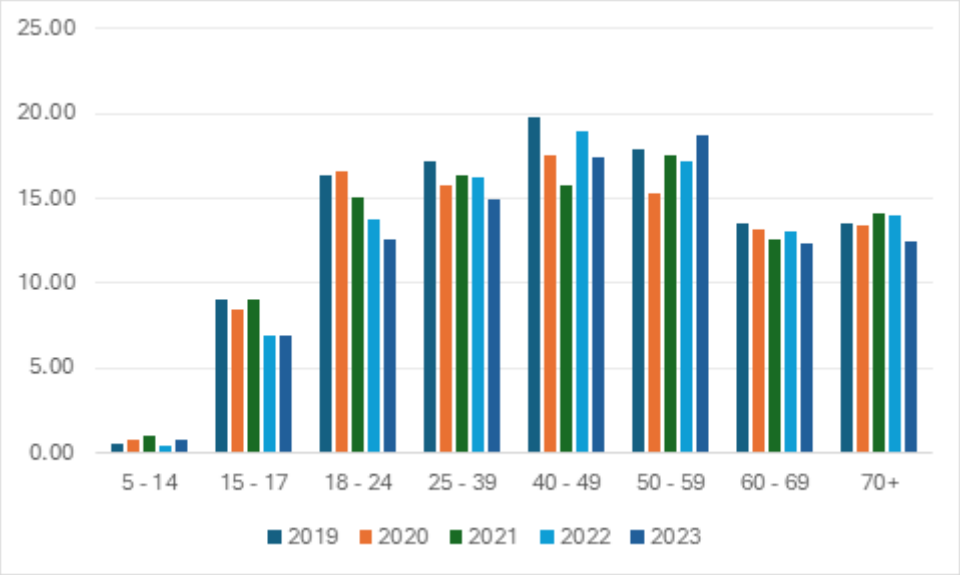


Figure 34 shows that population-adjusted annual suicide deaths in 2020 to 2023 were generally lower than in 2019. The exception was Victoria, where suicide deaths peaked in 2022, falling back to about the 2019 level in 2023. Note, however, that the absolute numbers of such deaths remain a very small proportion of all deaths and are not a major driver of excess mortality.

The median age of people who died by suicide in 2023 was 45.5 years. Figure 35 shows a history of crude death rates due to suicide per age band. In most age bands, the rates are either decreasing or stable, apart from the 40 – 60 age band. This may be important for insurers to monitor as this age band likely represents the largest cohort of insured lives.

Figure 35 – Crude suicide death rates per 100,000, by age band



Although the crude suicide rates for ages 5 – 14 are negligibly small compared to other age groups (on average less than 1 per 100,000), suicides represent 9% of all mortality causes for this age band. This compares to 34% of all causes for ages 15 – 17 and 35% for ages 18 – 24 respectively.

If you or anyone you know needs support call Lifeline on 131 114.

5 Australian mortality in context: what happened in the rest of the world?

5.1 Methodology

While the emphasis in our analysis of Australia is shifting to reflect a "post-pandemic" world, we believe that there is still value in viewing the global perspective in terms of excess mortality relative to a pre-pandemic world.

As discussed earlier, the impact of the pandemic on global and national mortality can best be seen by considering excess mortality. It is, therefore, interesting to consider how excess mortality differs between countries. Fortunately, a rich data repository is available in the form of Our World in Data (OWID: ourworldindata.org). Except where otherwise specified, all data for the charts and tables in this section comes from this source. It is important to note that this data (such as for excess mortality) is, in turn, sourced by OWID from a primary source. We refer to OWID as our source to reflect how we accessed the material, and for convenience.

Our analysis of excess mortality in different countries revolves around two measures of mortality as a percentage of expected deaths:

- **total excess mortality**, which we have taken directly from OWID data, extrapolating and interpolating where required; and
- **COVID-19 mortality**, which we have calculated by dividing COVID-19 deaths by the expected deaths for the relevant period. We understand that the COVID-19 deaths included in OWID are taken from each country's surveillance statistics (rather than being based on death certificates). However, in Section 5.2 we show that this data clearly materially understates COVID-19 deaths in the past two years or so.

5.2 Handle with care

We note that the approach used by OWID to calculate excess mortality is to compare reported deaths for each week or month with projected deaths for that period based on the experience in 2015 to 2019. In turn, this generally uses estimates of expected deaths produced by Ariel Karlinsky and Dmitry Kobak as part of their World Mortality Dataset (WMD)[30]. We are very grateful to Karlinsky and Kobak for their work.

This work is subject to general uncertainty, to the extent that there may be reporting delays or errors. Also, there may be issues relating to the interpretation of data in some countries. For example, our own analysis gives slightly different rates of excess mortality in Australia. However, the WMD analysis is objective, and we do not expect any material differences in the context of our analysis.

Karlinsky and Kobak's estimates of expected deaths for each country have a seasonal intra-year shape (weekly or monthly, according to the periodicity of available data) overlaid on a linear annual trend. In effect, this means that the impacts of year-to-year demographic changes during the projection period are assumed to be consistent with such changes during the 2015-19 base period. This does not appear to be unreasonable in Australia or New Zealand[31], but it is likely that there are countries where demographic changes have had a material impact. This would be the case, for example, in countries where the number of older people is quite different from the 2015-19 trend, since most deaths occur among the old.

In addition, the estimates of expected deaths reported by OWID only extend to the end of 2023. Because of the linear trend in those estimates, we have been able to project 2024 estimates by extrapolation. While this does not seem unreasonable, the length of elapsed time since 2015-19 means that there is increasing uncertainty in our country baselines as time goes on.

[30] GitHub - akarlinsky/world_mortality: World Mortality Dataset: international data on all-cause mortality.

[31] See, for example, Estimating excess mortality during the Covid-19 pandemic in Aotearoa New Zealand

In relation to COVID-19 deaths from surveillance reports, it is important to understand that the criteria vary between countries, and within countries/jurisdictions the definitions can change over time. Further, since the World Health Organisation declared the emergency phase of the pandemic over in May 2023 the level of reporting of COVID-19 surveillance deaths has reduced and/or ceased in many countries.

The likelihood that a person dying with COVID-19 has had a positive test will also vary across countries and over time, so our assessment of the contribution of COVID-19 to excess mortality in different countries and/or time periods is subject to considerable uncertainty.

We can illustrate both the overstatements and the understatements in the OWID data on COVID-19 deaths by considering Australia:

Table 3 – Reported deaths from COVID-19 in Australia: death certificates (ABS) v surveillance reports (OWID)

Year	*ABS*	*OWID*
2020	906	920
2021	1,356	1,523
2022	10,305	16,467
2023	4,609	5,510
2024	3,867	892

Table 3 shows that surveillance data accessed by OWID overstates deaths from COVID-19 up to 2023, but this data is significantly incomplete in 2024. As this problem is not confined to Australia, we devote less attention to deaths specifically attributed to COVID-19 in this analysis of international experience than we have done in previous reports.

5.3 Selected countries[32]

Appendix D contains tables, derived from OWID data, showing COVID-19 deaths and total excess deaths for 40 countries, for the five years 2020 to 2024, individually and combined.

There are 75 countries for which, at the time of collecting our data (9 June 2025), OWID had produced excess death data covering the whole of 2020 to 2023 and at least one quarter of 2024[33]. We have selected the largest 28 of these (including Australia) by expected deaths, plus a further 12 (Sweden, Austria, Ecuador, Azerbaijan, Denmark, Israel, Georgia, Lithuania, New Zealand, Paraguay, Kyrgyzstan and Singapore) for their relevance. The reasons for selecting these additional countries are set out in Appendix D Appendix D .

These 40 countries represent about 95% of the 75 countries by population[34] and by expected and actual deaths. They had 9.5% combined excess mortality across 2020-2024, with reported COVID-19 deaths representing 5.4% of expected deaths in that period.

Adopting the criterion of "at least one quarter of 2024" enabled us to include (in decreasing order of annual expected deaths):

- Brazil (3 months of data in 2024);
- The Philippines (7 months);
- Canada (50 weeks);
- Uzbekistan (9 months);

[32] We use "country" as a shorthand, given that the list includes Taiwan on the basis that it is in the top 30 territories by expected deaths in the available OWID data

[33] In this paper, we show that 2024 excess mortality was generally similar to 2023, so this does not seem unreasonable, given the extra countries that could therefore be included

[34] Total population of the 40 countries is over 1.9 billion

- Sweden (47 weeks); and
- Paraguay (8 months).

Nevertheless, notable omissions[35] from the list include:

- four of the top five countries by population (China, India, Indonesia and Pakistan) and parts of Africa[36] – for which OWID has no data on excess mortality; and
- Mexico, Ukraine, Türkiye, Iran, Argentina, South Korea, Colombia, Algeria and Peru – which are in the OWID top 30 for expected deaths but for which OWID has little or no excess mortality data for 2024.

The latter nine countries are included in individual country charts in Appendix C .

We have been able to use a larger set of 120 countries for regional analysis. This includes countries that we had excluded from detailed analysis on the grounds of size or the incompleteness of data. They include the nine countries listed above.

Our 40 selected countries represent about 70% of the expanded set of 120 countries by population and 76% by expected annual deaths.

In our analysis, we have generally grouped countries in accordance with the UN geoscheme[37] to provide an objective basis for comparison at a regional level. For this purpose, we have combined some regions to give a total of eight, being:

- Oceania;
- South-East & East Asia;
- Other Asia;
- North America;
- Latin America (including the Caribbean);
- Northern & Western Europe;
- Southern & Eastern Europe; and
- Africa.

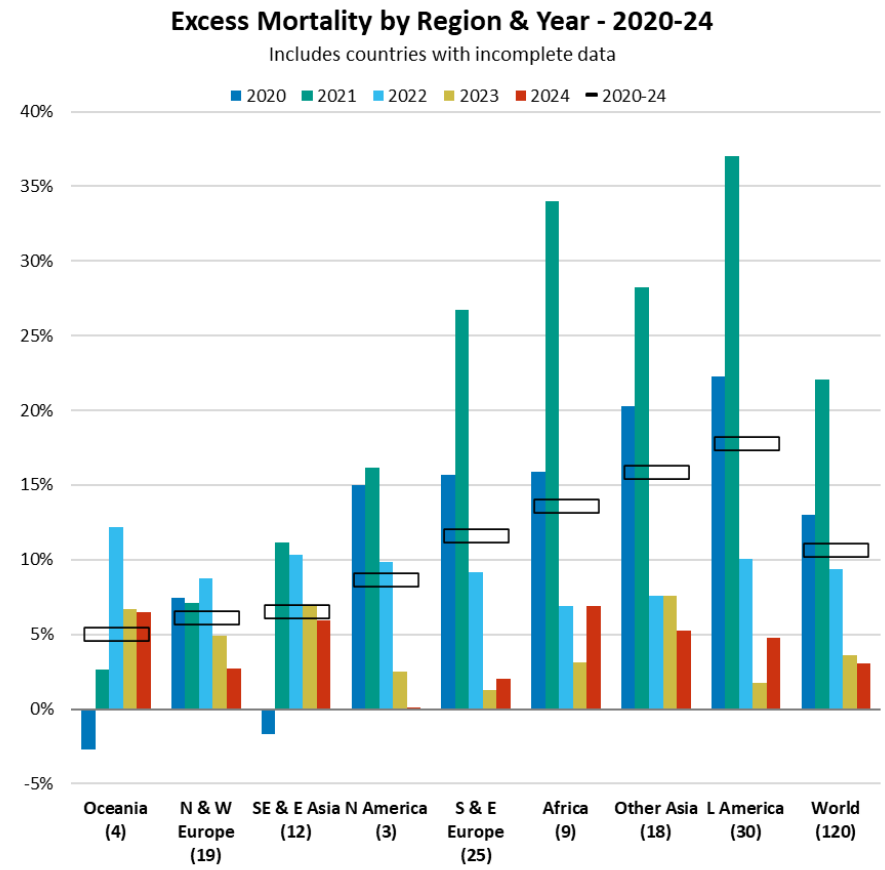
[35] Countries that would have made the top 40

[36] Egypt and South Africa are included in our 40 countries, and there are only two others of reasonable size (Algeria and Tunisia) for which OWID has any excess mortality data at all

[37] Found at https://en.wikipedia.org/wiki/List_of_countries_by_United_Nations_geoscheme

5.4 Excess mortality by region in 2020-24

Figure 36 – Excess mortality by region in 2020-24, showing differences in regional trends[38]



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 36 shows that excess mortality across the world (at least, the countries in our database) was high (13%) in 2020, very high (22%) in 2021 and still high (9%) in 2022, falling to 4% in 2023 and 3% in 2024. However, it is clear from the chart that there are significant regional differences.

Oceania (dominated by Australia) had negative excess mortality in 2020 and a low positive excess in 2021, but it had the highest regional excess mortality in 2022, the third highest in 2023 and the second highest in 2024.

N & W Europe, which is generally quite wealthy, saw excess mortality below the world average each year to 2022, but it was above the world average in 2023.

SE & E Asia had negative excess mortality in 2020. Excess mortality was 11% in 2021 (still only half the world average), falling back to 10% in 2022, 1% above the world average. At almost 7%, it had the second highest regional excess mortality in 2023, dropping back to third in 2024.

North America (dominated by the USA) had high excess mortality above the world average in 2020, with an increase in 2021 (though well below the world average) and a drop in 2022. There was little excess mortality in the region in 2023 and virtually none in 2024.

Excess mortality in S & E Europe was high in 2020 and very high in 2021, dropping to around the world average in 2022 and becoming very low in 2023 and 2024.

[38] Note that the averages may be misleading, since the inclusion of incomplete data means that later years are underrepresented. This is particularly the case for Other Asia (average of 15.9% drops to 11.6% if only calculated from data for countries with 2024 data), Latin America (17.9% drops to 15.4%) and the World (10.7% drops to 9.5%).

Africa (to the extent that we have data) also had excess mortality that was high in 2020 and very high in 2021, dropping to relatively low levels (around or below the world average) in 2022 and 2023 but increasing in 2024.

Other Asia (mostly the Middle East or Central Asia) had very high excess mortality in 2020, increasing in 2021 but falling below the world average in 2022. 2023 and 2024 have been back above the world average.

Latin America had the highest excess mortality in 2020 and in 2021, dropping to just above the world average in 2022. Although excess mortality was below average in 2023, it rose again in 2024.

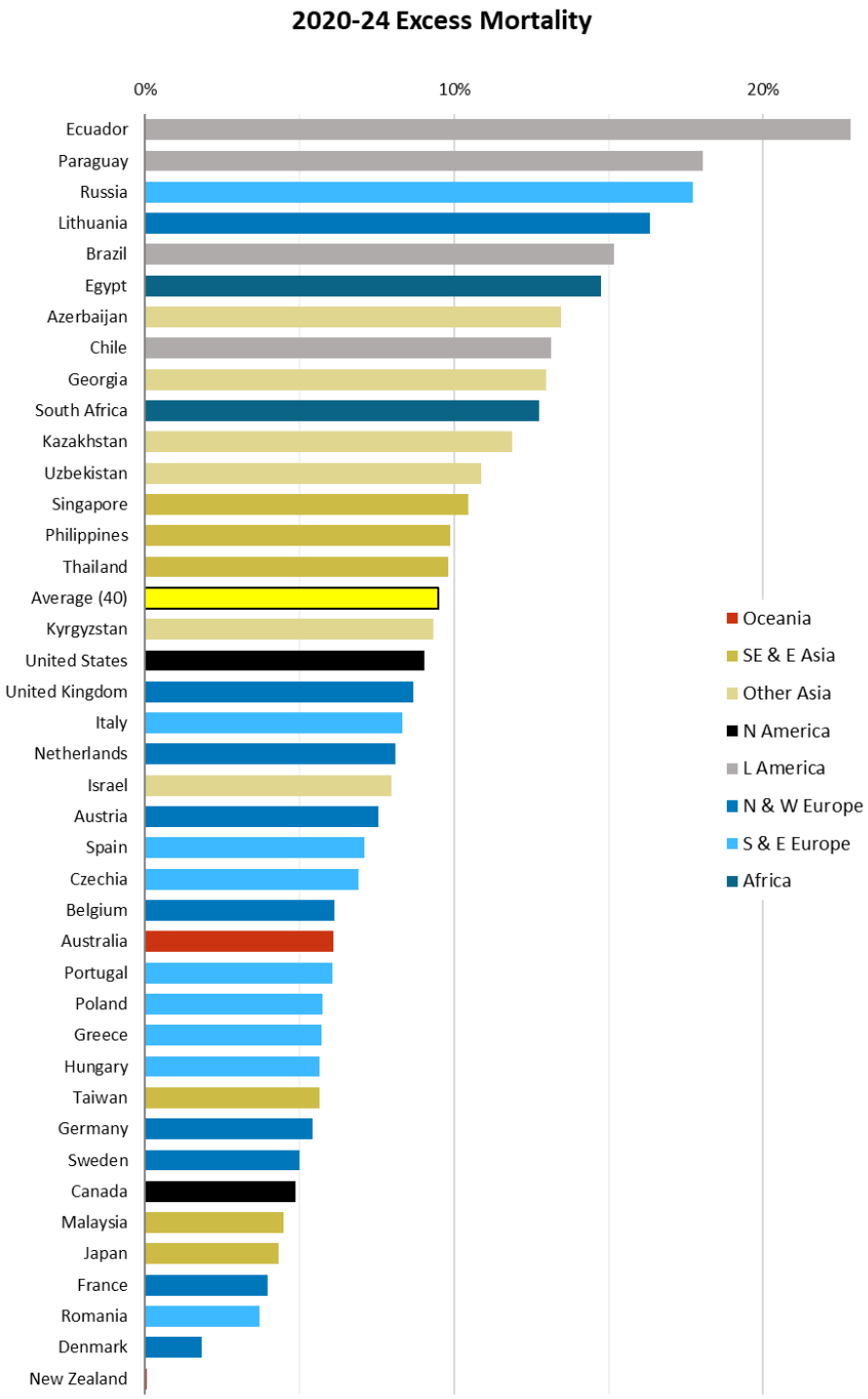
Overall, we can see that:

- regions with higher excess mortality in 2020 and 2021 had higher overall excess mortality across the five years;
- the regions containing wealthier countries tend to have experienced lower excess mortality across the five years; and
- mortality displacement is apparent, with higher (lower) than average excess in 2020 and 2021 being correlated with lower (higher) than average excess in 2022 to 2024.

We will explore these observations, and others, in the rest of this section.

5.5 Overall excess mortality by country in 2020-24

Figure 37 – Excess mortality for five years ending 31/12/24, as a percentage of expected deaths



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 37 shows that all of our 40 selected countries had positive total excess mortality across the five years, with an average of almost 10%. Ecuador was the highest, at 23% - representing more than an extra year of mortality across the period. New Zealand (0.1%) was the lowest.

Excess mortality has been very high in Latin America, averaging about 18% over the five years.

South-East and East Asia have generally had lower excess mortality than Other Asia. Similarly, Northern and Western Europe has generally lower excess mortality than Southern and Eastern Europe.

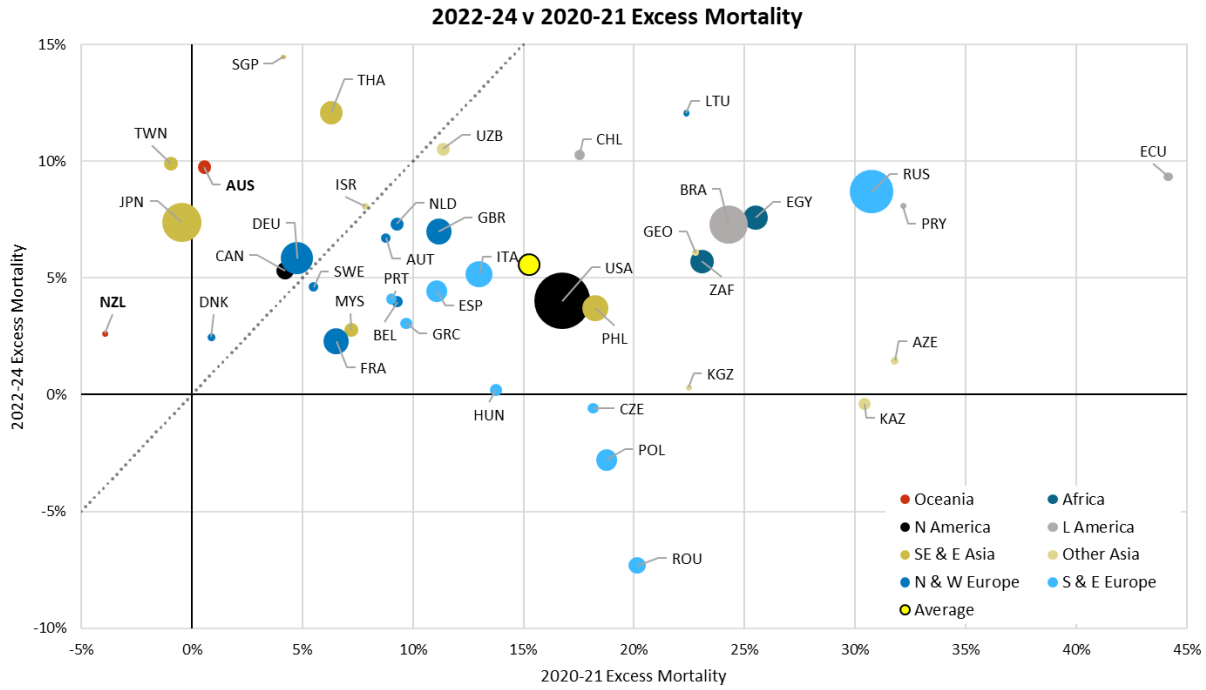
The United States has experienced 9% excess mortality across the five years, substantially higher than Canada (5%). The difference is mostly due to reported COVID-19, with excess mortality from other causes at about 1% in both countries. US excess mortality was virtually zero in 2024. Perhaps coincidentally, deaths from drug overdoses, which peaked in 2022-3, fell markedly in 2024[39].

Despite high excess mortality since borders opened in 2022, Australian excess mortality over the five years (6%) is in the bottom half of the countries included in our selection – at 26th out of 40.

In our regional analysis above (Figure 36), we have seen several examples of high 2020-21 excess mortality followed by quite low 2022-24 excess mortality, and vice versa. The period 2020-21 broadly corresponds to border closures in Australia and many other countries. While vaccines were available early in 2021, vaccination rates in many countries did not reach reasonable levels until late 2021 or even 2022. It is interesting to consider the comparison between 2020-21 and 2022-24 for all our selected countries as representing the difference between "unvaccinated and closed" and "vaccinated and open".

Figure 38 shows the excess mortality for the 2022-24 years versus the 2020-21 years, with a dotted line to show where excess mortality rates in the two periods are equivalent. Countries to the left of that line, including Australia, had higher rates of excess mortality in 2022-24 than 2020-21.

Figure 38 – A comparison of 2020-21 and 2022-24 excess mortality, showing no clear relationship



Sources: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths. Bubble size reflects projected deaths.

