Swiss Re Institute

September 2024

# The future of excess mortality after COVID-19

# Executive summary

The COVID-19 pandemic has been synonymous with excess mortality. Four years on, many countries worldwide still report elevated deaths in their populations. This impact appears generally independent of healthcare systems and population health. It is evident even after accounting for shifting population sizes, and the range of reporting mechanisms and death classifications that make inter-country comparisons complex. There is also likely a degree of excess mortality under-reporting.

Quantifying excess mortality has been an acute challenge since 2020 due to the exceptional mortality rates of the pandemic. Excess mortality refers to the number of deaths over and above an assumed "expected" number of deaths. The different methods of estimating expected mortality can generate very different excess mortality rates.

This represents a potential challenge for Life and Health (L&H) insurance, with potentially several years of elevated mortality claims ahead, depending on how general population trends translate into the insured population. Ongoing excess mortality can have implications for L&H insurance claims and reserves. Excess mortality that continues to exceed current expectations may affect the long-term performance of in-force life portfolios as well as the pricing of new life policies.

In this research Swiss Re Institute projects excess mortality in the US and UK over the next 10 years under different scenarios, by analysing excess mortality trends globally and disaggregating the underlying factors driving them. We find that excess mortality persists today and may potentially continue for the next decade. Our general population forecasts suggest that excess mortality will gradually tail off by 2033, to 0–3% in the US population, and 0–2.5% in the UK. In comparison, by our calculation excess mortality in 2023 was in the range of 3–7% for the US, and 5–8% in the UK.

Under an optimistic scenario, we find that US and UK pandemic-linked excess mortality would disappear by 2028, reverting to pre-pandemic mortality expectations. Under a pessimistic scenario, we expect excess mortality to remain elevated until 2033, above pre-pandemic expectations. The ranges allow for varying mortality improvement assumptions – used to calculate the expected level of mortality – and differing data quality and reporting methods. Our estimates use our chosen approach for the mortality improvement assumption and so may differ from those reported by other institutions.

We developed a standardised methodology for cross-country comparison of pandemic-era excess mortality. This shows four key patterns: in the US, excess mortality peaked early and declined rapidly. In contrast, the UK's early peak was followed by a slower decline. Australia delayed its peak by close to two years and achieved a quick decline. Canada reported very low excess mortality in 2020, with a gradual increase peaking in 2022 and 2023, reflecting a late peak and slow decline. These patterns correlate with countries' responses to COVID-19, specifically the timing and effectiveness of preventive measures and the rate at which mortality returned to expected levels.

The pandemic has significantly altered the causes of excess deaths. We analysed the evolution of major causes of death from 2020 in developed countries that report such data. Respiratory mortality accounts for the largest share of excess deaths each year since 2020, as expected. However, we find evidence of inconsistency in the causes of death recorded over this period, with signs that other causes of death were misclassified as COVID-19. The UK and US data shows a large, unexplained jump in deaths attributed to cardiovascular disease (CVD) since 2020. Some countries also reported excess mortality over a pre-pandemic baseline for other major causes of death, such as cancer.

Based on current medical trends and expected advancements, we conclude that COVID-19 is still driving excess mortality both directly and indirectly. In the long term, lifestyle factors that contribute to poor metabolic health and lead to obesity and diabetes may become another compounding factor in population excess mortality. Insurers may wish to continue to monitor excess mortality and its underlying drivers in the general population closely, as well as the differences between general and insured populations.