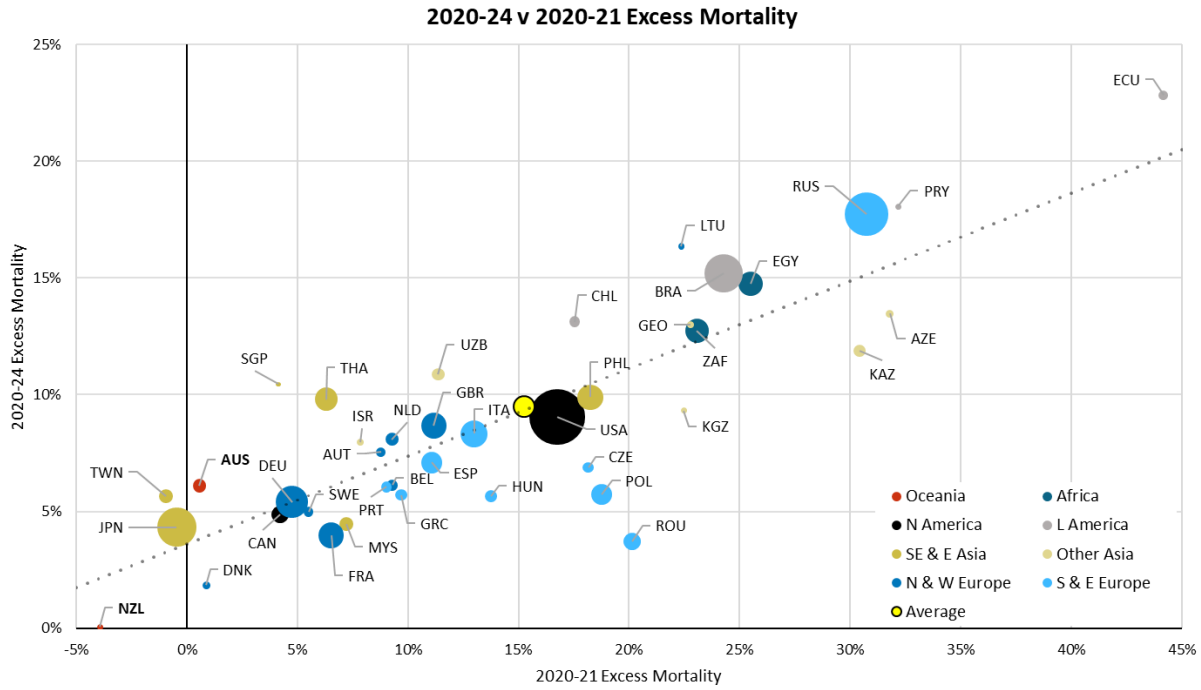
Figure 38 shows that there is no clear relationship between excess mortality in 2020-21 and that in 2022-24 (R^2=0.01). It is encouraging that most countries with high excess mortality in 2020-21 have had relatively low excess mortality in 2022-24. Indeed, excess mortality rates fell for all countries in the chart with more than 8% excess mortality in 2020-21[40]. It is likely that this reflects a degree of mortality displacement. This relates to the fact that there are many people whose age and health unfortunately mean that they are expected to die within one or two years – a period that can be cut short by

[39] See Products - Vital Statistics Rapid Release - Provisional Drug Overdose Data, for example

[40] The only exception among **all** countries with data up to 2024 is Qatar (+20.5% 2020-21 & +21.1% 2022-24)

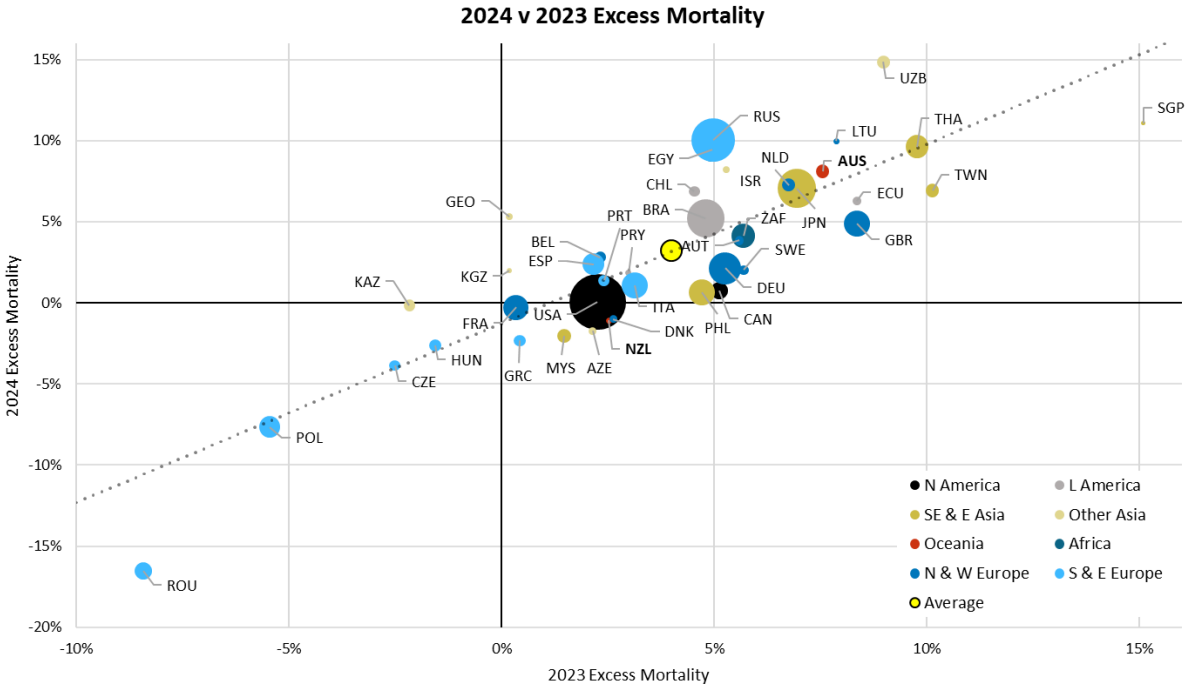
respiratory disease such as flu. Contracting COVID-19 hastened death for some, while defence measures protected others from both COVID-19 and other respiratory diseases, gaining them an extra year or two of life.

Figure 39 – Comparison of excess mortality in 2020-24 with excess mortality in 2020-21, showing that overall excess mortality is highly correlated with experience in the first two years of the pandemic



Sources: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths. Bubble size reflects projected deaths.

Figure 40 – Comparison of excess mortality in 2024 with excess mortality in 2023, showing a close relationship



Sources: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths. Bubble size reflects projected deaths.

Despite the comment above, Figure 39 shows that there is a strong correlation (R^2 = 0.70) between excess mortality in 2020-21 and the total excess over 2020-24 for our 40 countries. There has not been a significant relative mortality catch-up in 2022-24 of lives saved in 2020-21 by lockdowns and other

defence measures, i.e. those measures appear to have had a net positive effect over the duration of the pandemic.

Figure 40 shows a similar strength of correlation (R^2 = 0.73) between 2023 and 2024, with excess mortality generally reducing slightly.

5.6 Excess mortality compared with COVID-19 mortality

Our analysis of Australian mortality showed that the shape of excess mortality reflected COVID-19 waves. Does this apply to other countries, too?

We have derived monthly excess mortality and COVID-19 mortality[41] from OWID data. Displaying this data in charts enables us to see any obvious relationships.

Figure 41 – Monthly excess mortality compared with Covid mortality, by region

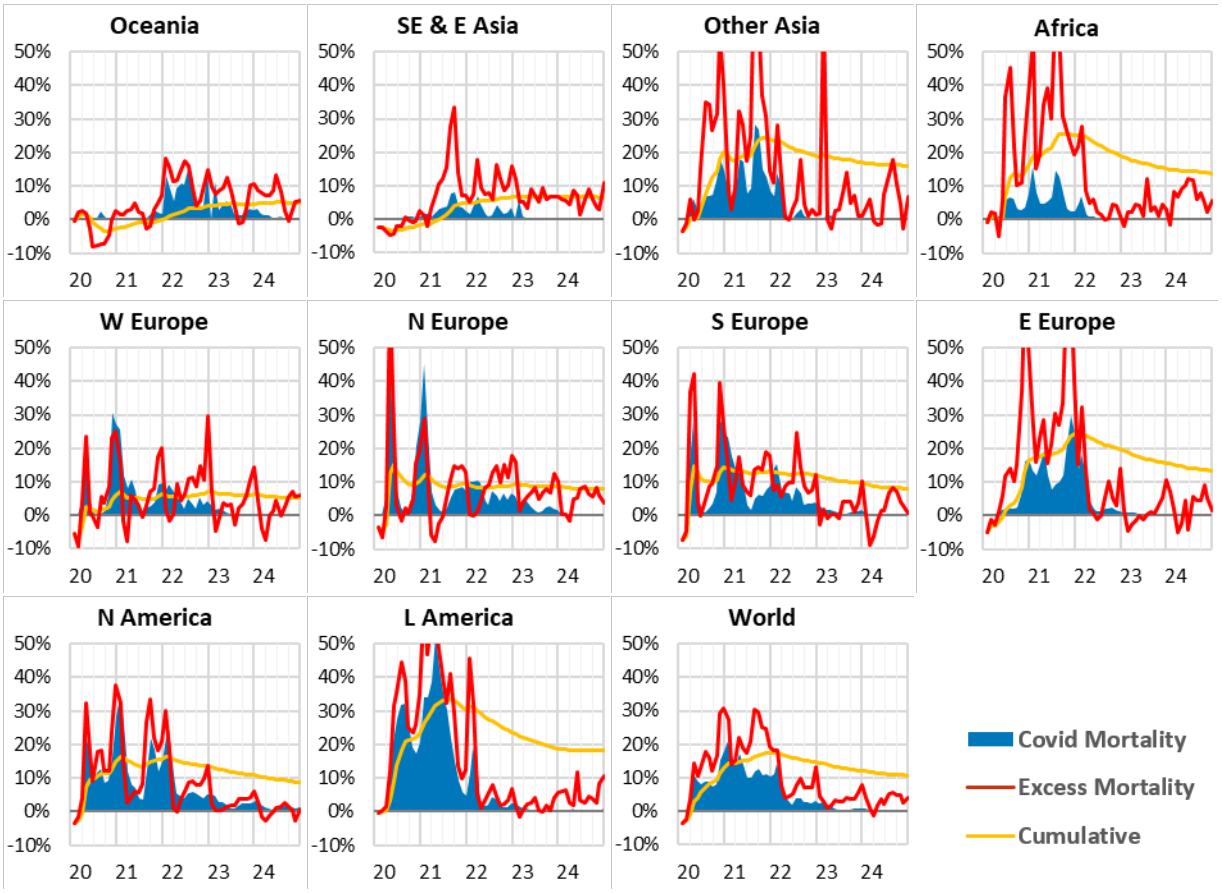


Figure 41 shows that there is a strong relationship between COVID-19 mortality and total excess mortality, which has experienced spikes when there have been regional COVID-19 waves. Note that surveillance reporting of COVID-19 mortality has varied between countries (and regions) and over time. There has been generally low reporting in Africa, SE & E Asia, Other Asia and Eastern Europe, and most regions appear to have been under-reporting in the past year or two. This recent under-reporting is consistent with our experience in Australia, where testing is now far less prevalent.

The first COVID-19 wave, in the northern spring of 2020, can be seen in Europe (other than Eastern Europe) and in North America, with delayed transmission to Latin America, Africa and Other Asia, while Oceania and SE & E Asia were in lockdown. Global waves are also apparent in the northern winter of 2020-21 and in the second half of 2021.

[41] We understand that this data comes from surveillance reporting. We have calculated monthly COVID-19 mortality rates as reported COVID-19 deaths divided by the expected deaths for that month.

There appear to be continued six-monthly waves of excess mortality, which we would attribute to COVID-19. These waves are higher in the winter than in the summer, arguably because of the proximity of people indoors in the winter. Because about 90% of the world's population lives north of the equator, the global waves are more pronounced in the northern winter than in the southern winter.

5.7 Monthly actual and expected deaths

It is instructive to observe how actual mortality compares with expected mortality month by month. The following charts show actual and expected deaths each month, expressed per million per day. This perspective allows us to see both the seasonality and the trend in deaths.

Figure 42 – Actual and Expected deaths per million per day – selected countries

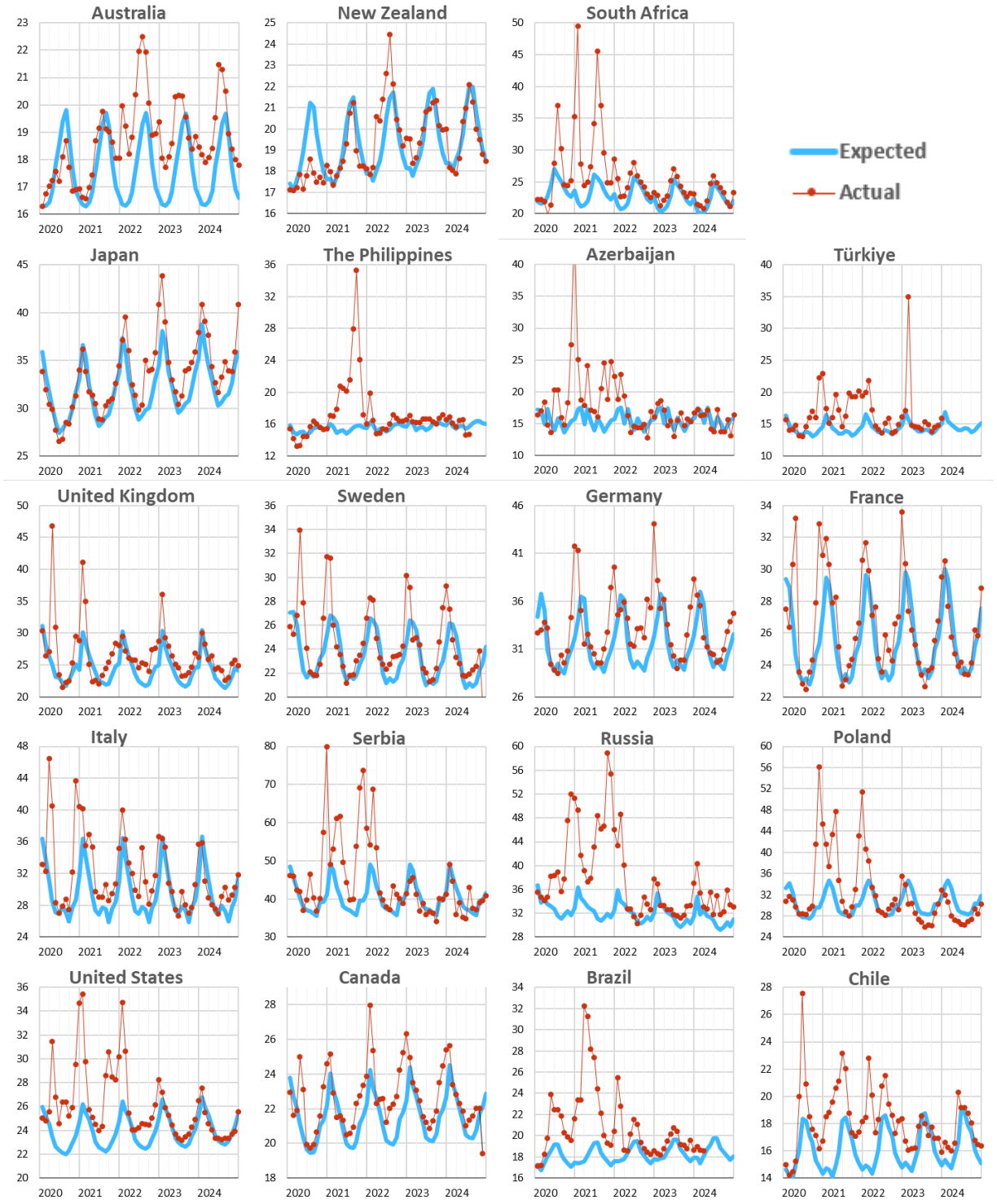


Figure 42 shows that mortality in several countries has returned to trend. In some cases, such as Poland, mortality is now clearly below trend. Other features not directly related to the pandemic are visible, too, including the impact of the February 2023 earthquake in Türkiye that killed more than 55,000 people (630 per million) and, to some extent, the impact on Russia of the war in Ukraine.

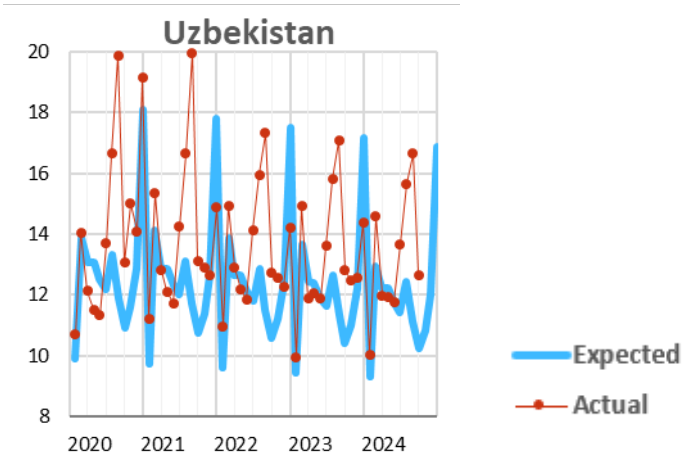
We can also see the raw impact of pandemic mortality spikes. Table 4 lists the highest excess deaths per million population over any three consecutive months for each of the countries in Figure 42, listed in order of the timing of that peak and compared with a quarter of the average expected yearly deaths in the five-year period.

Table 4 – Maximum pandemic mortality spike – selected countries – excess deaths per million over three consecutive months

Central Month	Country	Excess	Excess %
Apr 2020	United Kingdom	913	32.0%
Apr 2020	Italy	861	40.7%
May 2020	Sweden	536	25.1%
Nov 2020	France	435	18.7%
Nov 2020	Poland	1,582	56.8%
Nov 2020	Türkiye	574	43.8%
Dec 2020	United States	756	34.6%
Dec 2020	Azerbaijan	1,501	105.7%
Jan 2021	South Africa	1,380	66.4%
Apr 2021	Brazil	1,115	67.0%
Sep 2021	The Philippines	1,200	84.0%
Oct 2021	Russia	1,994	67.9%
Oct 2021	Serbia	2,458	66.5%
Feb 2022	Chile	521	35.5%
Jun 2022	Australia	283	17.6%
Jun 2022	New Zealand	219	12.4%
Nov 2022	Canada	304	15.5%
Nov 2022	Germany	665	23.1%
Dec 2022	Japan	448	15.3%

It is interesting to note that countries in our selection with their maximum spike in 2021 (or late 2020) generally had the highest three-monthly maximum excess, in both absolute and relative terms, while those with their maximum in 2022 generally had the lowest. We note that this seems to be borne out more broadly in our data, with the particular exceptions of Ecuador (+116% centred in April 2020) and Bolivia (+158% centred in July 2020).

Figure 43 – Actual and Expected deaths per million per day – Uzbekistan



At this point, we must remind the reader that our charts and tables are only as good as the underlying data. Figure 43 shows a persistent time shift in seasonal mortality in Uzbekistan that strongly suggests issues with the underlying data.

Note that Appendix C contains the equivalent chart for each of the 61 countries represented in the regional charts in Figure 41, including the 40 countries discussed in this chapter.

5.8 Life expectancy

While we could not find comparable mortality data in OWID for most of the world's largest countries, the World Bank[42] tracks period life expectancy[43] at birth for every country in the world. Broadly, higher (lower) mortality in a year results in a lower (higher) calculated life expectancy, so this data can be used to indicate the experience of those missing countries. The World Bank data doesn't yet extend to 2024, but it is still interesting to see some comparisons. In these charts, built from World Bank data, we show the progression of life expectancy from 2010 to 2023, with the overlay of the linear trend of 2015-19. This gives a crude indication of the extent to which there was still excess mortality in 2023.

Figure 44 – Period life expectancy at birth for the five largest countries – 2010 to 2023

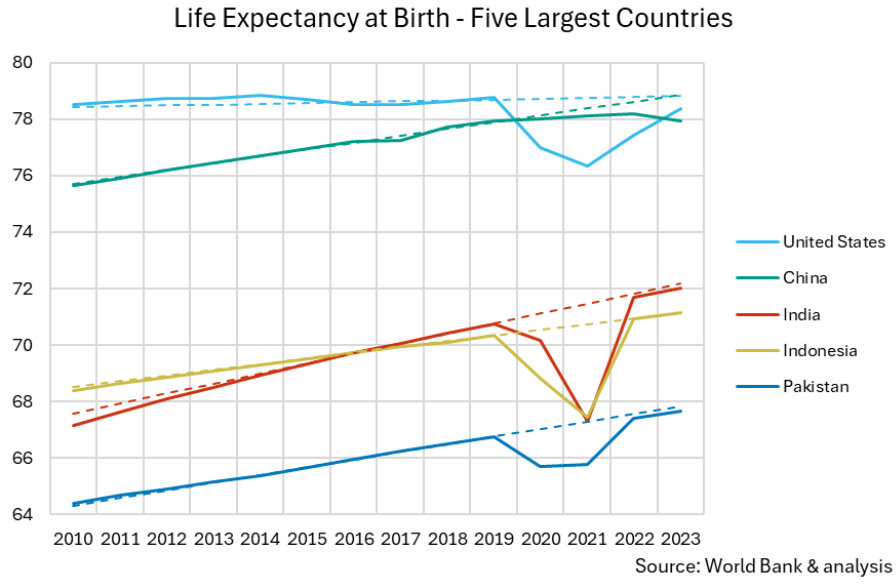


Figure 44 indicates that India and Indonesia experienced significant excess mortality in 2020 and (especially) 2021, which is consistent with the general experience of less wealthy nations discussed in Section 5.4. However, both have returned to trend. Pakistan suffered a smaller impact in 2020 and 2021 and has also returned to trend. China, which imposed severe localised lockdowns, saw a lower reduction in life expectancy but has seen no improvement relative to trend; in fact, there was a further deterioration in 2023. Life expectancy in the United States has moved as the excess mortality experience for North America (see Section 5.4) would suggest.

It is interesting to note that the 2015-19 trend in life expectancy on the United States shows virtually no mortality improvement. This is consistent with evidence from other sources, including a recent Peterson-KFF Health System Tracker article[44] that highlights that US life expectancy is considerably lower than that of 11 "comparable countries" and shows that the gap has been getting wider.

[42] See Life expectancy at birth, total (years) | Data, but note that we have not reviewed how this data (which is also available via OWID) is sourced by the World Bank
[43] Period Life Expectancy vs Cohort Life Expectancy: The Difference is Important - Actuaries Digital - Actuaries Institute
[44] How does U.S. life expectancy compare to other countries? - Peterson-KFF Health System Tracker

Figure 45 – Period life expectancy at birth for five selected countries – 2010 to 2023

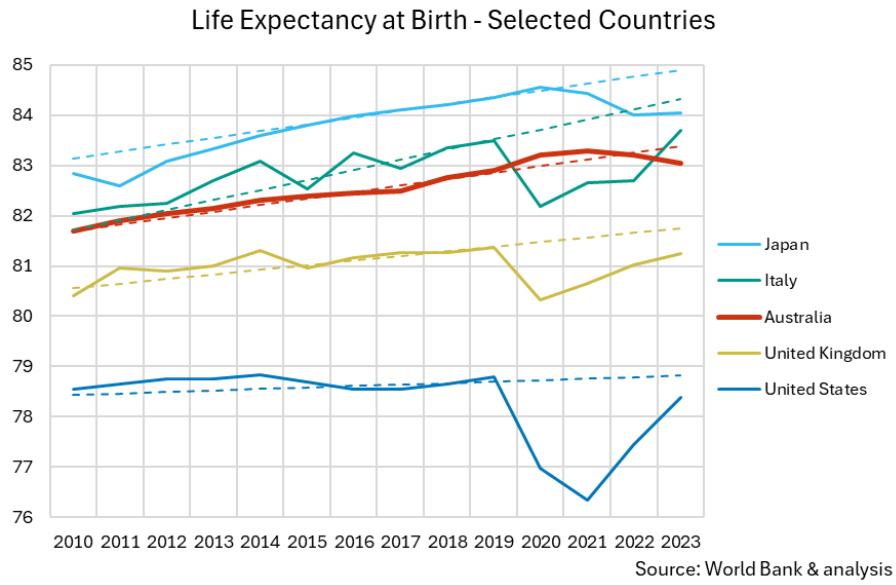
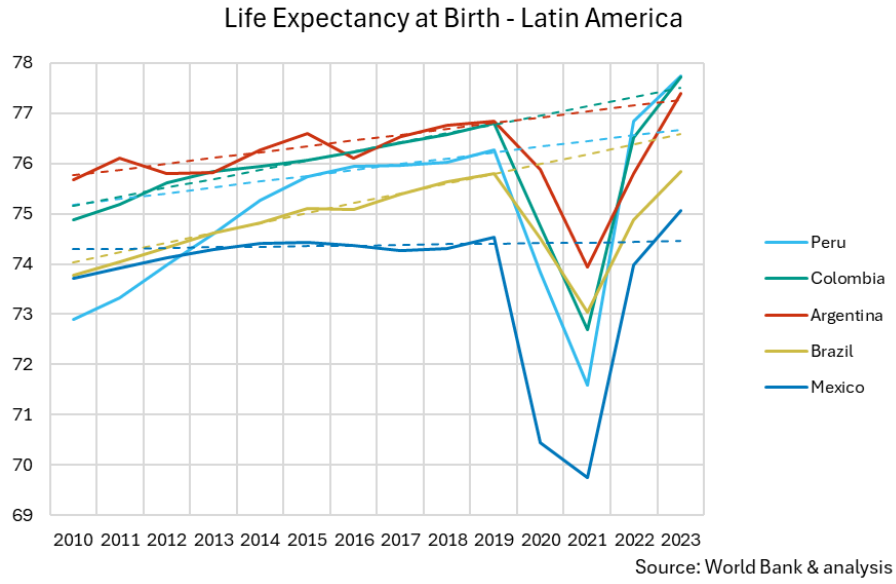


Figure 45 compares US life expectancy with four of the countries in the Health System Tracker article. While all four countries demonstrate stronger trends in mortality improvement, there are notable differences in recent experience. In fact, each country's life expectancy has recently moved in a manner broadly consistent with that country's excess mortality experience[45]. In particular, Japan and Australia experienced a delayed mortality impact from the pandemic because of their initial defence measures.

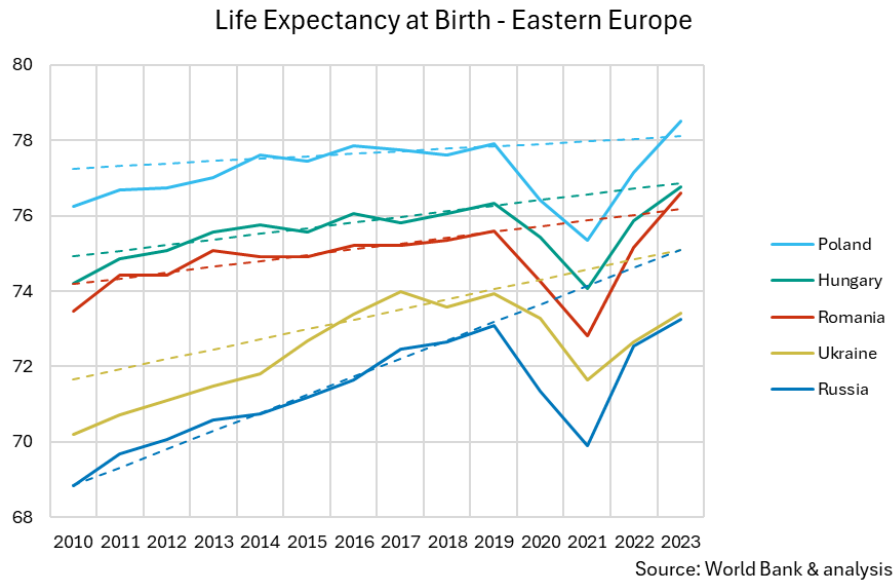
Figure 46 – Period life expectancy at birth – Latin America – 2010 to 2023



In Latin America, where the pandemic hit particularly hard in 2020 and 2021, the data suggests that life expectancy has generally at least returned to trend, with the exception being Brazil.