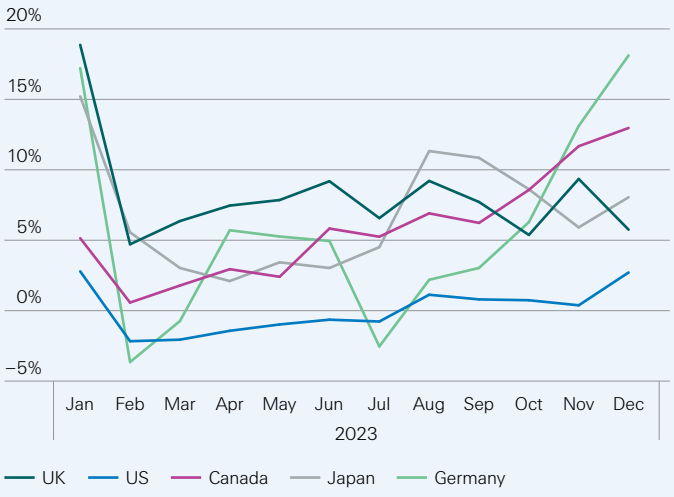
# General population mortality trends are changing

In the four years since the outbreak of COVID-19, many countries have reported deaths in excess of pre-pandemic expectations. This trend is evident even after accounting for shifting population demographics, and the range of reporting mechanisms and death classifications that make inter-country comparisons of excess mortality complex. Excess mortality is observed across countries with differing healthcare systems, medical provisions and population health.

Excess mortality refers to the number of deaths over and above an assumed baseline "expected" number of deaths, which can be estimated by various methods (see *Calculating excess mortality*). Such a baseline would typically exclude major spikes in mortality such as from wars or pandemics.

After the significant rise in mortality during the pandemic, authorities in various countries have been examining the best method to define the baseline mortality from which any excess is calculated. The actual observed number of deaths is typically reported by government agencies. During the pandemic, countries made great efforts to share data publicly, but many have scaled back reporting of deaths since 2023. However, in most cases we still observe excess mortality today, compared with pre-pandemic baselines (see Figure 1). Naturally, the evidence that today there are still more people dying than the expected pre-pandemic government forecasts, raises many questions.

**Figure 1**
Reported excess mortality rates in developed countries in 2023




| Country | 2020–2023 | 2022 | 2023 |
|---|---|---|---|
| **Germany** | 6.3% | 10.1% | **5.3%** |
| **Canada** | 6.1% | 10.1% | **5.9%** |
| **Japan** | 3.6% | 8.2% | **6.8%** |
| **UK** | 9.4% | 7.8% | **8.2%** |
| **US** | 11.1% | 9.1% | **0.0%** |

*Officially reported statistics vary by country, reporting methodology and excess mortality quantification.*
*A degree of under-reporting and baseline adjustment is assumed.*
Source: Our World in Data; reproduced by Swiss Re Institute

## Calculating excess mortality

Excess mortality estimates can vary widely depending on how the provider calculates expected mortality, ie the baseline level of deaths expected in a future year. The current year mortality rate is compared with the expected mortality rate estimated from past data, to identify any excess mortality.

The expected future mortality rate is generated from an extrapolation of the observed mortality in a given year, and the assumed annual mortality improvements. The higher the expected mortality improvement, the lower the expected baseline of deaths (see Figure 2).

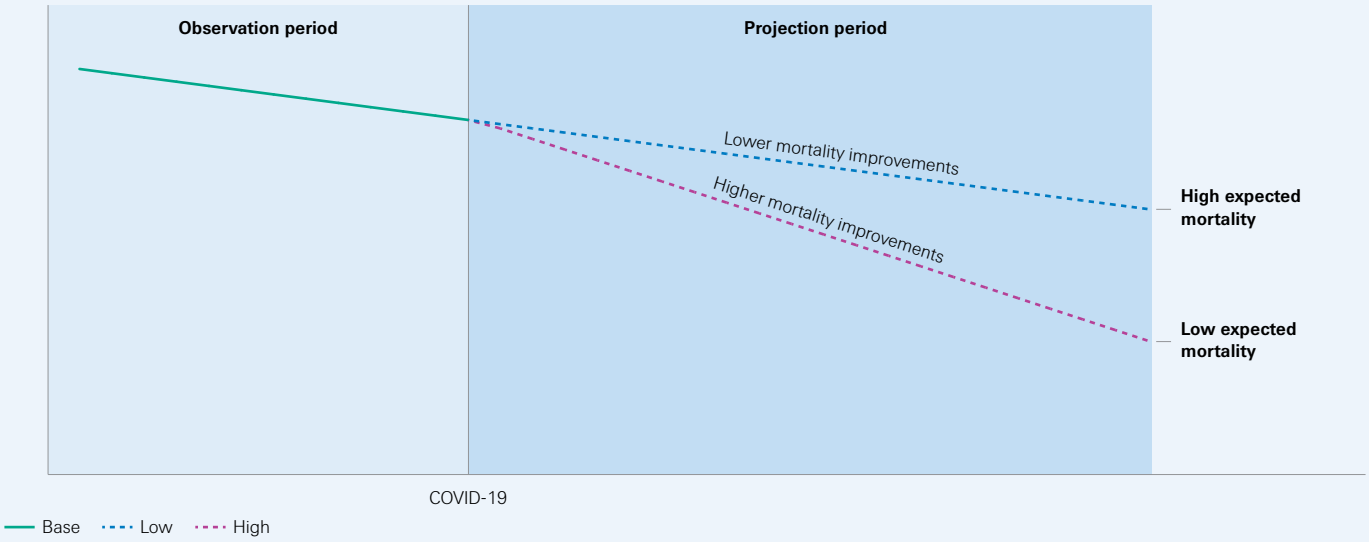
There are two established methods to forecast expected mortality:

1. The observed **number of deaths** from a set of past years is extrapolated linearly into the future deaths, which assumes a constant rate of change in populations, demographics and mortality improvements. This method is used by Our World in Data (Figure 1). However, this method does not consider the impact of COVID-19, which significantly reduced population numbers in certain demographic groups, particularly older ages, due to accelerated mortality from the virus and related healthcare issues (see Chapter 2, *The pandemic shifted the major causes of death*). This results in a smaller denominator for calculating mortality rates. Normally, without mortality shocks, extrapolating deaths works well, reflecting factors like ageing, migration, and mortality improvements.

2. The observed **mortality rate** by age (number of deaths as a share of the population) for a set of past years is extrapolated into the future, either linearly or by using a more sophisticated actuarial method. This approach is more suited to later years of a projection, since it does recognise the impact of accelerated deaths.

As we are now in the fourth year since the start of the pandemic, mortality rates rather than absolute numbers of deaths are the most appropriate basis from which to estimate expected mortality.

**Figure 2**
Impact of differing mortality improvement rates on expected mortality estimates




Source: Swiss Re Institute

**Removing excess mortality: when a baseline is changed**

Excess mortality calculations are highly sensitive to a change in the expected baseline. The UK is a recent example of a substantial reporting change occurring at a national level (see Figure 3). The UK's Office for Health Improvement and Disparities (OHID) established a new baseline in February 2024. The monthly reporting schedule is based on mortality rates, including demographic changes from the 2021 census, rather than on absolute deaths. The new model's baseline uses a five-year moving window of mortality rates, excluding the most severe months of COVID-19, but including several months where substantial related mortality continued to occur. This change means that the expected baseline mortality is higher, so the reported excess mortality appears lower.

Using the old method, England experienced 8% excess mortality in 2023, but the new model shows a much lower rate of 2%, with negative excess mortality reported in every month from July 2023.[1]

**Figure 3**

Reported excess mortality in England under new and old methodologies


Source: Swiss Re Institute reproduced from Our World in Data, and the Office for Health Improvement and Disparities

We explored several methods to estimate excess mortality in the US using different choices of mortality improvements. The first method is based on a five-year moving average of observed mortality. In 2023, this method also includes data during the pandemic, which leads to high negative excess mortality. The second method uses a fixed 2019 baseline, and the expected projection does not include mortality improvements since the start of the pandemic. This results in minimal positive excess mortality.