[45] See Figure 38, for example

Figure 47 – Period life expectancy at birth – Eastern Europe – 2010 to 2023



In Eastern Europe, there has also been a general return to trend. Notable exceptions include Ukraine and Russia; at least in part, this will be for the obvious reason of the war between these two countries.

Figure 48 – Period life expectancy at birth – Other Asia – 2010 to 2023

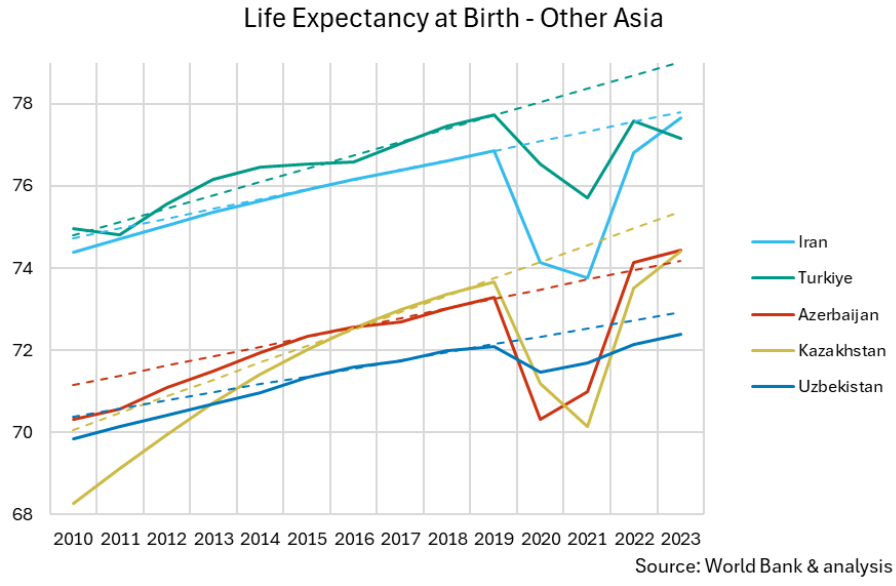


Figure 48 shows, once again, that countries that were hit hard in 2020 and 2021 have generally returned to trend. Türkiye is an exception, because of the 2023 earthquake.

5.9 The impact of vaccines

We reviewed the question of the impact of vaccines on Australian mortality in Section 4.3. What can we deduce from the experience of other countries?

We can overlay monthly population vaccination rates (sourced from OWID[46]) on our charts showing monthly averages of actual and expected daily deaths per million. For these charts, we have used

[46] But note that national vaccination data appears to be of variable quality after about 2022

mortality scales that always span a range of 20 deaths per million, while monthly vaccination rates (right-hand scale) are always shown on a scale of 0% to 40%. The charts all use this legend:

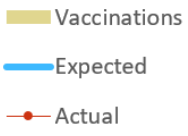
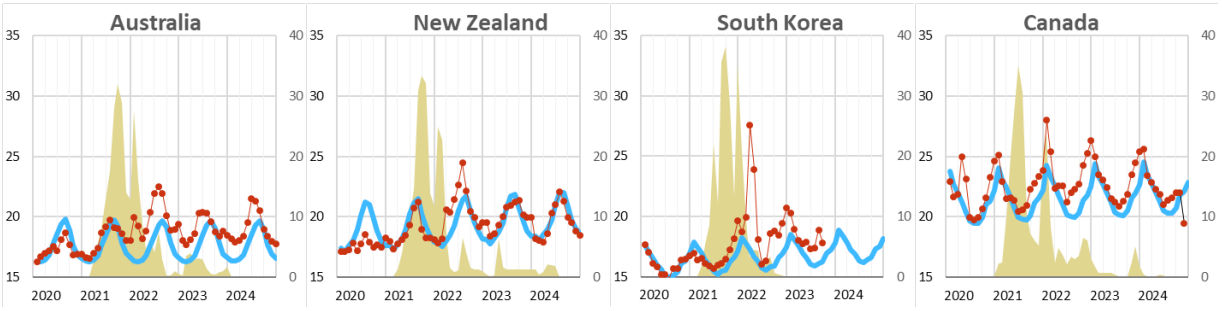


Figure 49 – Mortality spike following vaccination spike



The countries shown in Figure 49 each experienced their largest mortality spike after their largest vaccination spike. However, as each country only re-opened borders and relaxed internal controls after vaccinations had reached high levels, it is likely that the mortality spikes were driven by a much greater spread of COVID-19 than had occurred earlier in the pandemic.

Figure 50 – Mortality spike coincident with vaccination spike

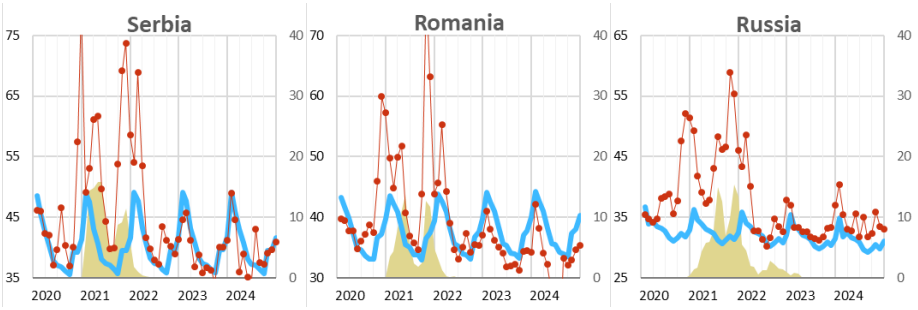


Figure 51 – Mortality spike precedes vaccination spike

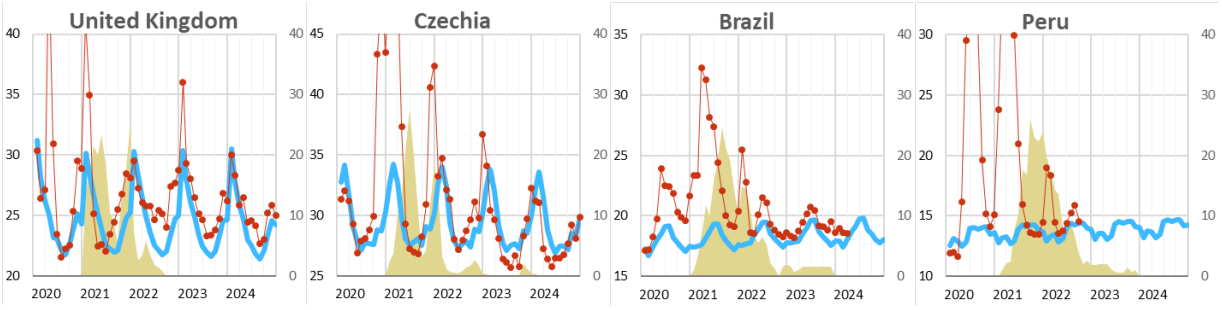


Figure 50 shows examples of countries where mortality spikes coincide with vaccination spikes. However, Figure 51 shows examples of the more common case, namely where mortality spikes **precede** vaccination spikes. These mortality spikes cannot be caused by future vaccinations, but it is highly likely that high mortality would encourage people to get vaccinated.

5.10 Reversion to trend?

As discussed earlier in this Section 0, we note that mortality rates have generally returned to levels close to pre-pandemic trends. This seems to be largely independent of the level of vaccination. We

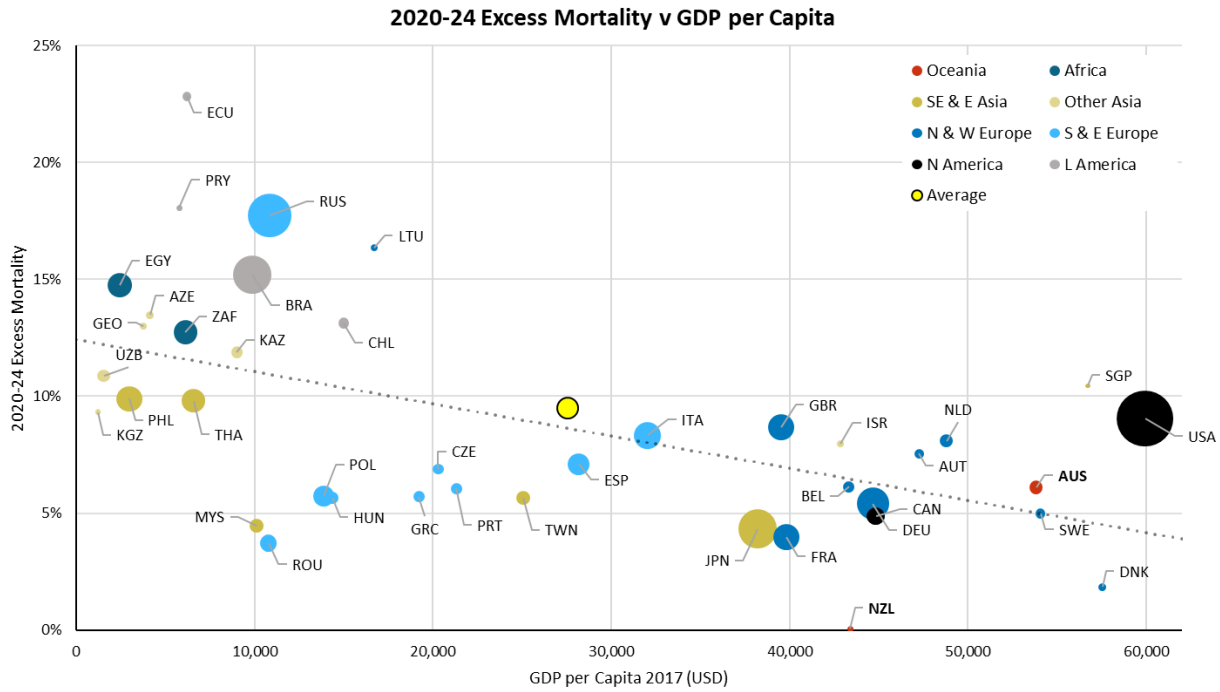
do not consider that this means that vaccines are ineffective. Rather, much as had been expected early in the pandemic, a degree of "herd immunity" can be achieved by widespread exposure to the virus – but the mortality cost is much lower if much of the exposure is achieved via vaccination.

We do note that excess mortality in several countries (including Australia, Japan, Israel, Chile and the Netherlands) increased from 2023 to 2024 and was above 6% in 2024. Accordingly, we consider that it is still too soon to form a view on whether (and, if so, when) mortality in these countries will return to the pre-pandemic trend. We are also mindful of the increasing time between the pre-pandemic data and recent experience.

5.11 Comparing excess mortality with GDP

It is worth considering the impact of wealth (measured by GDP per capita) on excess mortality. To do this, we sourced 2017 GDP per capita in US dollars from Worldometer.

Figure 52 – Comparison of 2020-24 excess mortality with per capita GDP, showing a clear (but weak) inverse relationship



Sources: Our World in Data (OWID), Worldometer and analysis. Excess mortality relative to projected deaths. Bubble size is projected deaths.

A clear but weak ($R^2 = 0.30$) inverse relationship between per capita GDP and excess mortality for our 40 selected countries can be seen in Figure 52. Interestingly, the USA is an outlier. Given its wealth, it might be expected to have achieved a much lower level of excess mortality. Singapore, too, appears to be above the trend, while other countries in the SE & E Asia region appear to have done better than might have been expected based solely on per capita GDP.

Among the less wealthy countries in the chart, the Latin American countries are also above the trend, as are Russia and Lithuania. In that context, we note that a logarithmic trend line has a marginally less good fit and would result in most of those countries being further above trend.

Locally, Australia is broadly on trend, while New Zealand has experienced considerably lower excess mortality than per-capita GDP would suggest.

Overall, although the relationship is weak, we consider that this chart demonstrates the advantage of wealth in the face of a pandemic.

5.12 Comparing excess mortality with state capacity

Given the weak – but clear – relationship between excess mortality and GDP, is there a better predictor? It turns out that there is.

Jonathan K. Hanson and Rachel Sigman have measured state capacity (the ability of a government to implement its policies and achieve its goals) by combining 21 different indicators related to three key dimensions:

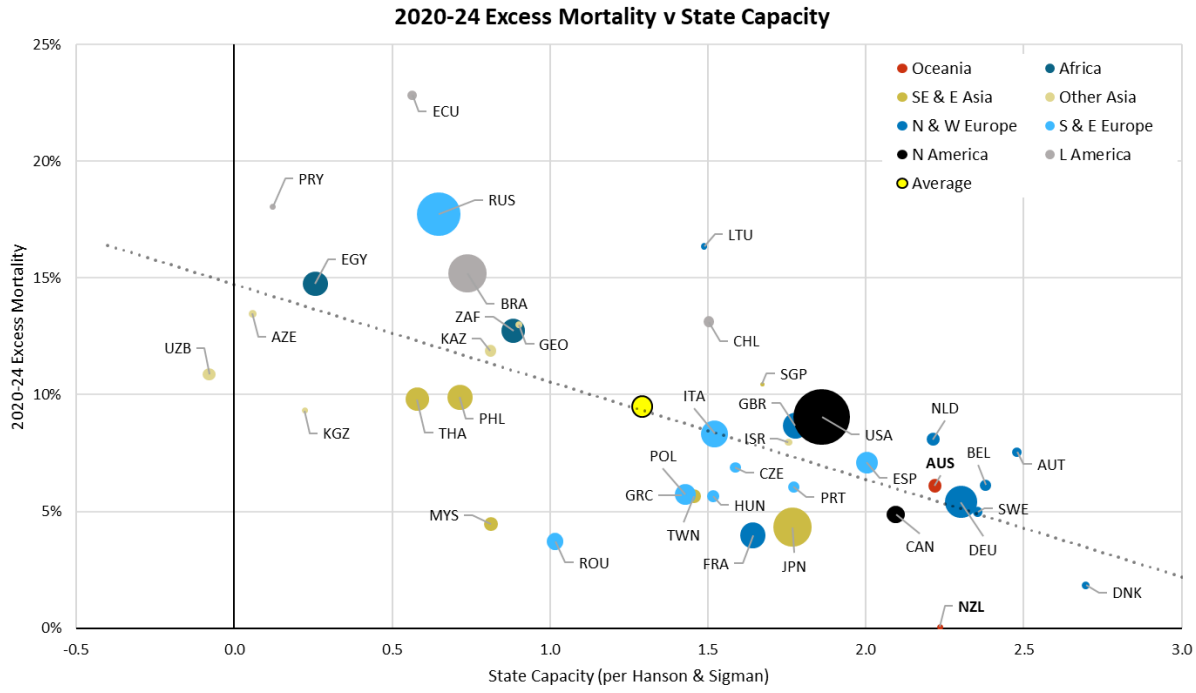
- extractive capacity – the state's ability to raise tax revenue;
- coercive capacity – the state's ability to preserve its borders, protect against external threats, maintain internal order, and enforce policy; and
- administrative capacity – a broader dimension that includes the ability to develop policy, the ability to produce and deliver public goods and services, and the ability to regulate commercial activity.

Higher values indicate greater state capacity. While there is a high correlation between per-capita GDP and state capacity, the latter is a more nuanced measure of the ability of a state to manage a crisis such as a pandemic.

OWID maintains a copy of the annual measures, updated every year or so. The latest values (updated in October 2023) relate to 2015.

We can compare excess mortality over the four years with state capacity.

Figure 53 – Comparison of 2020-24 excess mortality with state capacity, showing a clear (but somewhat weak) inverse relationship



Sources: Our World in Data (OWID), Worldometer and analysis. Excess mortality relative to projected deaths. Bubble size is projected deaths.

Figure 53 shows this comparison for our 40 countries. The inverse relationship that we saw with GDP is still there, but it is less weak ($R^2 = 0.42$). We can see that the USA and Singapore are no longer outliers – because their measured state capacity is lower than would be implied by their per capita GDP. (We do not know why this is the case, because we do not have access to the component calculations.)

Once again, other countries in the SE & E Asia region generally appear to have done better than might have been expected based solely on per capita GDP, although South Korea is now on trend.

Among the less wealthy countries in the chart, the Latin American countries are still above the trend, as are Russia and Lithuania.

Locally, Australia is again on trend, while New Zealand has experienced considerably lower excess mortality than state capacity would suggest.

5.13 Excess mortality by age

OWID data allows us to drill into excess mortality by age group for some countries. However, this data has not been updated for 2024. Therefore, we refer the reader to our discussion of this topic in our previous Research Paper.

6 What does the future hold?

Prediction is very difficult, especially if it's about the future![47]

We include this quote from Niels Bohr, as we did in our previous Research Papers, because it has been hard enough to form a view about what has already happened, and yet we will now attempt to predict (or at least sketch) the future.

6.1 Future mortality

How do we predict mortality in the future after these five years of COVID-19 experience?

Overall, in the authors' view, mortality is likely to remain above pre-pandemic expectations for some years for two main reasons:

1. COVID-19 is likely to remain a significant (perhaps top 10) cause of death, which increases total deaths in the population, and
2. a population which has experienced COVID-19 infection, particularly multiple times, is likely to be less healthy than it would have been without COVID-19 infections.

6.1.1 COVID-19 mortality

The biggest unknown is COVID-19, both in the acute phase and in relation to its longer-term impacts.

In the acute phase, over 2022 and 2023 we saw successive COVID-19 waves result in fewer deaths, but this was not the case in 2024, when the winter wave was higher than the preceding 2023/24 summer wave and similar in size to the 2023 winter wave. It is unclear how this pattern will stabilise. Undoubtedly some of this improvement was due to survivorship bias, so we could expect the rate of improvement to perhaps slow down. There is also the possibility that a more deadly COVID-19 variant could emerge in the future. Population vaccination rates have fallen, and we expect that this has also led to a slow down in the rate of improvement.

As to the longer-term impacts of COVID-19, it is unclear what the population-wide impact on mortality will be now that the vast majority have had COVID-19. To some degree, we can look to other countries where COVID-19 has been circulating in the population for longer than in Australia to understand what might happen with respect to COVID-19 mortality.

Section 6 shows a broad pattern that higher excess mortality in 2020 and 2021 tends to be correlated with lower excess mortality in 2024 – i.e., those countries that had more excess deaths earlier in the pandemic tended to have a lower excess mortality experience in 2024 than countries like Australia.

This suggests that the direct contribution of COVID-19 to excess mortality in Australia is likely to reduce over time, which would be consistent with the development of "herd immunity". However, it is not yet clear when, if at all, mortality will return to the pre-pandemic trend.

It seems likely that COVID-19, directly or indirectly, will continue to be a significant contributor to mortality in Australia.

6.1.2 Non- respiratory mortality

The COVID-19 pandemic disrupted the mortality trends for several of the non-respiratory causes in Australia. Causes that had displayed fairly stable trends in the years immediately prior saw different patterns during the pandemic. Deaths from cardiovascular causes, diabetes and other unspecified

[47] Niels Bohr, atomic physicist

diseases, as well as coroner-referred deaths, were above trend, while dementia deaths slowed compared to their pre-pandemic increasing trend. Of the major causes, only cancer largely maintained its pre-pandemic trend.

Thus, the 2023 experience was usually different from what would have been anticipated before the pandemic, for all of these causes. However, in each case, the change in experience from 2023 to 2024 was in line with the pre-pandemic trend. The year-on-year changes that were typically observed from 2015 to 2019 returned. This suggests that the COVID-19 pandemic caused mortality trends for these causes to pause, but that they may now have returned.

6.1.3 Non-COVID-19 respiratory mortality

Mortality for respiratory causes is typically more volatile than other causes. Historically, influenza seasons that vary significantly between years drive significant correlations in the other respiratory causes. Since 2022, these correlations are further complicated by the emergence of COVID-19.

The uncertainty of future COVID-19 experience (as well as influenza) makes predictions of respiratory mortality particularly difficult. However, analysis of the experience from 2015 through to 2024 seems to suggest that experience in 2024 was largely in line with the pre-pandemic trend and it seems a reasonable best estimate to expect that to continue.

6.2 What is the new normal?

In our view, the "new normal" level of mortality is likely to be higher than it would have been in the absence of a pandemic. 2022 had 11% higher than predicted mortality while 2023 had 5% higher than predicted mortality, where those predictions ignored the direct impact of COVID-19, but did include some allowances for deterioration in other causes since before the pandemic.

Our view is that 2024 had no material excess mortality, *but this was against a new baseline that does include COVID-19*. When compared to a straight 2015-19 trend, 2024 mortality was around 6% higher, similar to 2023.

COVID-19 is likely to continue to be a leading cause of death for some years to come, directly as a cause of death and less directly, as a contributor to other causes such as heart disease. There will also be an indirect impact, with the largest contributor likely to be the ongoing consequences of disruption to usual healthcare practices in the earlier years of the pandemic. Counter to this, to the extent that mask-wearing and other defence measures persist in vulnerable settings, this may lead to lower deaths from respiratory disease.

There has been a long-term underlying trend of mortality improvement in Australia (i.e. over decades). Although the rate of improvement has gradually been slowing, we do not think that it will cease. The underlying drivers of mortality improvement, such as medical advances, reduction in smoking rates, and other societal improvements are continuing (noting that improvements in many causes of death are "baked in" from population-wide changes years, or even decades, beforehand).

The question remains as to whether mortality will eventually return to the pre-pandemic trajectory, or whether there may be a permanent loss of a few years of mortality improvement. Based on the (limited) available information, our view is that mortality rates will continue to improve year on year, at a rate similar to that observed before the pandemic, but will not return to the 2015-19 trend in the near future.

6.3 2025 Baseline

6.3.1 Basic approach

Since 2024, we have set the baseline as our expected level of "new normal" post-pandemic levels of mortality, rather than comparing to the expected number of deaths had the COVID-19 pandemic not occurred. This approach was outlined in our Actuaries Digital Article: "Excess Mortality: Considerations in Moving Away from a Pre-pandemic Baseline", published on 24 April 2024.

In setting the 2025 baseline, we considered how to incorporate the limited post-pandemic data, and the extent to which we rely on pre-pandemic data. By 2030, we expect our baseline will be entirely derived from post-pandemic experience (2023-2029). We have set our 2025 baseline consistent with this expectation, using a method that moves towards the intended ultimate method by gradually increasing the reliance on post-pandemic data as it emerges. To achieve this, we have adopted a credibility-based approach that blends post-pandemic and pre-pandemic trend data.

For 2025, we have used an equally weighted mix of the two years of post-pandemic experience (2023 and 2024) as our starting point. We have then applied one year of mortality improvement, based on both pre- and post-pandemic trends, to obtain our 2025 baseline prediction. This approach was implemented separately for the three broad categories of causes of death: non-respiratory, COVID-19 and non-COVID-19 respiratory.

6.3.2 Allowance for mortality improvement by cause

In calculating the baseline, we first determine the expected Standardised Mortality Rates (SDRs by cause. We then apply these rates to the implied population mortality base from the ABS for 2025 to estimate the number of expected deaths.

For non-respiratory causes:

- As the starting point, we have taken an average of:
    - 2023 SDRs (adjusted for deaths that have not yet been reported) and applying one year of pre-pandemic mortality improvement to align to 2024
    - 2024 SDRs (adjusted for deaths that have not yet been reported)
- We then applied one year of the pre-pandemic (2015-2019) rate of mortality improvement to estimate the 2025 SDR.
- This method reflects a rebasing of the death rate in the post-pandemic world, where certain causes of death, such as diabetes and heart disease, have increased compared to the pre-pandemic levels, potentially due to COVID-19-related factors. However, we consider pre-pandemic mortality improvements to be the most reliable indicators for future forecasting.

For COVID-19:

- We have assumed that the SDR and timing of COVID-19 in 2025 will be the same as in 2024, with no improvement.
- After adjusting for the timing of the winter wave and removing the early spike in 2023, the raw numbers for 2024 closely followed the experience of 2023. Our expectations for significant reductions in the severity of each COVID-19 wave were not met in 2024, so we have decided not to forecast any COVID-19 mortality improvements for the 2025 baseline.

For non-COVID-19 respiratory causes:

- We applied a linear trend to the SDRs from the pre-pandemic period (2015-2019) and the post-pandemic period (2023-2024), then extrapolated an additional year to estimate the 2025 SDR.
- This method accounts for the significant variability and multiple factors impacting respiratory deaths by cause in 2023-2024, making it difficult to rely solely on data from those years for the

starting point. Therefore, we excluded data from the pandemic period (2020-2022) and applied a trend to the remaining data.

The following charts illustrate the selected baselines for each of the major causes, shown as annualised SDRs (deaths per 100,000 in a standardised population mix).

6.3.3 Baselines for non-respiratory causes

Figure 54 – 2025 Baseline: Cancer

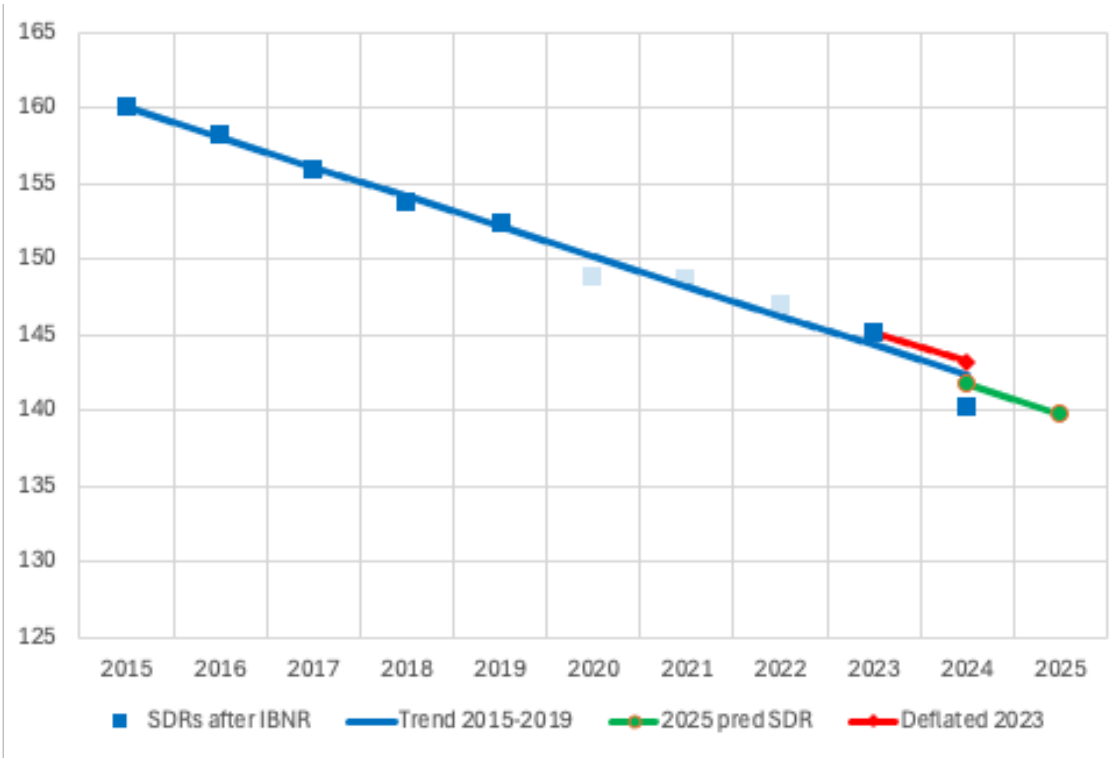


Figure 55 – 2025 Baseline: Ischaemic Heart Disease

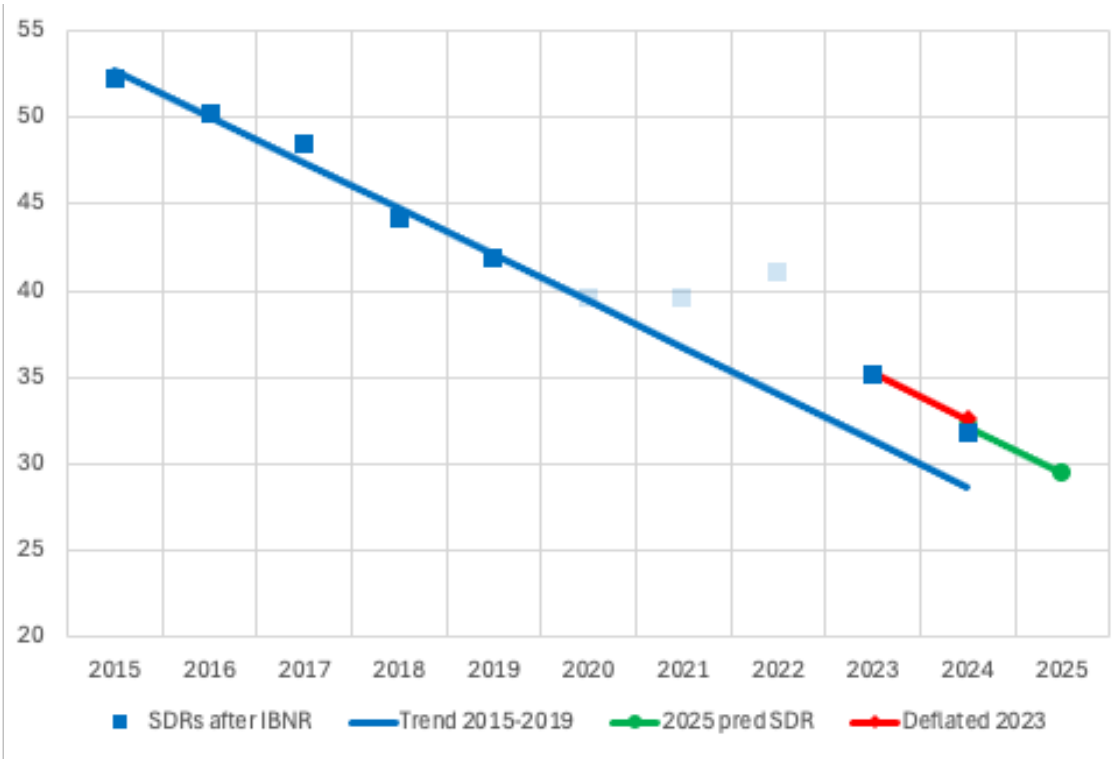


Figure 56 – 2025 Baseline: Other Cardiac Conditions

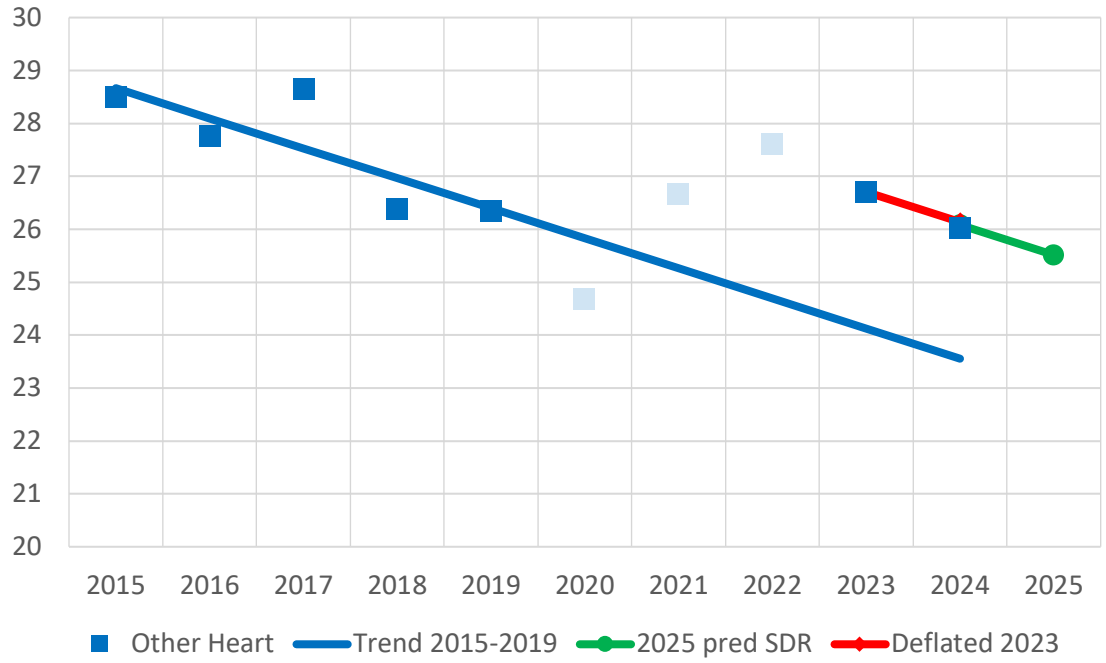


Figure 57 – 2025 Baseline: Cerebrovascular Disease

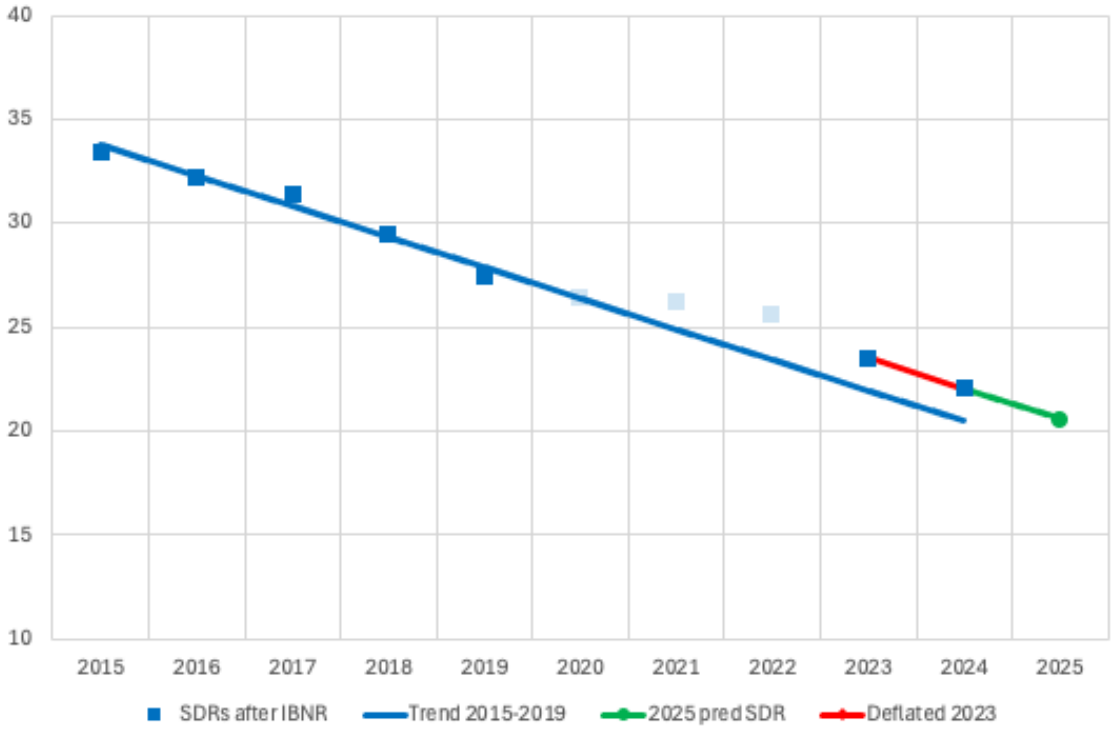


Figure 58 – 2025 Baseline: Diabetes

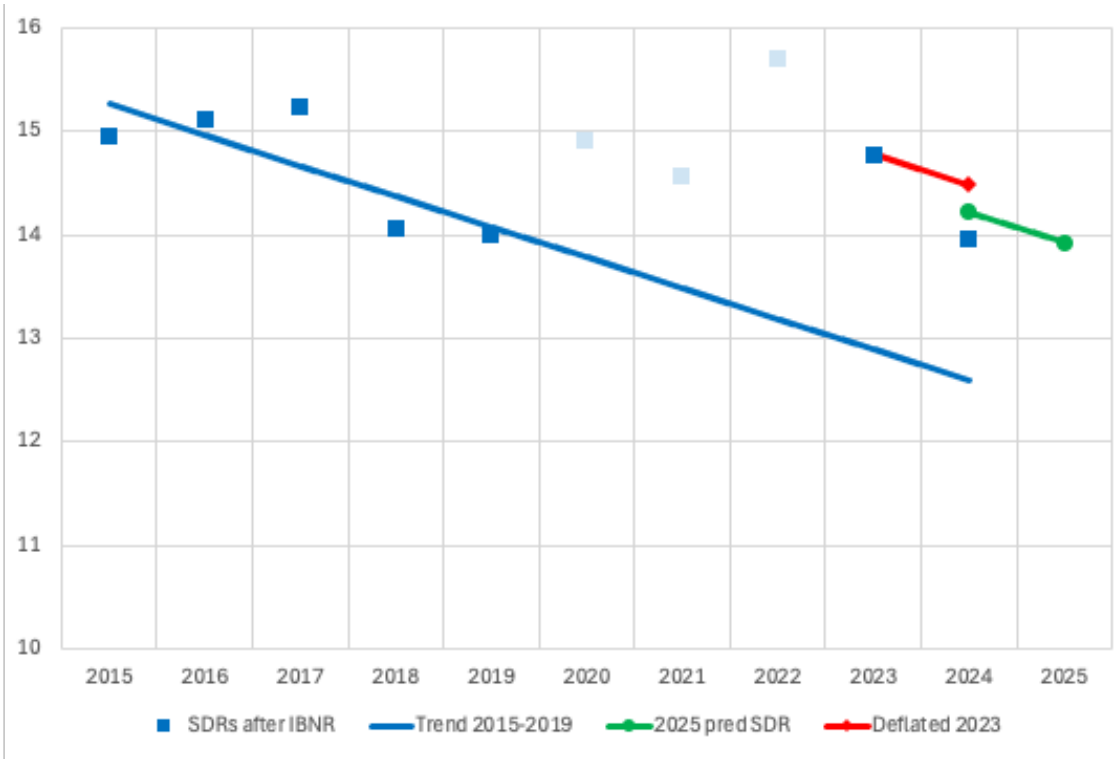


Figure 59 – 2025 Baseline: Dementia

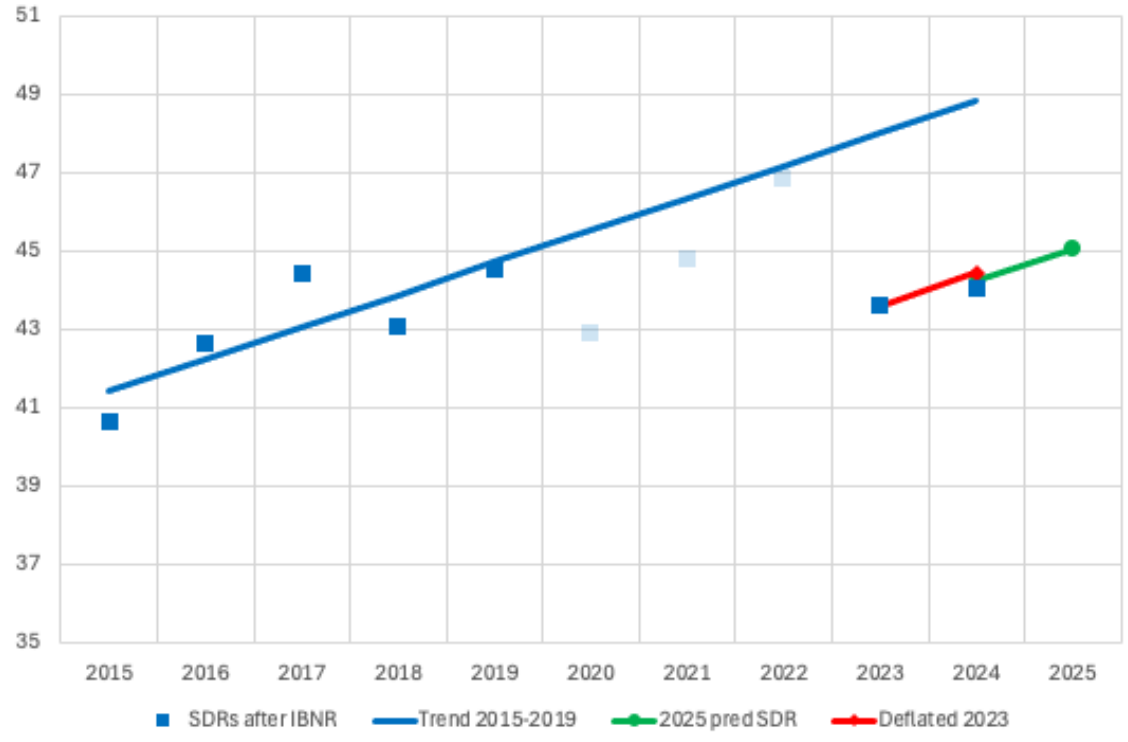


Figure 60 – 2025 Baseline: Other Unspecified Disease

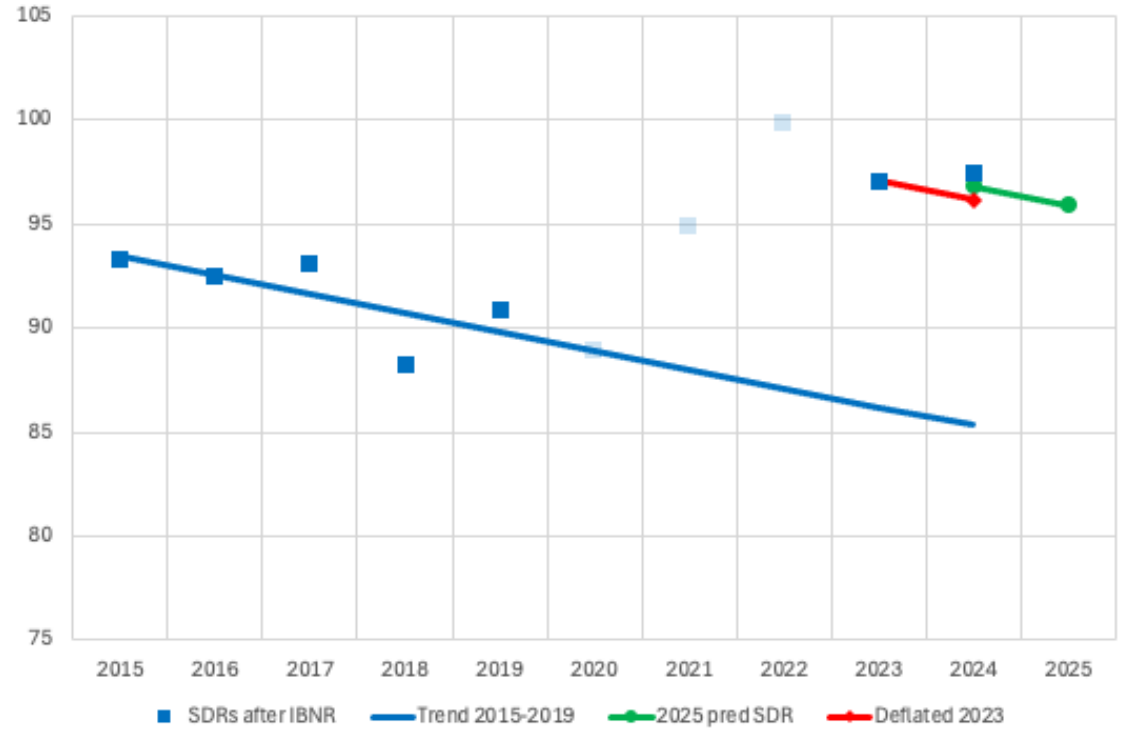
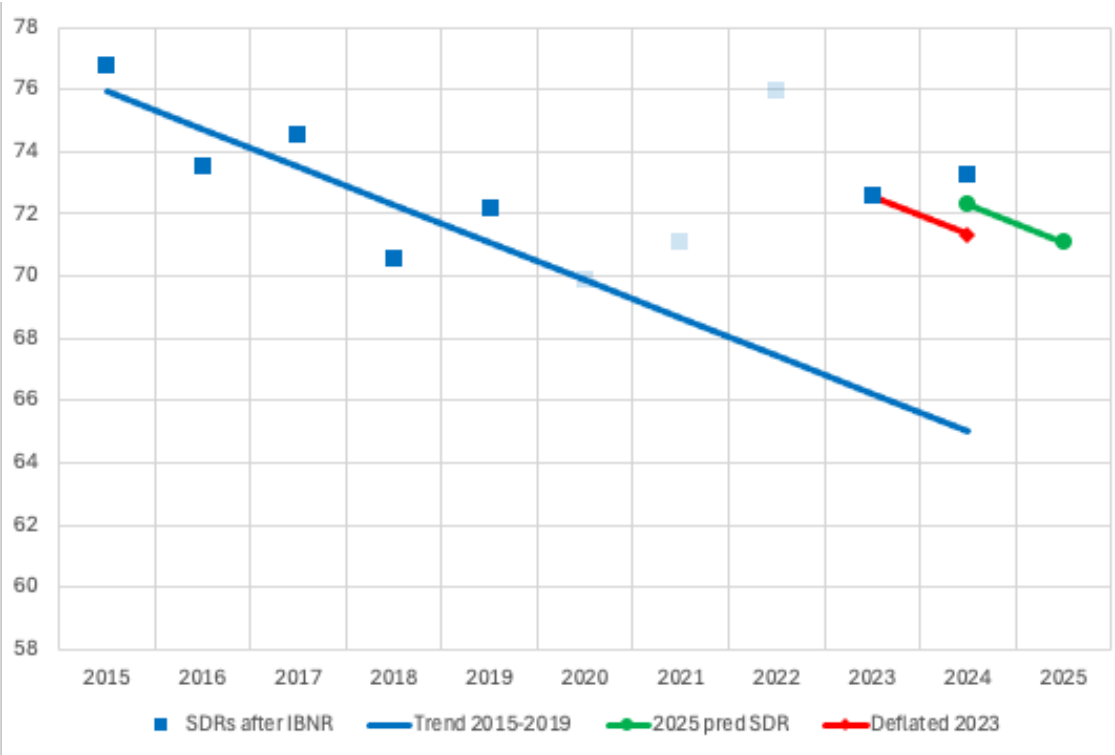


Figure 61 – 2025 Baseline: Coroner Referred Deaths



The graphs show that the "deflated 2023 SDR," which serves as the starting point before applying one year of mortality improvement, is quite close to the actual 2024 SDR.