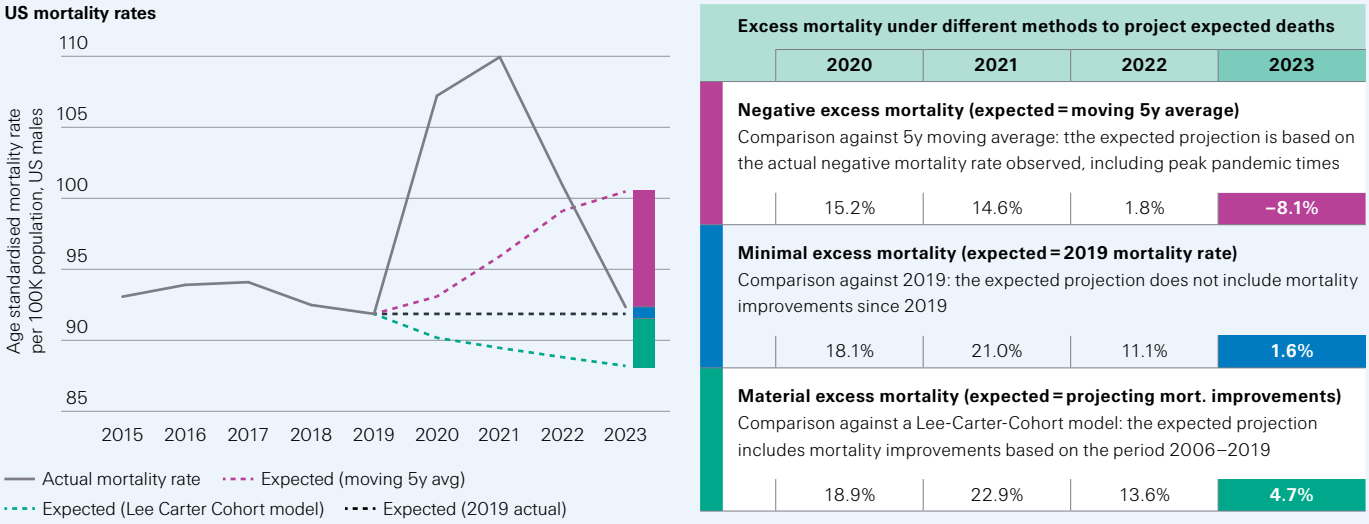
Our preferred methodology is the Lee-Carter with age Cohorts (LCC) model. This is an extension of the Lee-Carter model, capturing variable mortality improvements by age as well as cohort effects.[2] Applied to the US population, the LCC method results in higher excess mortality rates than the other two methods, because it projects mortality improvements and so lowers the expected mortality rate.

We believe this LCC method is the closest reflection of true excess mortality since this approach best addresses how mortality improvement and rates would have appeared today, had the pandemic not occurred. We use this method in all our forecasts of excess mortality in this report (see Figure 4).

[1] *Excess mortality within England: post pandemic method, Office for Health Improvement and Disparities, accessed June 2024*

[2] *A.E. Renshaw & S. Haberman, "A cohort-based extension to the Lee–Carter model for mortality reduction factors", Insurance: Mathematics and Economics, 2006.*

**Figure 4**
Swiss Re calculations of US excess mortality by methodology and assumed mortality improvements




Note: US mortality rates shown in chart are age standardised mortality rate per 10 000 population, US males. Source: Swiss Re Institute

## We establish a method for cross-country comparison

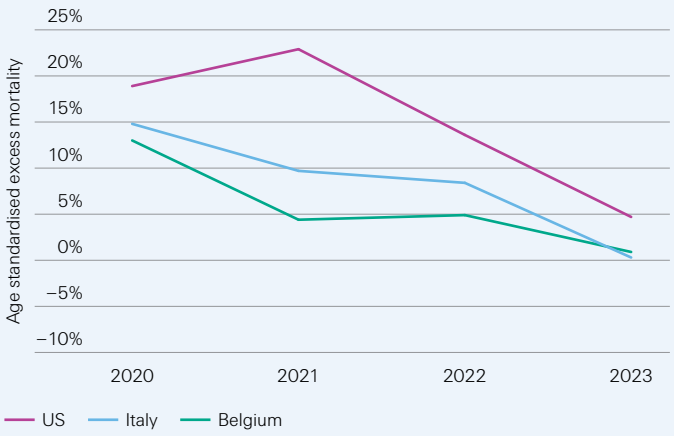
Some countries show similarities in the persistence of population-level excess mortality despite structural differences in many factors, including healthcare infrastructure, public health measures, socioeconomic conditions, lockdowns, and vaccination types and rates during the pandemic (see Figure 5).