6.3.4 Baselines for respiratory causes

Figure 62 – 2025 Baseline: Influenza

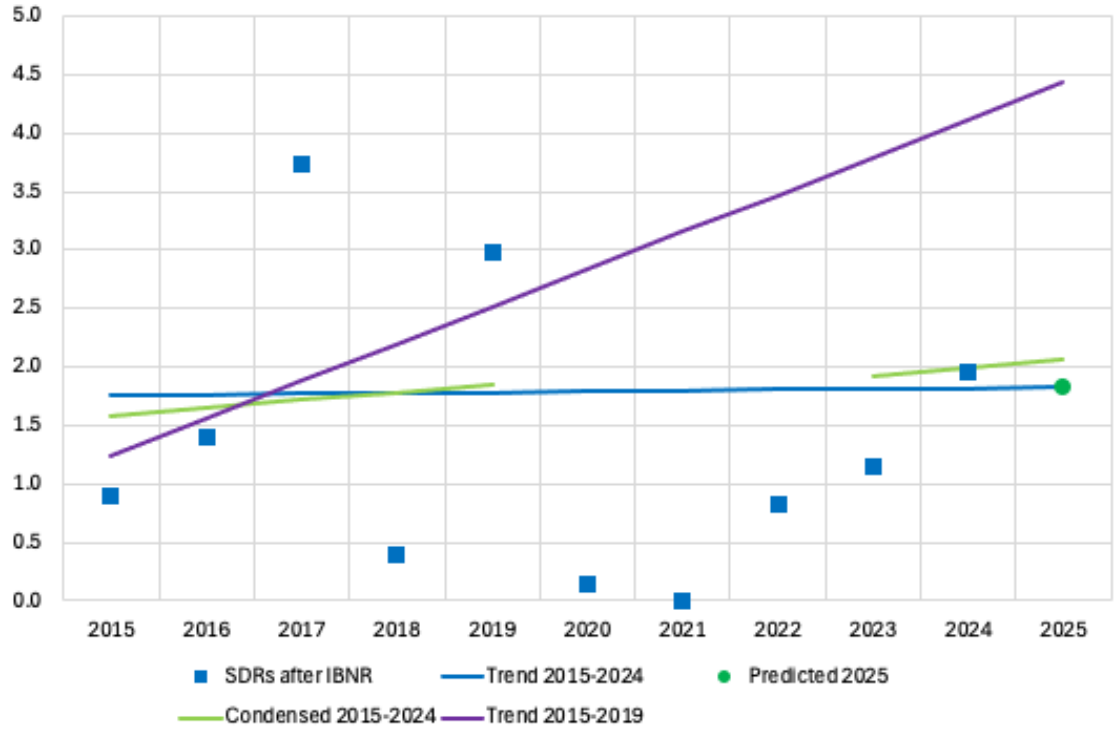


Figure 63 – 2025 Baseline: Chronic Lower Respiratory Disease

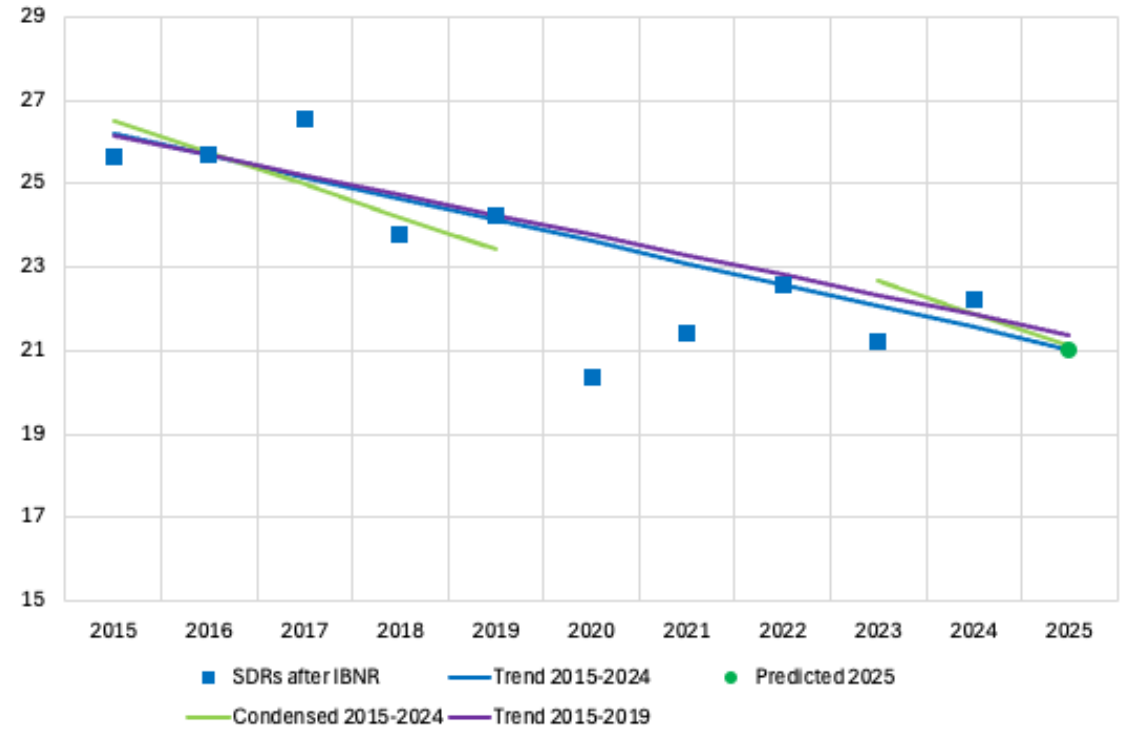


Figure 64 – 2025 Baseline: Pneumonia

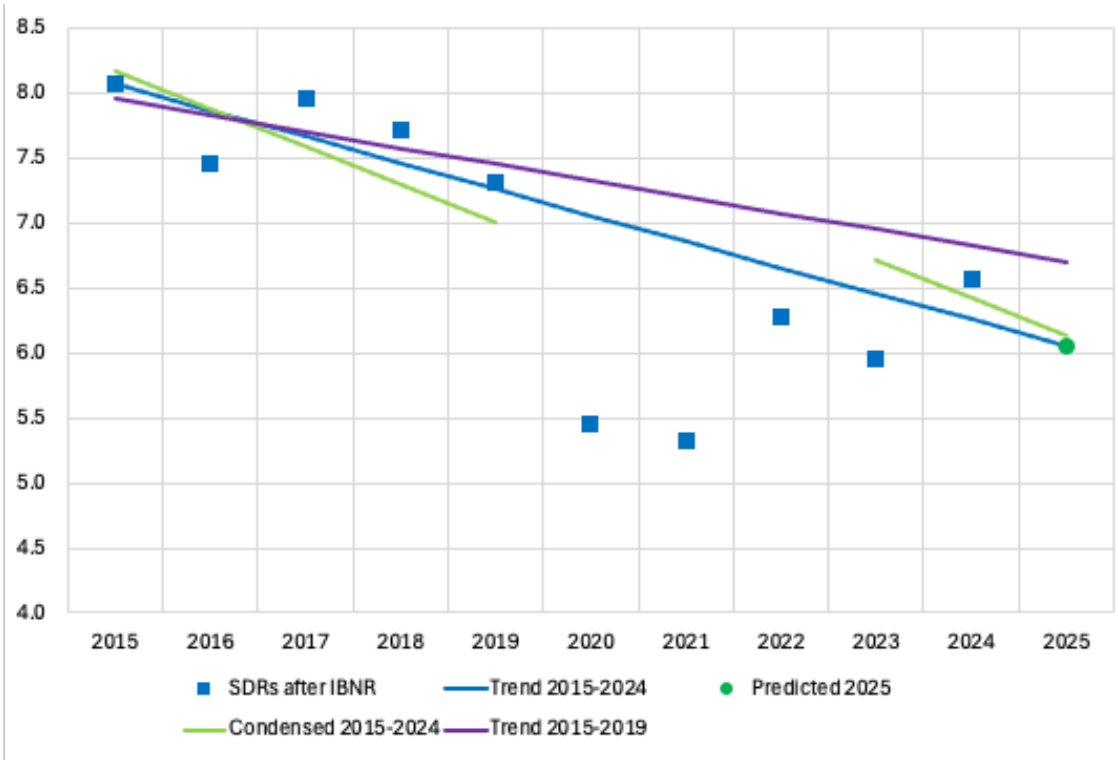
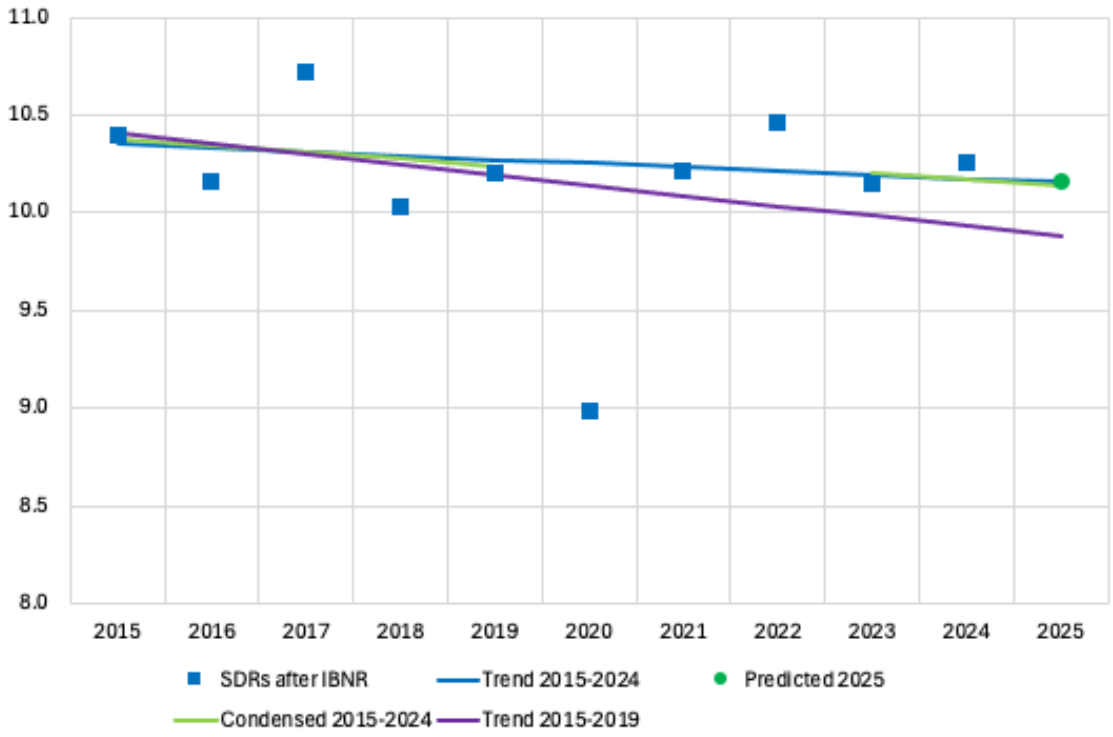


Figure 65 – 2025 Baseline: Other Respiratory Diseases



The charts above illustrate the method used to predict SDRs for non-COVID-19 respiratory causes. A trend has been applied to data from all non-pandemic years. Unlike the approach for non-respiratory causes, this method extends the trend to include post-pandemic data.

6.3.5 COVID-19

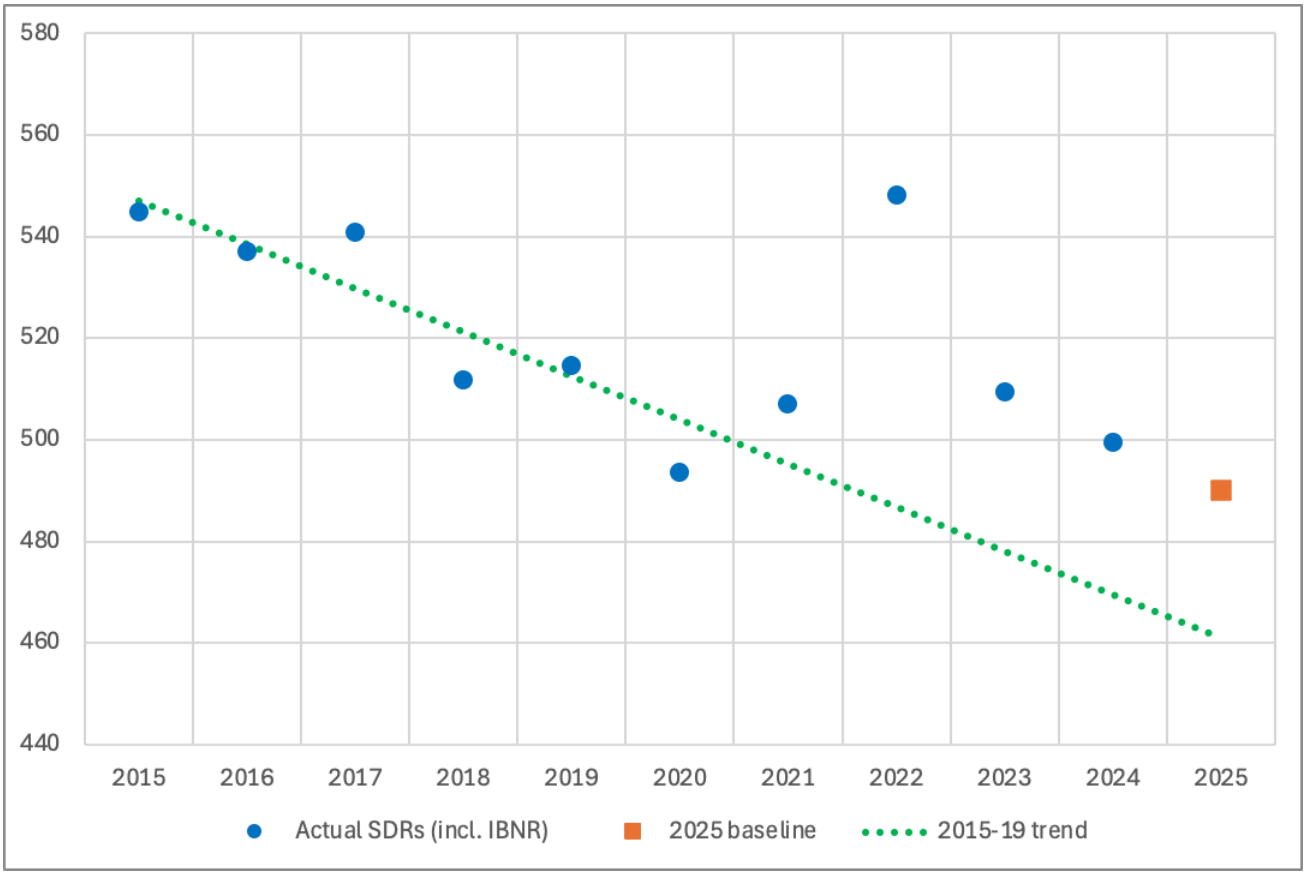
COVID-19 mortality in 2024 was largely in line with 2023. Our 2025 baseline is that COVID-19 mortality will be in line with 2024.

6.3.6 Allowance for seasonality

For non-COVID-19 respiratory causes, it was evident that the timing of post-pandemic winter waves has shifted. For non-respiratory causes, we applied an average of the observed seasonality over 2023-24, incorporating additional smoothing to determine the expected seasonality for 2025.

6.3.7 Selected baseline – all causes

Figure 66 – 2025 baseline: All Causes



The chart shows the actual annual SDRs for all mortality causes, along with our selected 2025 baseline prediction. The 2025 baseline is an aggregate of the by-cause baselines and incorporates the by-cause improvements shown above. The linear trend of the 2015-19 experience is also shown. It can be seen the 2023 and 2024 experience are both around 6% above the pre-pandemic trend and our 2025 baseline is consistent with this.

Appendix A IBNR factors and scaling of deaths

This appendix sets out the allowances we have made for late-reported deaths (incurred but not reported or "IBNR" factors) and also the factors used to scale past deaths to 2024 values for the age band/gender. These scaling factors are used as a proxy as standardised death rates are not available by age band/gender.

A.1 IBNR Factors

Table 5 shows the adjustments made for late-reported deaths for 2024.

Table 5 – Adjustments for late-reported deaths

	Doctor certified deaths				Coroner referred deaths			
Week ending	Registered	Late Reporting	Percent Loading	Adopted deaths	Registered	Late Reporting	Percent Loading	Adopted deaths
7-Jan to 30-Jun	80,292	59	0.1%	80,351	11,669	0	0.0%	11,669
7-Jul-24	3,518	5	0.2%	3,523	477	0	0.0%	477
14-Jul-24	3,406	6	0.2%	3,412	484	0	0.0%	484
21-Jul-24	3,552	6	0.2%	3,558	513	0	0.0%	513
28-Jul-24	3,520	6	0.2%	3,526	480	0	0.0%	480
4-Aug-24	3,435	7	0.2%	3,442	482	0	0.0%	482
11-Aug-24	3,430	7	0.2%	3,437	478	1	0.2%	479
18-Aug-24	3,429	7	0.2%	3,436	508	1	0.2%	509
25-Aug-24	3,257	7	0.2%	3,264	426	1	0.2%	427
1-Sep-24	3,228	7	0.2%	3,235	485	1	0.2%	486
8-Sep-24	3,104	9	0.3%	3,113	463	2	0.4%	465
15-Sep-24	3,028	9	0.3%	3,037	449	2	0.5%	451
22-Sep-24	3,092	9	0.3%	3,101	387	2	0.6%	389
29-Sep-24	3,150	10	0.3%	3,160	461	3	0.6%	464
6-Oct-24	2,976	11	0.4%	2,987	423	3	0.8%	426
13-Oct-24	2,972	12	0.4%	2,984	429	5	1.2%	434
20-Oct-24	3,068	14	0.4%	3,082	468	6	1.3%	474
27-Oct-24	2,982	15	0.5%	2,997	453	6	1.4%	459
3-Nov-24	2,919	16	0.6%	2,935	417	7	1.7%	424
10-Nov-24	2,913	21	0.7%	2,934	460	11	2.5%	471
17-Nov-24	2,857	24	0.8%	2,881	433	13	3.0%	446
24-Nov-24	2,964	25	0.8%	2,989	426	14	3.2%	440
1-Dec-24	2,862	27	0.9%	2,889	452	16	3.5%	468
8-Dec-24	2,881	35	1.2%	2,916	421	21	4.9%	442
15-Dec-24	2,942	44	1.5%	2,986	428	27	6.2%	455
22-Dec-24	2,860	47	1.6%	2,907	408	26	6.5%	434
29-Dec-24	2,746	58	2.1%	2,804	450	34	7.7%	484

A.2 Scaling factors – by age band/gender

Table 6 – Population and other adjustments applied to actual deaths for each age band/gender

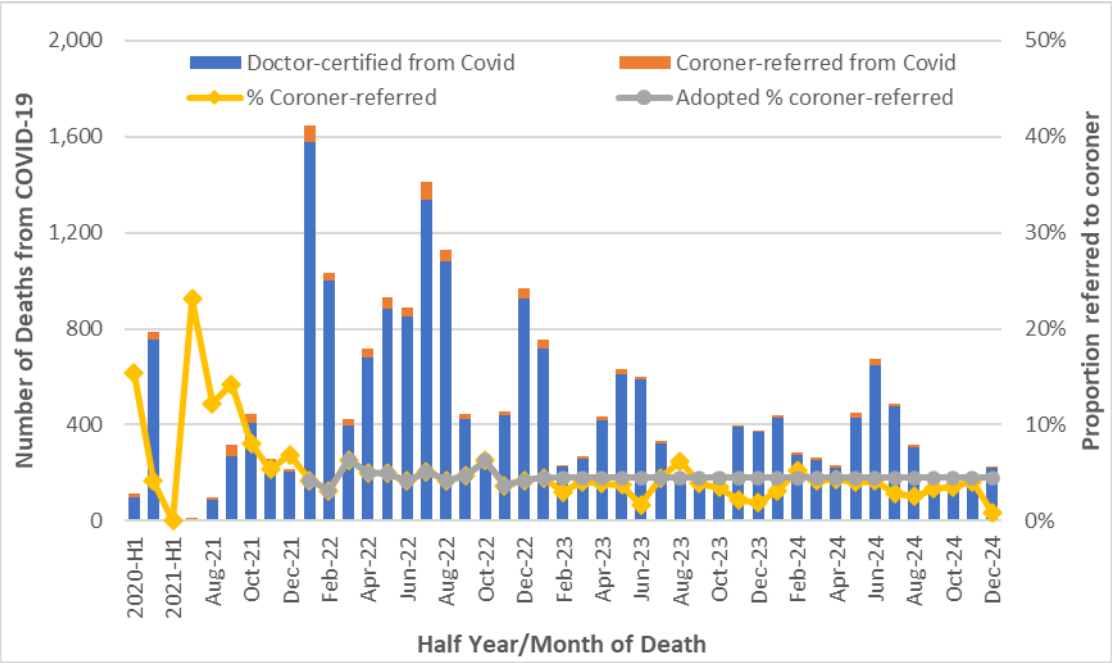
	Gender/Age Group										
Year	M, 0-44	M, 45-64	M, 65-74	M, 75-84	M, >85	F, 0-44	F, 45-64	F, 65-74	F, 75-84	F, >85	Total
Reported Deaths											
2015	5,339	13,280	15,027	22,659	25,552	2,869	8,160	9,552	18,547	38,930	159,915
2016	5,180	12,910	15,253	22,657	25,892	2,856	7,980	9,572	17,932	38,219	158,451
2017	5,323	13,077	15,919	23,201	27,088	2,832	8,138	10,196	18,581	39,569	163,924
2018	5,057	12,996	15,629	22,632	26,485	2,666	8,202	9,985	17,855	37,575	159,082
2019	5,248	13,322	15,880	23,607	27,423	2,750	8,101	10,394	18,533	39,128	164,386
2020	5,159	13,200	16,292	24,007	27,695	2,751	8,226	10,426	18,771	38,247	164,774
2021	4,997	13,172	16,548	25,525	29,407	2,722	8,093	10,977	19,741	40,535	171,717
2022	5,183	13,905	17,843	29,112	33,549	2,845	8,742	11,575	22,174	45,396	190,324
2023	5,046	13,361	17,053	28,335	31,561	2,801	8,327	11,215	22,053	42,111	181,864
2024	5,213	13,634	17,305	28,690	32,700	2,730	8,326	11,375	22,430	43,362	185,766
Population (m)											
2015	7.29	2.88	0.99	0.50	0.17	7.12	2.97	1.02	0.58	0.30	23.82
2016	7.38	2.91	1.03	0.51	0.18	7.21	3.02	1.06	0.60	0.30	24.19
2017	7.48	2.96	1.06	0.53	0.18	7.30	3.07	1.10	0.61	0.31	24.59
2018	7.57	2.99	1.09	0.55	0.19	7.39	3.11	1.14	0.63	0.31	24.96
2019	7.66	3.03	1.12	0.58	0.19	7.47	3.14	1.18	0.66	0.31	25.33
2020	7.70	3.07	1.15	0.61	0.20	7.50	3.19	1.22	0.69	0.32	25.65
2021	7.64	3.09	1.17	0.64	0.21	7.45	3.19	1.25	0.71	0.33	25.69
2022	7.74	3.10	1.18	0.68	0.22	7.54	3.21	1.27	0.76	0.33	26.01
2023	7.99	3.11	1.19	0.71	0.22	7.76	3.23	1.29	0.80	0.34	26.65
2024	8.18	3.13	1.21	0.75	0.23	7.94	3.25	1.32	0.84	0.35	27.20
Population adjusted deaths											
2015	5,986	14,468	18,421	34,161	34,746	3,201	8,926	12,402	26,655	45,577	204,543
2016	5,742	13,902	18,034	33,171	33,763	3,147	8,582	11,956	25,214	43,804	197,316
2017	5,823	13,866	18,272	32,656	34,361	3,081	8,613	12,285	25,373	44,883	199,212
2018	5,464	13,611	17,405	30,702	32,751	2,866	8,580	11,585	23,709	42,189	188,863
2019	5,602	13,785	17,266	30,568	32,987	2,924	8,381	11,669	23,662	43,417	190,260
2020	5,479	13,478	17,175	29,499	32,251	2,911	8,390	11,257	22,907	41,763	185,110
2021	5,346	13,376	17,120	29,918	32,915	2,902	8,246	11,553	23,130	43,322	187,827
2022	5,476	14,068	18,366	32,057	36,333	2,997	8,868	12,043	24,457	47,646	202,311
2023	5,166	13,446	17,346	29,657	33,035	2,865	8,392	11,451	23,123	43,362	187,843
2024	5,213	13,634	17,305	28,690	32,700	2,730	8,326	11,375	22,430	43,362	185,766
Age mix adjustments											
2015	100.7%	101.9%	102.0%	98.8%	103.7%	100.1%	102.2%	102.0%	97.5%	104.0%	101.5%
2016	101.0%	101.9%	101.8%	98.9%	102.7%	100.6%	102.1%	101.9%	97.9%	103.0%	101.2%
2017	101.4%	101.8%	100.8%	99.0%	102.1%	101.1%	102.0%	101.1%	98.0%	102.0%	100.8%
2018	101.6%	101.7%	100.2%	98.9%	101.3%	101.4%	101.8%	100.5%	98.0%	101.1%	100.4%
2019	101.7%	101.4%	99.8%	99.0%	100.7%	101.5%	101.4%	100.2%	98.1%	100.3%	100.0%
2020	101.6%	101.0%	99.6%	99.0%	100.1%	101.2%	100.9%	99.9%	98.3%	99.6%	99.7%
2021	101.3%	100.7%	99.5%	99.2%	99.8%	100.6%	100.5%	99.6%	98.6%	99.0%	99.5%
2022	101.0%	100.3%	99.7%	99.7%	99.9%	100.3%	100.2%	99.9%	99.4%	99.3%	99.7%
2023	100.5%	100.1%	99.8%	100.2%	100.1%	100.2%	100.0%	99.9%	100.0%	99.7%	100.0%
2024	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Age mix adjusted deaths											
2015	6,026	14,747	18,793	33,736	36,035	3,204	9,119	12,655	25,997	47,382	207,694
2016	5,801	14,162	18,352	32,806	34,685	3,165	8,765	12,187	24,681	45,118	199,723
2017	5,902	14,121	18,423	32,331	35,068	3,113	8,785	12,415	24,874	45,760	200,793
2018	5,552	13,842	17,435	30,376	33,182	2,906	8,731	11,642	23,237	42,648	189,550
2019	5,698	13,977	17,239	30,264	33,230	2,967	8,495	11,691	23,213	43,563	190,336
2020	5,565	13,614	17,107	29,215	32,285	2,946	8,461	11,249	22,516	41,589	184,548
2021	5,414	13,467	17,027	29,675	32,852	2,919	8,286	11,511	22,805	42,896	186,852
2022	5,529	14,114	18,313	31,967	36,307	3,005	8,886	12,025	24,301	47,313	201,760
2023	5,190	13,459	17,319	29,702	33,065	2,871	8,395	11,444	23,112	43,215	187,771
2024	5,213	13,634	17,305	28,690	32,700	2,730	8,326	11,375	22,430	43,362	185,766
Delayed reporting allowance											
2024	16	43	55	88	100	9	25	35	68	133	572
Total scaled deaths											
2015	6,026	14,747	18,793	33,736	36,035	3,204	9,119	12,655	25,997	47,382	207,694
2016	5,801	14,162	18,352	32,806	34,685	3,165	8,765	12,187	24,681	45,118	199,723
2017	5,902	14,121	18,423	32,331	35,068	3,113	8,785	12,415	24,874	45,760	200,793
2018	5,552	13,842	17,435	30,376	33,182	2,906	8,731	11,642	23,237	42,648	189,550
2019	5,698	13,977	17,239	30,264	33,230	2,967	8,495	11,691	23,213	43,563	190,336
2020	5,565	13,614	17,107	29,215	32,285	2,946	8,461	11,249	22,516	41,589	184,548
2021	5,414	13,467	17,027	29,675	32,852	2,919	8,286	11,511	22,805	42,896	186,852
2022	5,529	14,114	18,313	31,967	36,307	3,005	8,886	12,025	24,301	47,313	201,760
2023	5,190	13,459	17,319	29,702	33,065	2,871	8,395	11,444	23,112	43,215	187,771
2024	5,229	13,677	17,360	28,778	32,800	2,739	8,351	11,410	22,498	43,495	186,338

Appendix B Coroner-referred deaths from COVID-19

The ABS Provisional Mortality Statistics publications include the number of deaths *from* COVID-19 that were doctor-certified, while the COVID-19 Mortality in Australia articles (accompanying the Provisional Mortality Statistics) include total deaths *from* COVID-19. Taking the difference between the two gives the number of coroner-referred deaths *from* COVID-19.

Figure 67 shows the number of deaths *from* COVID-19 split between doctor-certified and coroner-referred, plus the proportion that are coroner-referred.

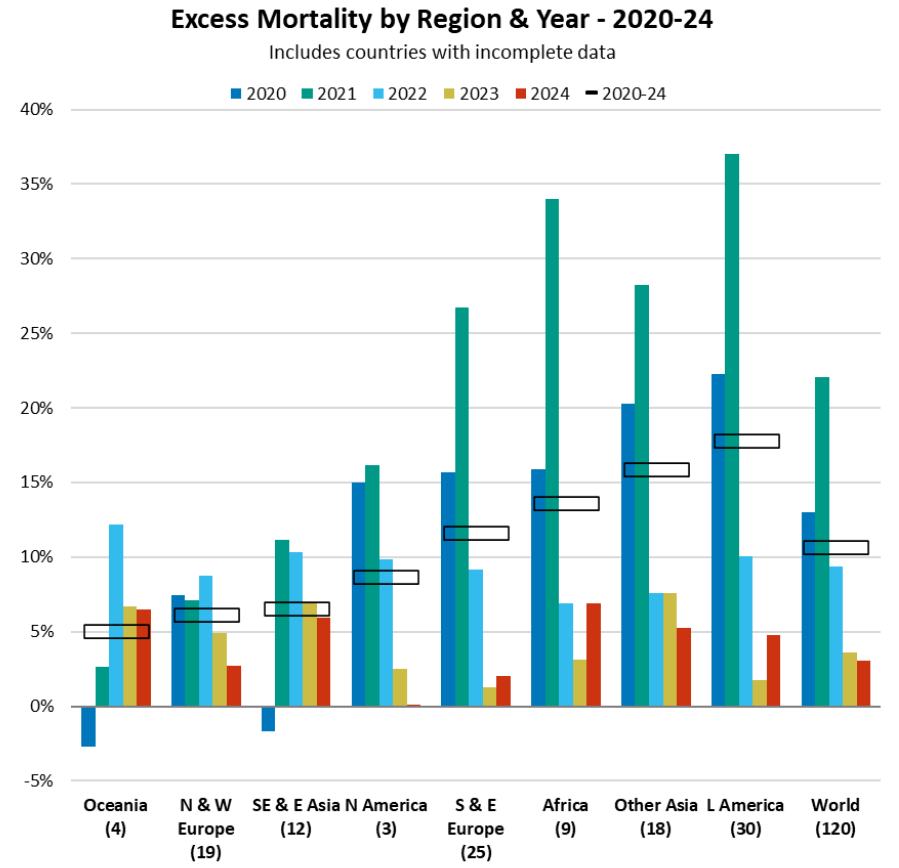
Figure 67 – Doctor-certified versus Coroner-referred deaths from COVID-19



In 2020 and early 2021, Australia experienced relatively small numbers of deaths *from* COVID-19 and the proportion that were coroner-referred varied quite significantly given the low numbers. We have assumed that coroner-referred deaths *from* COVID-19 will be 4.5% of all deaths *from* COVID-19 for each month of 2024, based on the experience of late 2021 to 2023. We have deducted these estimated coroner-referred deaths *from* COVID-19 from other coroner-referred deaths.

Appendix C Excess mortality by region in 2020-24

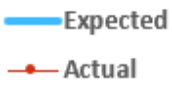
Figure 68 – Excess mortality by region in 2020-24, showing differences in regional trends



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

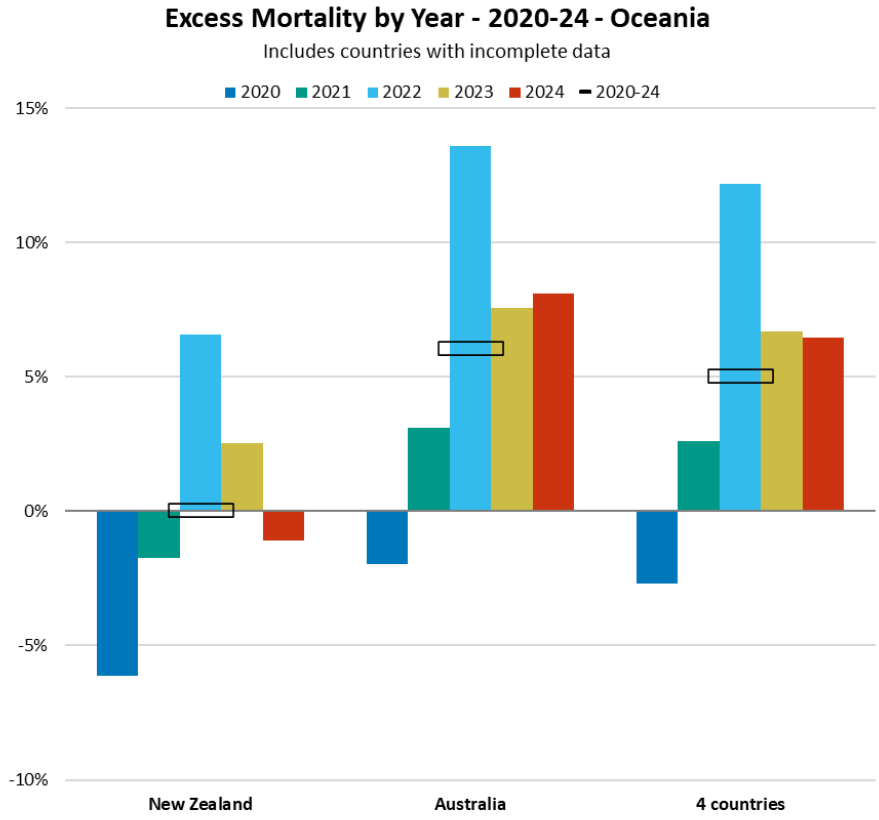
Figure 68 is a repeat of Figure 36, showing the different shapes of annual excess mortality in different regions. In this Appendix, we will look at these regions in more detail. In so doing, we will look at both annual excess mortality and a monthly comparison of COVID-19 mortality, vaccination rates and excess mortality for each of our selected countries. Because this comparison no longer requires data for at least one quarter of 2024, we are also able to include several other countries.

Each country chart shows actual and expected monthly averages of daily deaths per million, as in Section 5.7. As in that section, these charts all have the following legend:



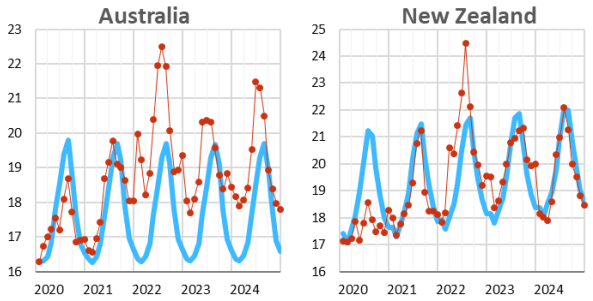
Oceania

Figure 69 – Annual excess mortality in Oceania in 2020-24, showing the dominance of Australia



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 70 – Monthly actual and expected mortality in Oceania in 2020-24, showing similar trends in Australia and New Zealand



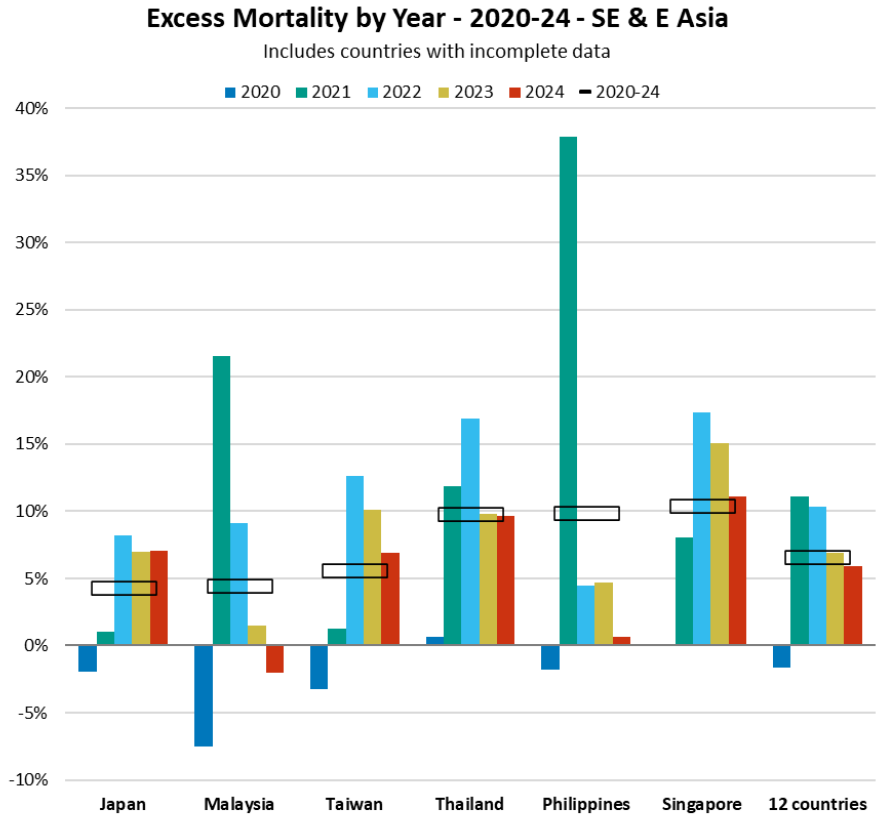
As Figure 69 shows, excess mortality in Oceania is dominated by Australia. New Zealand has experienced consistently lower excess mortality than Australia every year. In fact, in the OWID database, only three countries have lower aggregate excess mortality than New Zealand over the five years[48].

Figure 70 shows the similarity in mortality patterns between Australia and New Zealand, apart from the Omicron peak in early 2022 in Australia, when New Zealand's borders were still closed. The excess mortality in both countries in 2022 can be attributed to the opening of borders and consequent high prevalence of COVID-19, rather than the (delayed) impact of vaccination.

[48] These three are Mongolia (Other Asia), Luxembourg (W Europe) and Greenland (N America), the only country with negative excess mortality every year

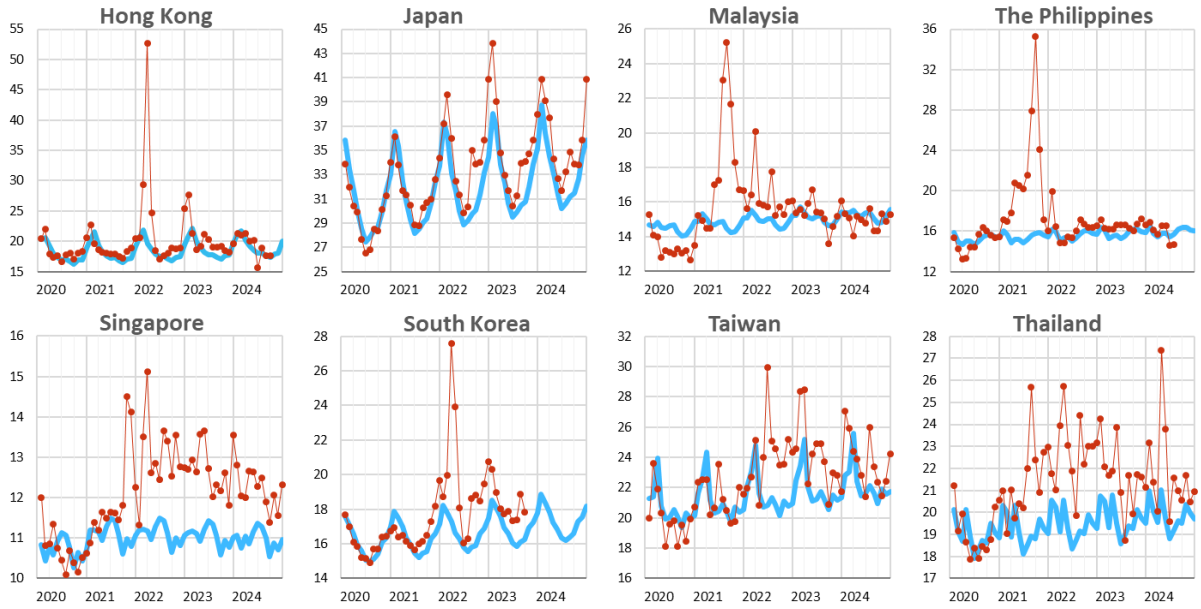
South-East & East Asia

Figure 71 – Annual excess mortality in SE & E Asia in 2020-24, showing significant differences between countries



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 72 – Monthly actual and expected mortality in SE & E Asia in 2020-24, showing high mortality spikes in Malaysia and the Philippines in 2021 (Delta) and in Hong Kong and South Korea in 2022 (Omicron)

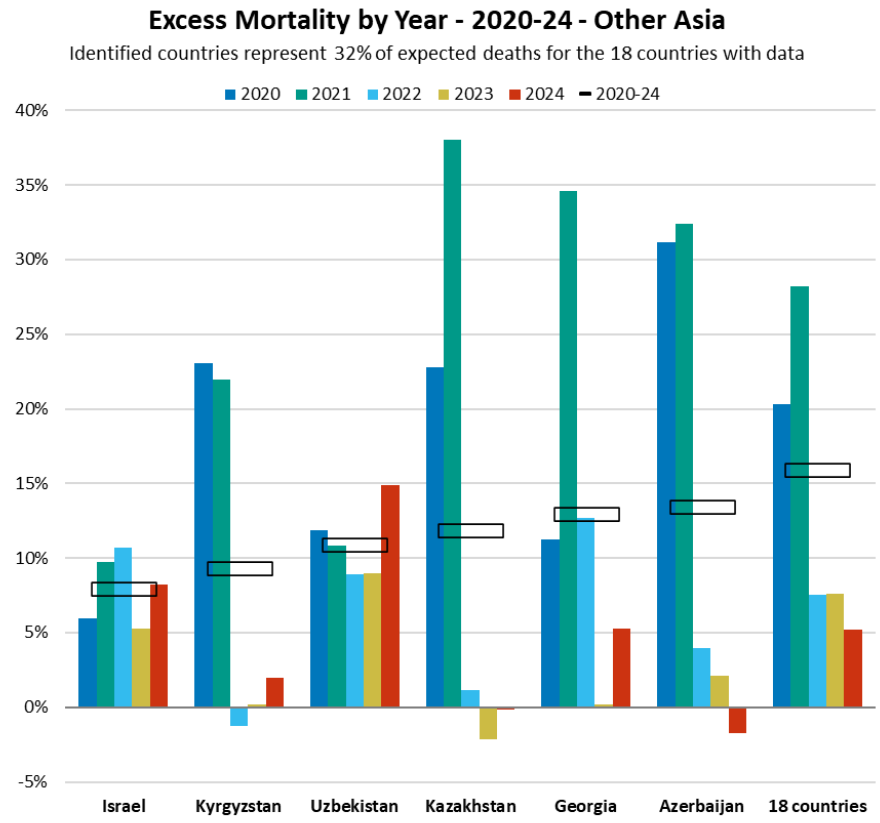


We see (Figure 71) significant annual mortality differences between countries in SE & E Asia. Some (including Japan, South Korea and Taiwan) show a similar pattern to Australia. However, Malaysia and the Philippines saw very high excess mortality in 2021 and a decline in 2022. To the extent that data is available, all saw declines in 2023 and 2024.

These observations are borne out by Figure 72, although there was a notable (and unexplained) spike in Thai mortality in April 2024.

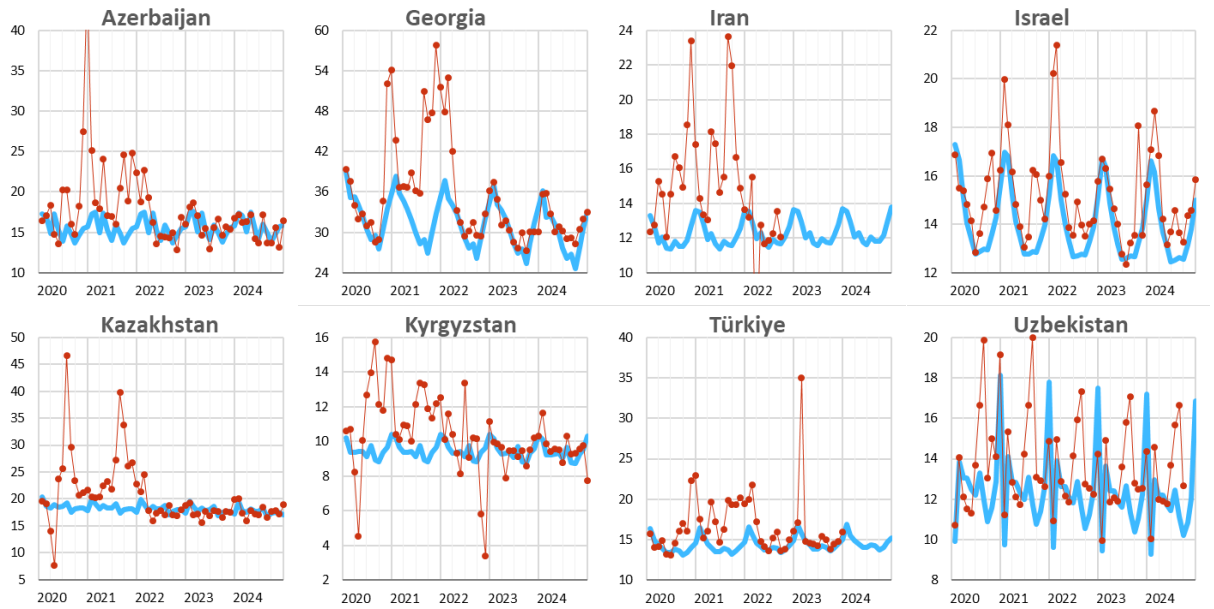
Other Asia

Figure 73 – Annual excess mortality in Other Asia in 2020-24[49]



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 74 – Monthly mortality in Other Asia in 2020-24, showing high spikes in several countries at various times



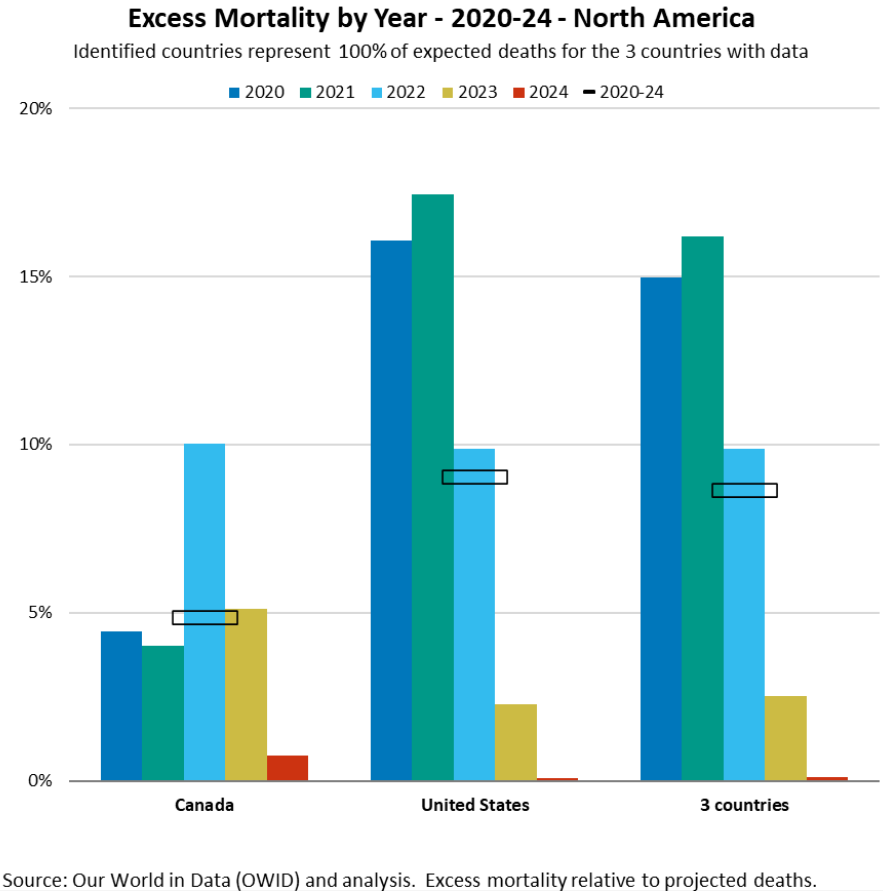
[49] There is insufficient data to show Türkiye or Iran, the two countries with the most expected deaths

In Figure 73 we can see a general pattern of high 2020 excess mortality, increasing in 2021 and dropping to much lower levels in 2022 and 2023. Israel, however, has behaved more like a North or West European country, and Uzbekistan is also different. Experience is also more varied in 2024.

Figure 74 shows the different timing of mortality spikes in different countries. It also shows the impact of the 2023 earthquake in Türkiye and the timing aberration in Uzbekistan, both of which we discussed in Section 5.7.

North America

Figure 75 – Annual excess mortality in North America in 2020-24, showing the dominance of the USA



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 76 – Monthly mortality in North America in 2020-24, showing consistently better mortality in Canada than in the USA

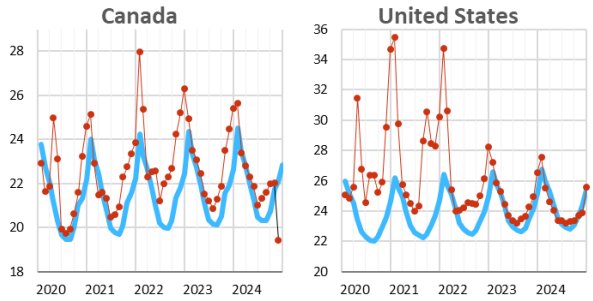


Figure 75 shows that excess mortality in the USA was above 15% in 2020 and even higher in 2021, dropping just below 10% in 2022 and essentially back to trend in 2024[50]. Annual Canadian excess

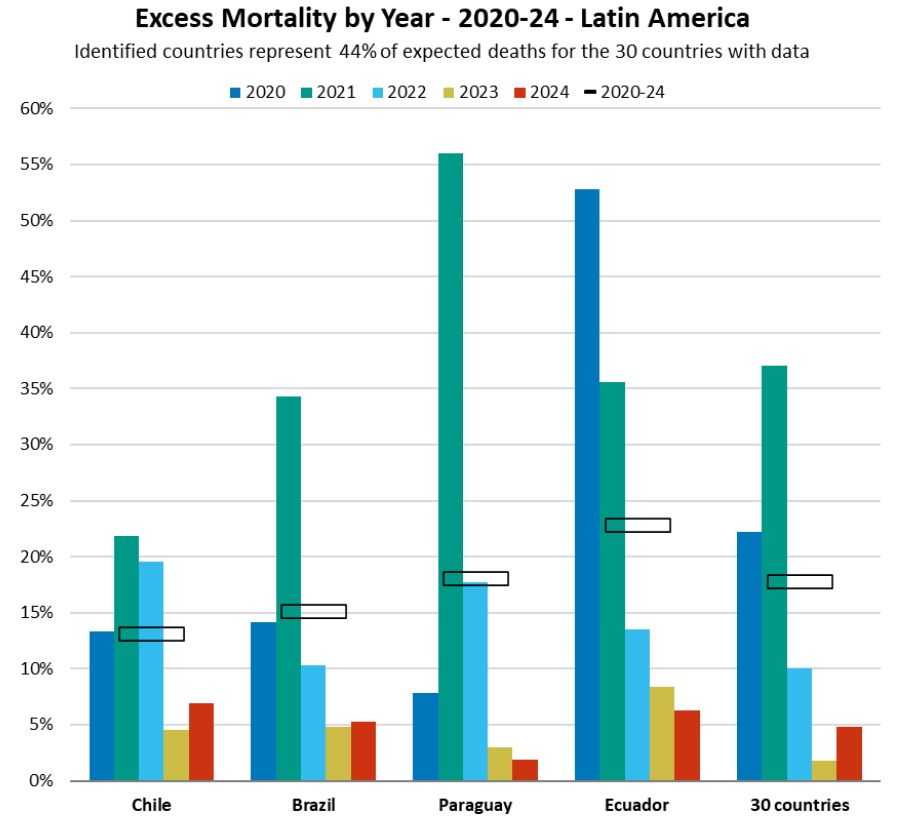
[50] Note, however, that the data used in last year's report suggested that US excess mortality was negative in 2023, meaning that recent US data may not be as reliable as might be expected

mortality was much lower than the USA in 2020 and 2021 but has since been higher. Figure 76 shows the relative experiences on a monthly basis.

Note that the UN geoscheme includes Mexico in Latin America and the Caribbean.