The US and the UK both continued to report excess mortality for similar causes of death in 2023, despite their respectively privatised and socialised healthcare systems. We focus on these two countries' excess mortality rates and outlook further in this report.

**Figure 5**
The four recognisable patterns of excess mortality among countries

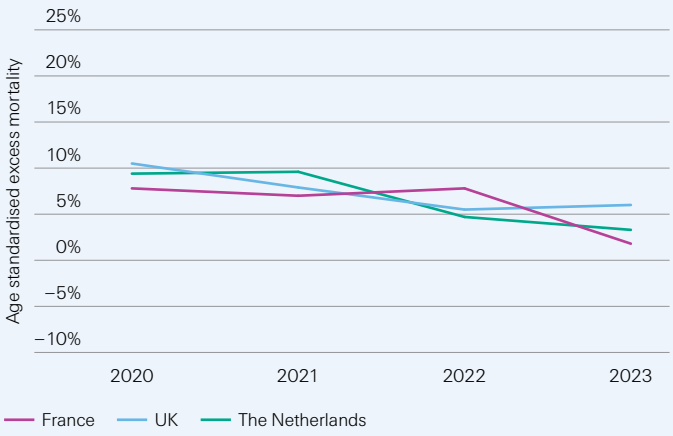
Our calculations suggest that population-level excess mortality persists across developed countries today. The current differences between these countries' excess mortality rates result from the different trajectories of their excess mortality from 2020 to 2023. These fall into four recognisable patterns:

**Early peak, quick run-off**



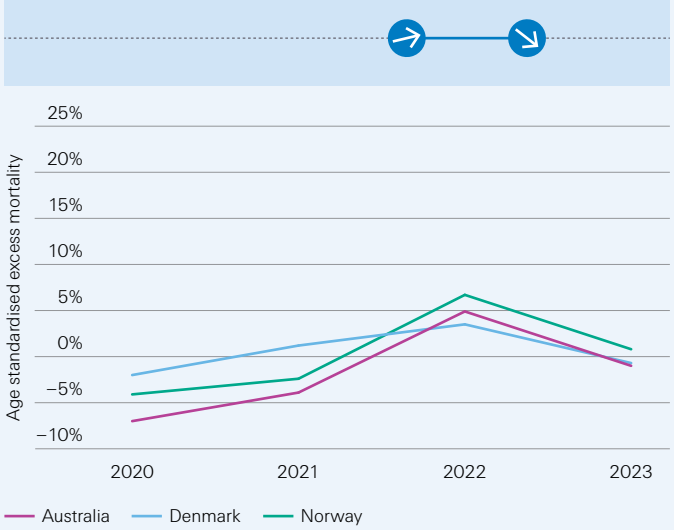

In countries such as the US, Belgium and Italy, excess mortality peaked early in 2020–21, with a quick run-off by 2023. The US is the most prominent example of this, with excess mortality hitting 20% in 2021, reducing to single digits by 2023. The peaks for Belgium and Italy were not so high but followed a similar trajectory and reported 0% excess mortality in 2023.