Latin America and the Caribbean

Figure 77 – Annual excess mortality in Latin America and the Caribbean in 2020-24, showing a range of outcomes[51]



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

[51] There is insufficient data to show Mexico, Argentina, Colombia or Peru, the four countries with the most expected deaths after Brazil

Figure 78 – Monthly mortality in Latin America and the Caribbean in 2020-24, with some extremely high excess mortality spikes in some countries

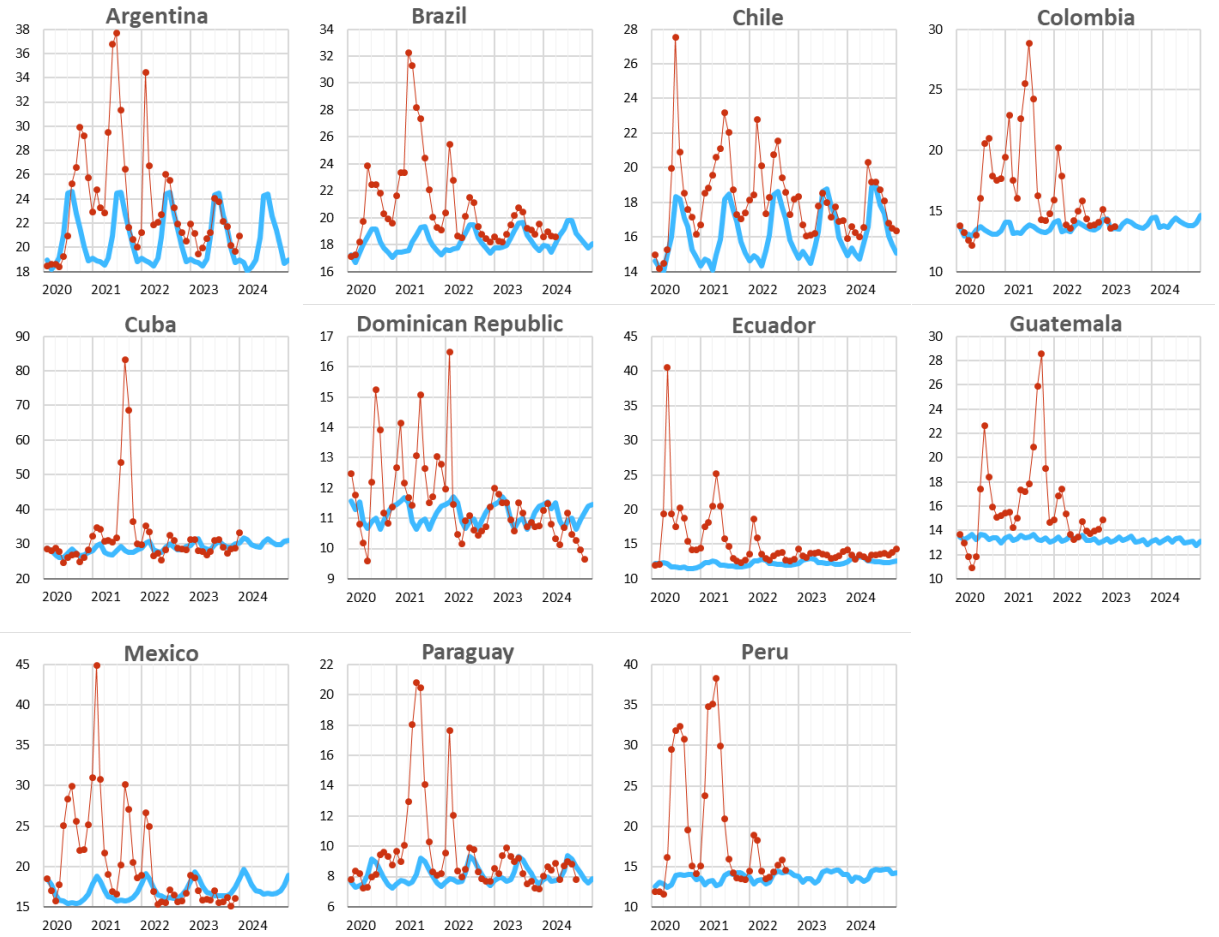


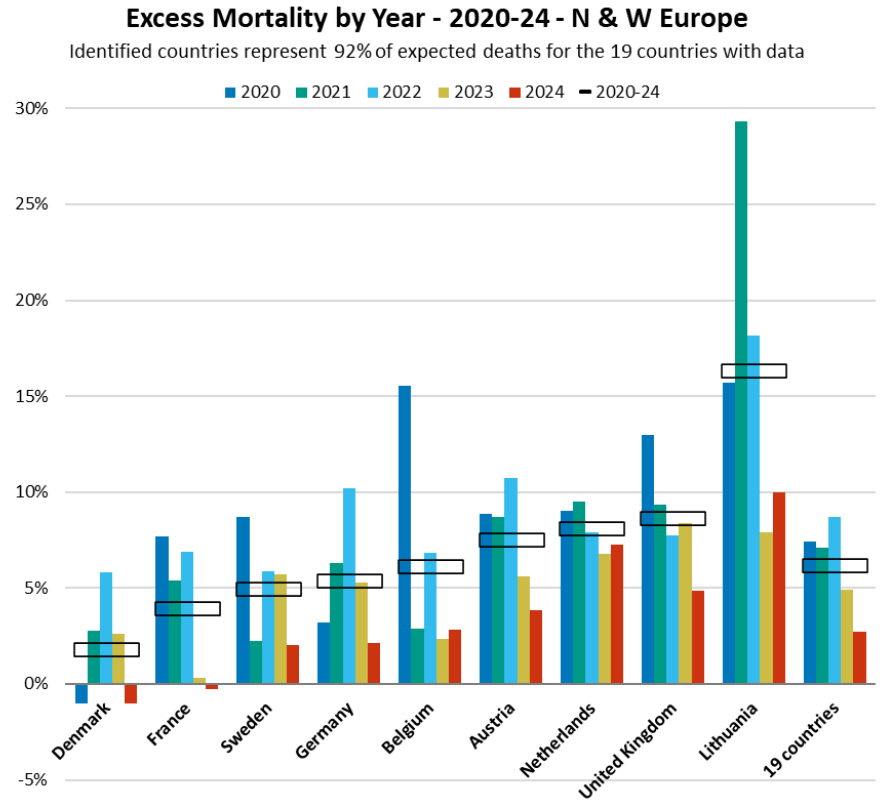
Figure 77 demonstrates the phenomenon of (very) high excess mortality in 2020 and 2021 being associated with low excess mortality in 2022, 2023 and 2024.

Figure 78 sheds further light on this. Where there is data, every country shows an Omicron spike in early 2022, but the relative level of that spike depends on how bad mortality has been in 2020 and 2021. Moreover, there has generally been little (or negative) excess mortality after early 2022, particularly in countries where mortality was very high in 2020 and 2021.

Countries in this region tend to be poor, with little financial or health services capacity to support their population through a pandemic. Some of these charts perhaps demonstrate the achievement of a form of "herd immunity", albeit at the cost of a huge loss of life. Overall, this region has the highest excess mortality across the full period, at almost 18%.

Northern and Western Europe

Figure 79 – Annual excess mortality in Northern and Western Europe in 2020-24, showing a range of outcomes



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 80 – Monthly mortality in Northern Europe in 2020-24, showing countries that experienced or avoided very high excess mortality spikes in 2020 & 2021

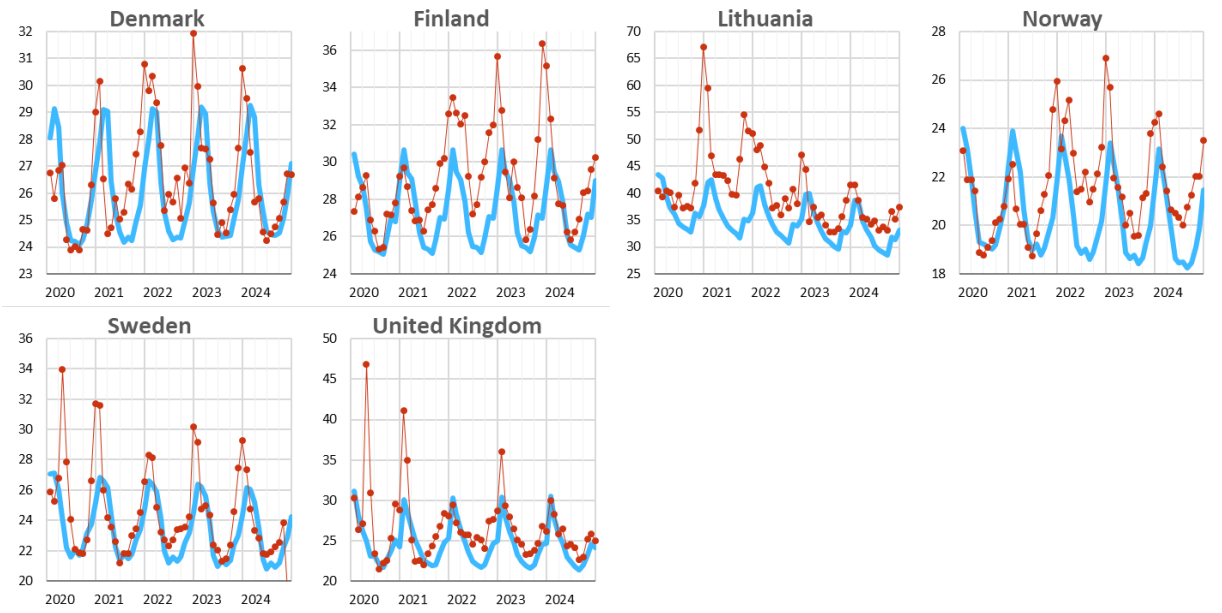


Figure 81 – Monthly mortality in Western Europe in 2020-24, showing countries that experienced or avoided very high excess mortality spikes in 2020 & 2021

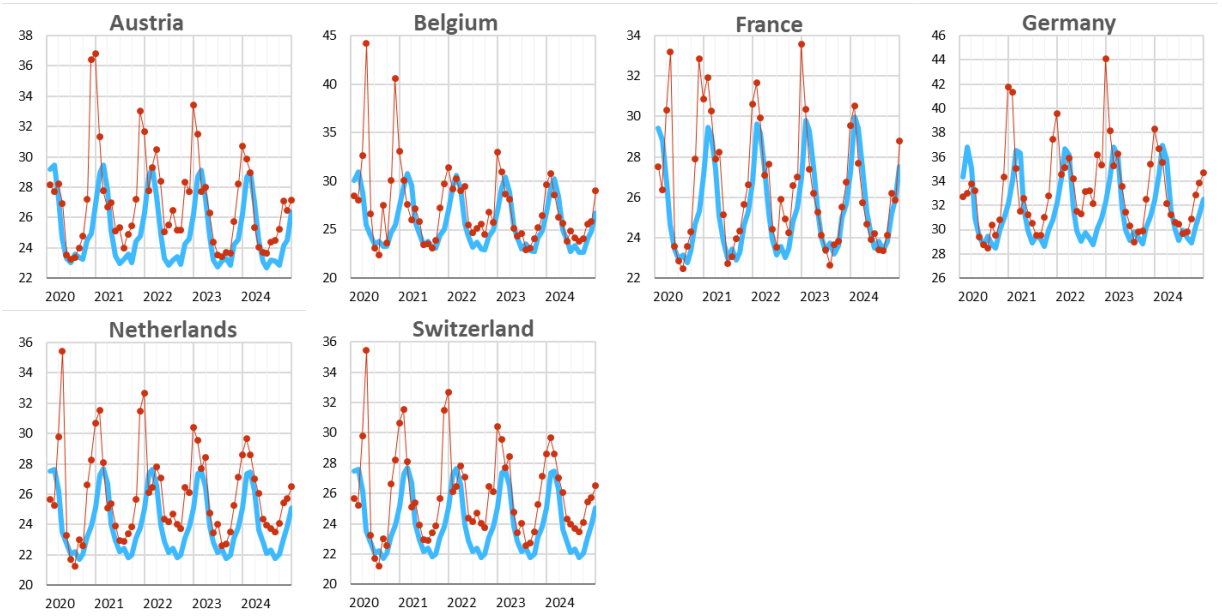
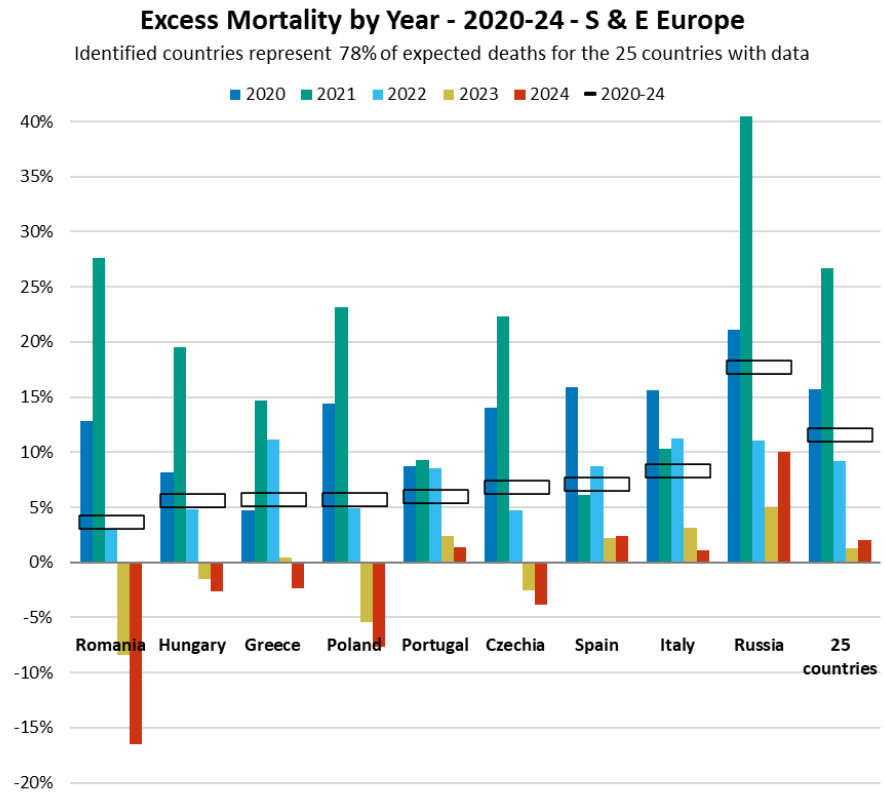


Figure 79 shows that excess mortality in Northern and Western Europe was quite flat in 2020 and 2021, rising in 2022 and dropping in 2023 and again in 2024. But this has **not** been the case for individual countries in the region; indeed, there is no consistent pattern at all. Neighbouring countries have had quite different experience – see, for example, Belgium and the Netherlands, France and Germany, and Denmark and Sweden. On the other hand, Lithuania has had mortality experience that more closely mirrors its East European neighbours (Poland, Belarus and Russia – see below) than its Northern European and Baltic neighbour, Latvia (not shown here).

Figure 80 and Figure 81 show generally persistent excess mortality in winter.

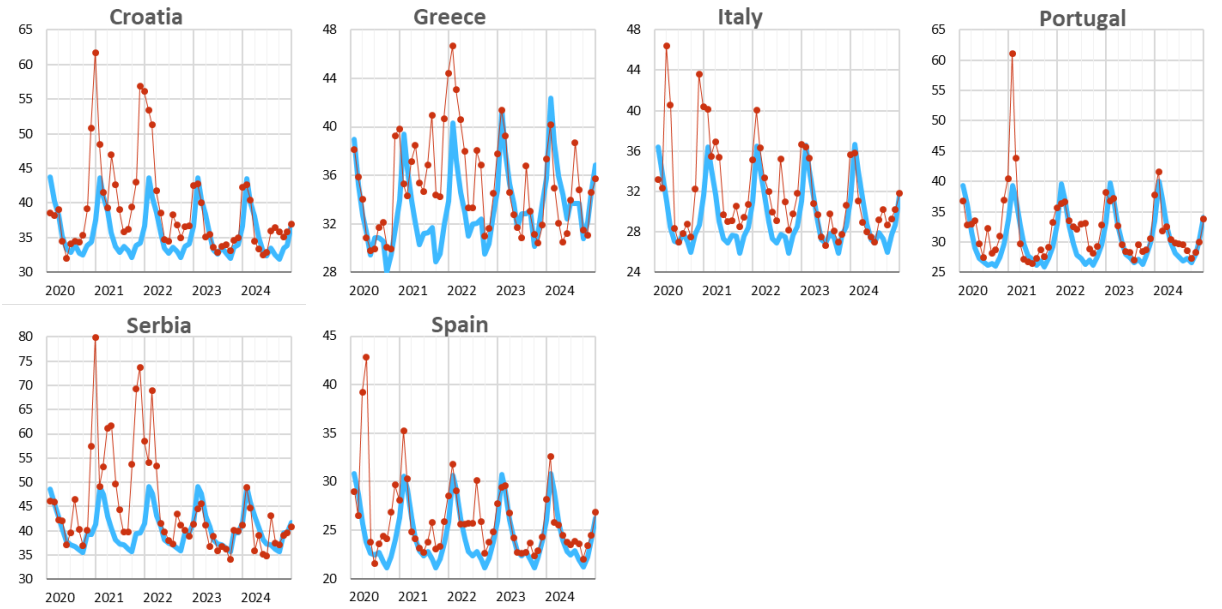
Southern and Eastern Europe

Figure 82 – Annual excess mortality in Southern and Eastern Europe in 2020-24, generally showing higher excess mortality in 2021 than in any other year, and several countries with negative excess in 2023 and 2024[52]



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 83 – Monthly mortality in Southern Europe in 2020-24, showing clear differences between countries



[52] There is insufficient data to show Ukraine, which represents abut 11% of expected deaths

Figure 84 – Monthly mortality in Eastern Europe in 2020-24, showing multiple high excess mortality spikes

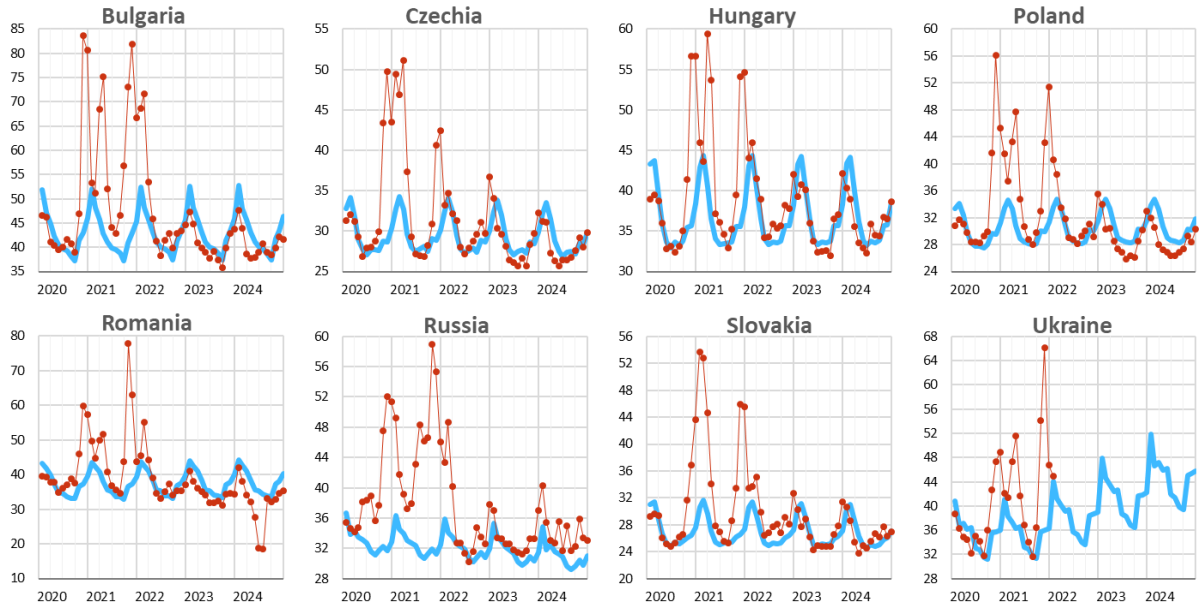


Figure 82 shows that Czechia, Hungary, Poland, Romania and Russia (all in Eastern Europe) had relatively high excess mortality in 2020 – generally above 10% – and even higher mortality in 2021, with much lower mortality in 2022. All bar Russia had negative excess mortality in 2023 and 2024[53]. For 2020 to 2022, this is quite similar to what we saw for Lithuania (like its fellow Baltic states, a former member of the Soviet Union), with excess mortality rising in 2021 before falling in 2022.

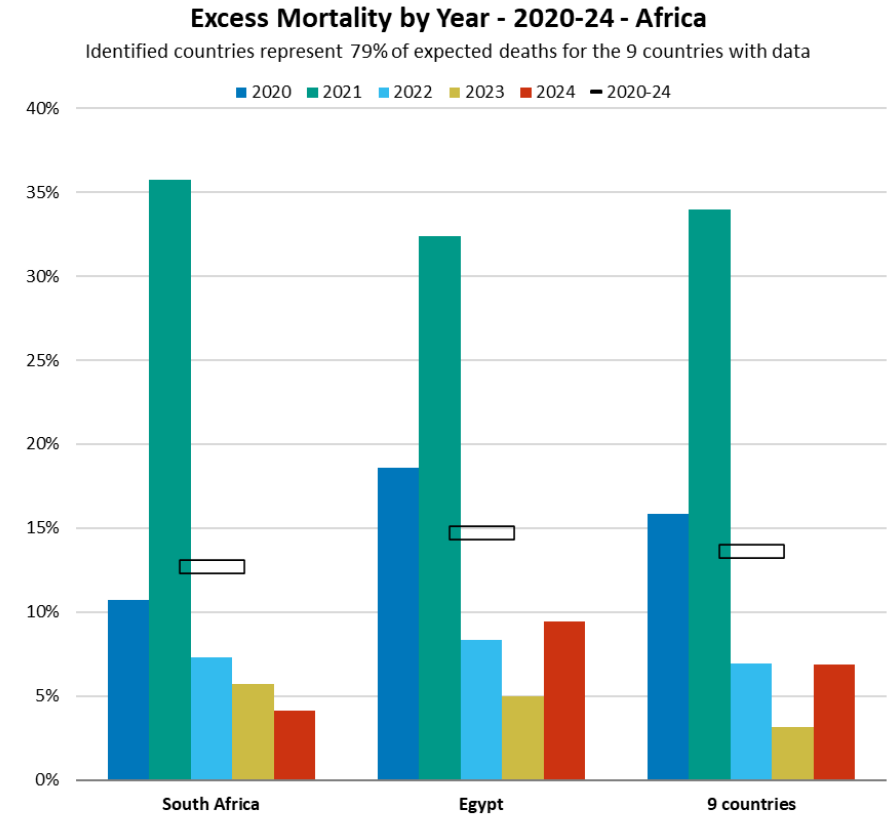
Figure 83 and Figure 84 show that two countries in Southern Europe that were once part of Yugoslavia (Croatia and Serbia) had similar mortality experience to that in (ex-communist) Eastern Europe, with major winter spikes in 2020-21 and 2021-22. The former communist countries in Europe (including the Baltic states, in Northern Europe) have had relatively low reported vaccination rates by European standards. Despite this, excess mortality in these countries (other than Lithuania) in 2023 and 2024 was low (generally negative). However, overall excess mortality in 2020-24 was about 13% (down from 24% in 2020-21), suggesting that this outcome has been achieved through mortality displacement. As with Latin America, "herd immunity" has perhaps been bought with a high loss of life.

Apart from differences in 2020 and the winter of 2020-21, the other countries in Southern Europe display broadly the same mortality patterns as those in Northern and Western Europe.

[53] Note that Russian excess mortality in 2022 and beyond would include war deaths in Ukraine. Estimates of that number vary significantly, but it seems likely that there were at least 100,000 such deaths by the end of 2023, with at least another 100,000 in 2024. As the annual baseline for excess mortality in Russia is about 1.8 million deaths, it is not unreasonable to suppose that the war contributed about 2.5% excess mortality in 2022, 3% in 2023 and 5.5% in 2024.

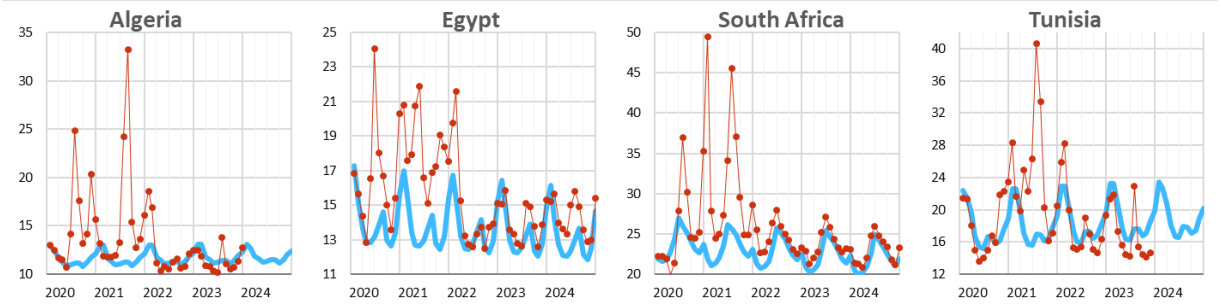
Africa

Figure 85 – Annual excess mortality in Africa in 2020-24, showing very high excess mortality in 2021[54]



Source: Our World in Data (OWID) and analysis. Excess mortality relative to projected deaths.

Figure 86 – Monthly mortality in Africa in 2020-24, showing high excess mortality spikes



As previously mentioned, we have little useful data on African countries. Figure 85 shows that Egypt and South Africa had similar patterns of annual excess mortality, and Figure 86 suggests that this is typical of other African countries as well, noting that Tunisia's Delta wave in 2021 was particularly high.

OWID data suggests that very few African nations have per capita vaccination rates above 1. Of the four shown in Figure 86, Tunisia (1.1) has the highest rate and Algeria (0.3) the lowest. Egypt is at 0.9 and South Africa at 0.6.

As with Latin America and ex-communist countries, it seems that a degree of "herd immunity" has been achieved – again, at a very high cost of lives rather than through high vaccination rates.

[54] Of the countries with data, Egypt and South Africa have the most expected deaths

Appendix D Excess Deaths in 40 Countries

Table 7 – Expected deaths in 40 countries – 2020-24

Region	Country	Code	Expected 2020	Expected 2021	Expected 2022	Expected 2023	Expected 2024	Expected 2020-24
Oceania	Australia	AUS	168,107	166,697	168,221	169,745	171,271	**844,041**
Oceania	New Zealand	NZL	35,364	35,421	36,102	36,783	37,464	**181,134**
SE & E Asia	Japan	JPN	1,412,548	1,437,432	1,462,317	1,487,201	1,512,086	**7,311,584**
SE & E Asia	Malaysia	MYS	180,111	184,686	189,261	193,836	198,411	**946,306**
SE & E Asia	Philippines	PHL	625,073	637,888	650,701	663,516	389,013	**2,966,190**
SE & E Asia	Singapore	SGP	22,032	22,476	22,919	23,362	23,805	**114,593**
SE & E Asia	Taiwan	TWN	178,894	181,419	183,945	186,469	188,995	**919,721**
SE & E Asia	Thailand	THA	498,062	503,906	509,751	515,595	521,440	**2,548,754**
Other Asia	Azerbaijan	AZE	57,660	58,069	58,479	58,888	59,298	**292,394**
Other Asia	Georgia	GEO	45,428	44,511	43,594	42,677	41,761	**217,971**
Other Asia	Israel	ISR	46,740	46,162	46,583	47,005	47,426	**233,916**
Other Asia	Kazakhstan	KAZ	132,473	132,810	133,148	133,485	133,822	**665,738**
Other Asia	Kyrgyzstan	KGZ	32,495	32,143	31,793	31,442	31,091	**158,965**
Other Asia	Uzbekistan	UZB	156,964	157,484	158,002	158,522	114,647	**745,619**
N America	Canada	CAN	299,099	298,959	304,856	310,749	303,755	**1,517,418**
N America	United States	USA	2,958,697	2,937,290	2,975,349	3,013,413	3,051,474	**14,936,222**
L America	Brazil	BRA	1,364,085	1,381,905	1,399,725	1,417,544	343,412	**5,906,672**
L America	Chile	CHL	112,792	112,714	114,540	116,362	118,186	**574,594**
L America	Ecuador	ECU	77,148	77,678	79,654	81,635	83,611	**399,724**
L America	Paraguay	PRY	34,081	34,880	35,680	36,479	25,338	**166,458**
N & W Europe	Austria	AUT	83,779	82,358	82,691	83,023	83,356	**415,207**
N & W Europe	Belgium	BEL	111,145	108,816	108,727	108,639	108,548	**545,875**
N & W Europe	Denmark	DNK	56,057	55,488	56,008	56,528	57,051	**281,132**
N & W Europe	France	FRA	616,972	609,155	614,257	619,358	624,456	**3,084,198**
N & W Europe	Germany	DEU	970,172	958,661	965,910	973,164	980,415	**4,848,321**
N & W Europe	Lithuania	LTU	38,307	36,701	35,874	35,042	34,212	**180,136**
N & W Europe	Netherlands	NLD	157,083	155,379	156,757	158,135	159,516	**786,871**
N & W Europe	Sweden	SWE	91,658	89,524	89,253	88,978	79,763	**439,175**
N & W Europe	United Kingdom	GBR	616,792	608,640	609,779	610,918	612,059	**3,058,189**
S & E Europe	Czechia	CZE	115,298	113,745	114,489	115,227	115,968	**574,727**
S & E Europe	Greece	GRC	126,947	125,246	126,187	127,128	128,069	**633,577**
S & E Europe	Hungary	HUN	132,457	129,773	129,768	129,768	129,763	**651,529**
S & E Europe	Italy	ITA	654,825	640,061	639,213	638,365	637,518	**3,209,982**
S & E Europe	Poland	POL	424,529	421,104	426,258	431,411	436,564	**2,139,866**
S & E Europe	Portugal	PRT	115,643	113,940	114,834	115,729	116,623	**576,768**
S & E Europe	Romania	ROU	267,149	261,897	262,193	262,489	262,786	**1,316,514**
S & E Europe	Russia	RUS	1,765,802	1,737,545	1,709,288	1,681,031	1,652,774	**8,546,439**
S & E Europe	Spain	ESP	431,584	423,415	424,408	425,401	426,394	**2,131,202**
Africa	Egypt	EGY	560,620	560,321	560,022	559,723	559,425	**2,800,111**
Africa	South Africa	ZAF	531,993	519,558	517,311	515,065	512,819	**2,596,746**
Total	**40 Countries**		**16,306,662**	**16,235,855**	**16,347,845**	**16,459,831**	**15,114,385**	**80,464,578**

Table 7 contains the expected deaths for each year and for the full period 2020-24, for each of the 40 countries selected for this paper. It should be read in conjunction with descriptions of the data, methodology and caveats in the paper.

Table 8 – Actual deaths in 40 countries – 2020-24

Region	Country	Code	Actual 2020	Actual 2021	Actual 2022	Actual 2023	Actual 2024	Actual 2020-24
Oceania	Australia	AUS	164,827	171,863	191,103	182,569	185,172	**895,534**
Oceania	New Zealand	NZL	33,197	34,803	38,478	37,712	37,054	**181,244**
SE & E Asia	Japan	JPN	1,384,544	1,452,289	1,582,033	1,590,503	1,618,684	**7,628,053**
SE & E Asia	Malaysia	MYS	166,507	224,569	206,525	196,698	194,327	**988,626**
SE & E Asia	Philippines	PHL	613,936	879,429	679,766	694,821	391,590	**3,259,542**
SE & E Asia	Singapore	SGP	22,054	24,292	26,891	26,888	26,442	**126,567**
SE & E Asia	Taiwan	TWN	173,156	183,732	207,230	205,368	202,107	**971,593**
SE & E Asia	Thailand	THA	501,438	563,650	595,965	565,992	571,646	**2,798,691**
Other Asia	Azerbaijan	AZE	75,647	76,878	60,810	60,150	58,279	**331,764**
Other Asia	Georgia	GEO	50,537	59,906	49,118	42,756	43,971	**246,288**
Other Asia	Israel	ISR	49,531	50,661	51,558	49,487	51,325	**252,562**
Other Asia	Kazakhstan	KAZ	162,613	183,357	134,709	130,596	133,592	**744,867**
Other Asia	Kyrgyzstan	KGZ	39,977	39,193	31,401	31,500	31,710	**173,781**
Other Asia	Uzbekistan	UZB	175,637	174,540	172,075	172,757	131,674	**826,683**
N America	Canada	CAN	312,360	310,925	335,400	326,665	306,025	**1,591,375**
N America	United States	USA	3,433,842	3,449,444	3,268,846	3,081,628	3,053,355	**16,287,115**
L America	Brazil	BRA	1,556,824	1,855,622	1,544,266	1,485,653	361,346	**6,803,711**
L America	Chile	CHL	127,782	137,285	136,966	121,640	126,320	**649,993**
L America	Ecuador	ECU	117,904	105,310	90,430	88,457	88,858	**490,959**
L America	Paraguay	PRY	36,738	54,405	42,002	37,570	25,804	**196,519**
N & W Europe	Austria	AUT	91,196	89,538	91,577	87,668	86,565	**446,544**
N & W Europe	Belgium	BEL	128,432	111,956	116,138	111,165	111,600	**579,291**
N & W Europe	Denmark	DNK	55,478	57,039	59,277	58,015	56,482	**286,291**
N & W Europe	France	FRA	664,335	641,872	656,419	621,468	622,709	**3,206,803**
N & W Europe	Germany	DEU	1,001,448	1,019,045	1,064,232	1,024,408	1,001,455	**5,110,588**
N & W Europe	Lithuania	LTU	44,322	47,463	42,380	37,802	37,622	**209,589**
N & W Europe	Netherlands	NLD	171,277	170,184	169,159	168,815	171,108	**850,543**
N & W Europe	Sweden	SWE	99,654	91,512	94,476	94,044	81,374	**461,059**
N & W Europe	United Kingdom	GBR	696,704	665,663	656,991	661,997	641,940	**3,323,295**
S & E Europe	Czechia	CZE	131,494	139,150	119,849	112,339	111,491	**614,323**
S & E Europe	Greece	GRC	132,969	143,668	140,292	127,671	125,088	**669,688**
S & E Europe	Hungary	HUN	143,236	155,052	135,960	127,746	126,355	**688,349**
S & E Europe	Italy	ITA	756,862	706,250	711,275	658,403	644,451	**3,477,241**
S & E Europe	Poland	POL	485,604	518,700	447,053	407,901	403,167	**2,262,425**
S & E Europe	Portugal	PRT	125,756	124,559	124,636	118,521	118,248	**611,720**
S & E Europe	Romania	ROU	301,427	334,154	270,189	240,379	219,347	**1,365,496**
S & E Europe	Russia	RUS	2,138,586	2,441,594	1,898,644	1,764,618	1,818,635	**10,062,077**
S & E Europe	Spain	ESP	500,201	449,477	461,616	434,612	436,563	**2,282,469**
Africa	Egypt	EGY	664,763	741,924	606,693	587,531	612,300	**3,213,211**
Africa	South Africa	ZAF	588,918	705,271	554,904	544,361	534,082	**2,927,536**
Total	**40 Countries**		**18,121,713**	**19,386,224**	**17,867,332**	**17,118,874**	**15,599,862**	**88,094,004**

Table 8 contains the actual deaths for each year and for the full period 2020-24, for each of the 40 countries selected for this paper.

Table 9 – Excess mortality in 40 countries – 2020-24

Region	Country	Code	Excess 2020	Excess 2021	Excess 2022	Excess 2023	Excess 2024	Excess 2020-24
Oceania	Australia	AUS	-2.0%	3.1%	13.6%	7.6%	8.1%	**6.1%**
Oceania	New Zealand	NZL	-6.1%	-1.7%	6.6%	2.5%	-1.1%	**0.1%**
SE & E Asia	Japan	JPN	-2.0%	1.0%	8.2%	6.9%	7.0%	**4.3%**
SE & E Asia	Malaysia	MYS	-7.6%	21.6%	9.1%	1.5%	-2.1%	**4.5%**
SE & E Asia	Philippines	PHL	-1.8%	37.9%	4.5%	4.7%	0.7%	**9.9%**
SE & E Asia	Singapore	SGP	0.1%	8.1%	17.3%	15.1%	11.1%	**10.4%**
SE & E Asia	Taiwan	TWN	-3.2%	1.3%	12.7%	10.1%	6.9%	**5.6%**
SE & E Asia	Thailand	THA	0.7%	11.9%	16.9%	9.8%	9.6%	**9.8%**
Other Asia	Azerbaijan	AZE	31.2%	32.4%	4.0%	2.1%	-1.7%	**13.5%**
Other Asia	Georgia	GEO	11.2%	34.6%	12.7%	0.2%	5.3%	**13.0%**
Other Asia	Israel	ISR	6.0%	9.7%	10.7%	5.3%	8.2%	**8.0%**
Other Asia	Kazakhstan	KAZ	22.8%	38.1%	1.2%	-2.2%	-0.2%	**11.9%**
Other Asia	Kyrgyzstan	KGZ	23.0%	21.9%	-1.2%	0.2%	2.0%	**9.3%**
Other Asia	Uzbekistan	UZB	11.9%	10.8%	8.9%	9.0%	14.9%	**10.9%**
N America	Canada	CAN	4.4%	4.0%	10.0%	5.1%	0.7%	**4.9%**
N America	United States	USA	16.1%	17.4%	9.9%	2.3%	0.1%	**9.0%**
L America	Brazil	BRA	14.1%	34.3%	10.3%	4.8%	5.2%	**15.2%**
L America	Chile	CHL	13.3%	21.8%	19.6%	4.5%	6.9%	**13.1%**
L America	Ecuador	ECU	52.8%	35.6%	13.5%	8.4%	6.3%	**22.8%**
L America	Paraguay	PRY	7.8%	56.0%	17.7%	3.0%	1.8%	**18.1%**
N & W Europe	Austria	AUT	8.9%	8.7%	10.7%	5.6%	3.8%	**7.5%**
N & W Europe	Belgium	BEL	15.6%	2.9%	6.8%	2.3%	2.8%	**6.1%**
N & W Europe	Denmark	DNK	-1.0%	2.8%	5.8%	2.6%	-1.0%	**1.8%**
N & W Europe	France	FRA	7.7%	5.4%	6.9%	0.3%	-0.3%	**4.0%**
N & W Europe	Germany	DEU	3.2%	6.3%	10.2%	5.3%	2.1%	**5.4%**
N & W Europe	Lithuania	LTU	15.7%	29.3%	18.1%	7.9%	10.0%	**16.4%**
N & W Europe	Netherlands	NLD	9.0%	9.5%	7.9%	6.8%	7.3%	**8.1%**
N & W Europe	Sweden	SWE	8.7%	2.2%	5.9%	5.7%	2.0%	**5.0%**
N & W Europe	United Kingdom	GBR	13.0%	9.4%	7.7%	8.4%	4.9%	**8.7%**
S & E Europe	Czechia	CZE	14.0%	22.3%	4.7%	-2.5%	-3.9%	**6.9%**
S & E Europe	Greece	GRC	4.7%	14.7%	11.2%	0.4%	-2.3%	**5.7%**
S & E Europe	Hungary	HUN	8.1%	19.5%	4.8%	-1.6%	-2.6%	**5.7%**
S & E Europe	Italy	ITA	15.6%	10.3%	11.3%	3.1%	1.1%	**8.3%**
S & E Europe	Poland	POL	14.4%	23.2%	4.9%	-5.4%	-7.6%	**5.7%**
S & E Europe	Portugal	PRT	8.7%	9.3%	8.5%	2.4%	1.4%	**6.1%**
S & E Europe	Romania	ROU	12.8%	27.6%	3.0%	-8.4%	-16.5%	**3.7%**
S & E Europe	Russia	RUS	21.1%	40.5%	11.1%	5.0%	10.0%	**17.7%**
S & E Europe	Spain	ESP	15.9%	6.2%	8.8%	2.2%	2.4%	**7.1%**
Africa	Egypt	EGY	18.6%	32.4%	8.3%	5.0%	9.5%	**14.8%**
Africa	South Africa	ZAF	10.7%	35.7%	7.3%	5.7%	4.1%	**12.7%**
Total	**40 Countries**		**11.1%**	**19.4%**	**9.3%**	**4.0%**	**3.2%**	**9.5%**

Table 9 contains the excess mortality for each year and for the full period 2020-24, for each of the 40 countries selected for this paper.

Table 10 – Excess mortality compared with GDP per capita (2017, USD) and state capacity (2015)

Region	Country	Code	Expected 2020-24	Excess 2020-24	GDP per Capita	Capacity	Excess v GDP	Excess v Capacity	Vax% 2020-24
Oceania	Australia	AUS	844,041	6.1%	53,831	2.21800	1.1%	0.6%	266%
Oceania	New Zealand	NZL	181,134	0.1%	43,415	2.23500	-6.4%	-5.3%	260%
SE & E Asia	Japan	JPN	7,311,584	4.3%	38,214	1.76800	-2.8%	-3.0%	347%
SE & E Asia	Malaysia	MYS	946,306	4.5%	10,118	0.81170	-6.6%	-6.9%	209%
SE & E Asia	Philippines	PHL	2,966,190	9.9%	2,982	0.71460	-2.1%	-1.9%	150%
SE & E Asia	Singapore	SGP	114,593	10.4%	56,746	1.67200	5.8%	2.7%	270%
SE & E Asia	Taiwan	TWN	919,721	5.6%	25,062	1.45500	-3.3%	-3.0%	291%
SE & E Asia	Thailand	THA	2,548,754	9.8%	6,579	0.57950	-1.7%	-2.5%	199%
Other Asia	Azerbaijan	AZE	292,394	13.5%	4,139	0.05768	1.6%	-1.0%	134%
Other Asia	Georgia	GEO	217,971	13.0%	3,762	0.90210	1.1%	2.0%	77%
Other Asia	Israel	ISR	233,916	8.0%	42,852	1.75500	1.4%	0.6%	207%
Other Asia	Kazakhstan	KAZ	665,738	11.9%	9,009	0.81130	0.7%	0.5%	191%
Other Asia	Kyrgyzstan	KGZ	158,965	9.3%	1,222	0.22390	-2.9%	-4.5%	0%
Other Asia	Uzbekistan	UZB	745,619	10.9%	1,554	(0.07955)	-1.3%	-4.2%	239%
N America	Canada	CAN	1,517,418	4.9%	44,841	2.09500	-1.4%	-1.1%	265%
N America	United States	USA	14,936,222	9.0%	59,939	1.86000	4.9%	2.1%	198%
L America	Brazil	BRA	5,906,672	15.2%	9,881	0.73820	4.1%	3.5%	244%
L America	Chile	CHL	574,594	13.1%	15,001	1.50300	2.8%	4.7%	342%
L America	Ecuador	ECU	399,724	22.8%	6,214	0.56360	11.3%	10.5%	222%
L America	Paraguay	PRY	166,458	18.1%	5,776	0.12220	6.4%	3.8%	0%
N & W Europe	Austria	AUT	415,207	7.5%	47,261	2.47900	1.6%	3.2%	226%
N & W Europe	Belgium	BEL	545,875	6.1%	43,325	2.37900	-0.3%	1.3%	270%
N & W Europe	Denmark	DNK	281,132	1.8%	57,545	2.69700	-2.7%	-1.6%	253%
N & W Europe	France	FRA	3,084,198	4.0%	39,827	1.64200	-3.0%	-3.9%	238%
N & W Europe	Germany	DEU	4,848,321	5.4%	44,680	2.30100	-0.9%	0.3%	230%
N & W Europe	Lithuania	LTU	180,136	16.4%	16,709	1.48800	6.2%	7.8%	163%
N & W Europe	Netherlands	NLD	786,871	8.1%	48,796	2.21300	2.4%	2.6%	222%
N & W Europe	Sweden	SWE	439,175	5.0%	54,075	2.35400	0.0%	0.1%	270%
N & W Europe	United Kingdom	GBR	3,058,189	8.7%	39,532	1.77700	1.7%	1.4%	222%
S & E Europe	Czechia	CZE	574,727	6.9%	20,291	1.58600	-2.7%	-1.2%	178%
S & E Europe	Greece	GRC	633,577	5.7%	19,214	1.41800	-4.1%	-3.1%	216%
S & E Europe	Hungary	HUN	651,529	5.7%	14,364	1.51700	-4.8%	-2.7%	172%
S & E Europe	Italy	ITA	3,209,982	8.3%	32,038	1.52100	0.3%	0.0%	246%
S & E Europe	Poland	POL	2,139,866	5.7%	13,871	1.42800	-4.8%	-3.0%	152%
S & E Europe	Portugal	PRT	576,768	6.1%	21,316	1.77100	-3.4%	-1.3%	271%
S & E Europe	Romania	ROU	1,316,514	3.7%	10,781	1.01600	-7.2%	-6.8%	88%
S & E Europe	Russia	RUS	8,546,439	17.7%	10,846	0.64630	6.8%	5.7%	129%
S & E Europe	Spain	ESP	2,131,202	7.1%	28,175	2.00300	-1.5%	0.7%	246%
Africa	Egypt	EGY	2,800,111	14.8%	2,441	0.25690	2.7%	1.1%	100%
Africa	South Africa	ZAF	2,596,746	12.7%	6,120	0.88330	1.2%	1.7%	66%
Total	**40 Countries**		**80,464,578**	**9.5%**	**27,542**	**1.29164**	**0.8%**	**0.2%**	**205%**

Table 9 – Excess mortality in 40 countries – 2020-24

Region	Country	Code	Excess 2020	Excess 2021	Excess 2022	Excess 2023	Excess 2024	Excess 2020-24
Oceania	Australia	AUS	-2.0%	3.1%	13.6%	7.6%	8.1%	**6.1%**
Oceania	New Zealand	NZL	-6.1%	-1.7%	6.6%	2.5%	-1.1%	**0.1%**
SE & E Asia	Japan	JPN	-2.0%	1.0%	8.2%	6.9%	7.0%	**4.3%**
SE & E Asia	Malaysia	MYS	-7.6%	21.6%	9.1%	1.5%	-2.1%	**4.5%**
SE & E Asia	Philippines	PHL	-1.8%	37.9%	4.5%	4.7%	0.7%	**9.9%**
SE & E Asia	Singapore	SGP	0.1%	8.1%	17.3%	15.1%	11.1%	**10.4%**
SE & E Asia	Taiwan	TWN	-3.2%	1.3%	12.7%	10.1%	6.9%	**5.6%**
SE & E Asia	Thailand	THA	0.7%	11.9%	16.9%	9.8%	9.6%	**9.8%**
Other Asia	Azerbaijan	AZE	31.2%	32.4%	4.0%	2.1%	-1.7%	**13.5%**
Other Asia	Georgia	GEO	11.2%	34.6%	12.7%	0.2%	5.3%	**13.0%**
Other Asia	Israel	ISR	6.0%	9.7%	10.7%	5.3%	8.2%	**8.0%**
Other Asia	Kazakhstan	KAZ	22.8%	38.1%	1.2%	-2.2%	-0.2%	**11.9%**
Other Asia	Kyrgyzstan	KGZ	23.0%	21.9%	-1.2%	0.2%	2.0%	**9.3%**
Other Asia	Uzbekistan	UZB	11.9%	10.8%	8.9%	9.0%	14.9%	**10.9%**
N America	Canada	CAN	4.4%	4.0%	10.0%	5.1%	0.7%	**4.9%**
N America	United States	USA	16.1%	17.4%	9.9%	2.3%	0.1%	**9.0%**
L America	Brazil	BRA	14.1%	34.3%	10.3%	4.8%	5.2%	**15.2%**
L America	Chile	CHL	13.3%	21.8%	19.6%	4.5%	6.9%	**13.1%**
L America	Ecuador	ECU	52.8%	35.6%	13.5%	8.4%	6.3%	**22.8%**
L America	Paraguay	PRY	7.8%	56.0%	17.7%	3.0%	1.8%	**18.1%**
N & W Europe	Austria	AUT	8.9%	8.7%	10.7%	5.6%	3.8%	**7.5%**
N & W Europe	Belgium	BEL	15.6%	2.9%	6.8%	2.3%	2.8%	**6.1%**
N & W Europe	Denmark	DNK	-1.0%	2.8%	5.8%	2.6%	-1.0%	**1.8%**
N & W Europe	France	FRA	7.7%	5.4%	6.9%	0.3%	-0.3%	**4.0%**
N & W Europe	Germany	DEU	3.2%	6.3%	10.2%	5.3%	2.1%	**5.4%**
N & W Europe	Lithuania	LTU	15.7%	29.3%	18.1%	7.9%	10.0%	**16.4%**
N & W Europe	Netherlands	NLD	9.0%	9.5%	7.9%	6.8%	7.3%	**8.1%**
N & W Europe	Sweden	SWE	8.7%	2.2%	5.9%	5.7%	2.0%	**5.0%**
N & W Europe	United Kingdom	GBR	13.0%	9.4%	7.7%	8.4%	4.9%	**8.7%**
S & E Europe	Czechia	CZE	14.0%	22.3%	4.7%	-2.5%	-3.9%	**6.9%**
S & E Europe	Greece	GRC	4.7%	14.7%	11.2%	0.4%	-2.3%	**5.7%**
S & E Europe	Hungary	HUN	8.1%	19.5%	4.8%	-1.6%	-2.6%	**5.7%**
S & E Europe	Italy	ITA	15.6%	10.3%	11.3%	3.1%	1.1%	**8.3%**
S & E Europe	Poland	POL	14.4%	23.2%	4.9%	-5.4%	-7.6%	**5.7%**
S & E Europe	Portugal	PRT	8.7%	9.3%	8.5%	2.4%	1.4%	**6.1%**
S & E Europe	Romania	ROU	12.8%	27.6%	3.0%	-8.4%	-16.5%	**3.7%**
S & E Europe	Russia	RUS	21.1%	40.5%	11.1%	5.0%	10.0%	**17.7%**
S & E Europe	Spain	ESP	15.9%	6.2%	8.8%	2.2%	2.4%	**7.1%**
Africa	Egypt	EGY	18.6%	32.4%	8.3%	5.0%	9.5%	**14.8%**
Africa	South Africa	ZAF	10.7%	35.7%	7.3%	5.7%	4.1%	**12.7%**
Total	**40 Countries**		**11.1%**	**19.4%**	**9.3%**	**4.0%**	**3.2%**	**9.5%**

Table 9 contains the excess mortality for each year and for the full period 2020-24, for each of the 40 countries selected for this paper.

Table 10 contains the data used to compare excess mortality with per-capita GDP (Figure 52) and state capacity (Figure 53), also showing the differences between excess mortality and the relevant trend lines. For added interest, and as a point of reference for the monthly charts, the table also shows the vaccination dose rates per capita, noting that it is likely that vaccination rates have been under-reported since about December 2022.

The countries in these tables and the associated figures were selected on the following basis:

First, we identified the 75 countries in the OWID database for which relevant data was available for all of 2020, 2021, 2022, 2023 and at least a quarter of 2024[55].

Of these, we selected the 28 with the highest expected deaths, on the basis that these would give the greatest global coverage and relevance and the least spurious variation. These countries included Australia (19th on this list).

Then, we identified a further 12 countries with special relevance. These were (in decreasing order of expected deaths):

- Sweden (31), because it adopted a COVID-19 strategy that differed greatly from the other Nordic nations;
- Austria (32), because it is the most easterly country in Western Europe;
- Ecuador (33), because we had selected it last year due to there being insufficient data for Colombia, which is still the case;
- Azerbaijan (35), because of its very high mortality in late 2020;
- Denmark (36), because it represents the Nordic nations other than Sweden;
- Israel (41), because it was a leader in vaccine take-up;
- Georgia (42), because it borders Russia, Türkiye and Azerbaijan;
- Lithuania (45), because it is representative of the Baltic states;
- New Zealand (47), for direct comparison to Australia;
- Paraguay (48), because (when the decision was made) we did not have enough data for the Dominican Republic, which is also in Latin America;
- Kyrgyzstan (49), because it borders Kazakhstan and Uzbekistan, as well as China; and
- Singapore (53), because it always seemed to be a point of comparison for Australia, at least early in the pandemic.

The resultant list of 40 countries differs from the 40 in our previous analysis as follows:

- Mexico, South Korea, Tunisia and the Dominican Republic have been omitted, due to insufficient data; and
- Austria, Georgia, Paraguay and Kyrgyzstan have been added.

[55] If we had required complete data for 2024, we would have excluded Brazil, The Philippines, Canada, Uzbekistan, Sweden and Paraguay

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