**Early peak, slow run-off**



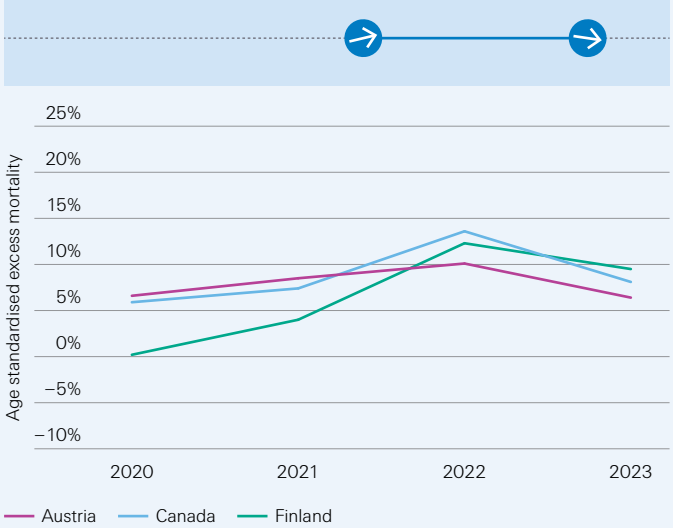

The UK, Netherlands and France all reported relatively flat ~10% excess mortality in 2020 and 2021, with prolonged waves of COVID-19. This led to a slower decline in to 2023.

**Late peak, quick run-off**




Norway, Denmark and Australia reported no or negative excess mortality until 2022, likely as a consequence of more stringent lockdowns, a vaccinated population and other societal actions. All countries reported a peak in 2022, followed by a sharp decline to ~0% in 2023. These countries typify the late COVID-19 wave experience.

**Late peak, slow run-off**




Canada and Austria experienced prolonged COVID-19 waves, though 2020 and 2021, with a smaller peak by 2022. This led to a slower runoff throughout the pandemic. Conversely, Finland, and Japan (not shown), started out by reporting 0% excess in 2020, with an incremental increase until peaking in 2022 and 2023, respectively. The run-off followed the same pattern as Canada and Austria in 2023, where all countries experienced elevated excess mortality in 2023. This pattern is more speculative, but given that these countries peaked late and started from a worse position, we reasonably expect them to run off slowly.

Note: 2023 data for some countries is still provisional.
Source: Swiss Re Institute

# The pandemic shifted the major causes of death

The causes of excess deaths have evolved in sometimes unexpected ways during the pandemic. We analysed the drivers underlying countries' excess mortality by disaggregating reported all-cause mortality data into its primary cause of death. We established a simplified 2018–2019 mortality expectation as a consistent pre-pandemic baseline for each cause of death, given the different death classification systems.

The finding of elevated excess mortality from respiratory causes in the period 2020-2023 is unsurprising given COVID-19 is a respiratory virus. However, across countries, excess mortality from other causes shows unusual deviations from pre-pandemic norms, such as seasonality or higher or lower than expected levels.

In our view these distortions principally reflect misclassification of the cause of death, especially in the early years of the pandemic when health personnel were under great strain. For example, COVID-19 deaths may have been recorded as CVD, or dementia deaths recorded as COVID-19, due to overlap in symptoms or a lack of knowledge of COVID-19 itself. We believe this accounts for most of the deviation, but the true split between genuine cause of death and misclassification may never be known.

However, some distortion in causes of death has continued long into COVID-19 endemicity with vaccine- and infection-derived population-level immunity. This suggests that there is a still-unexplained portion of excess mortality in non-COVID-19 causes of death up to today. This may become clearer as long-term data on COVID-19 accumulates.

### Respiratory mortality from COVID-19 is the largest cause of excess deaths

Respiratory mortality accounts for the largest share of excess deaths each year since 2020. Despite declining testing, COVID-19 is considered the primary factor behind this. In the US, respiratory mortality (COVID-19 and other respiratory deaths) accounted for 63.2% of all excess deaths during the pandemic years 2020–2023, the highest share of all causes of death. However, excess respiratory deaths have fallen every year from a peak of 76.5% in 2020, to 20.1% by 2023.

Some conditions, such as neurodegenerative diseases, saw negative excess mortality during the pandemic years. These conditions have a greater overlap with the risk factors associated with a poor COVID-19 outcome, such as old age and comorbidities and it is highly likely that some patients were attributed to another cause of death, such as COVID-19 rather than from their neurodegenerative condition.

Excess mortality from cancer saw more limited fluctuations (see Chapter 3, *The drivers of present and future excess mortality*). Given the specific characteristics of cancer and cancer treatment, we see this as genuinely reported excess mortality, likely driven by patients' vulnerability to infection.

### CVD is an unexpected major cause of excess deaths in the US and UK

UK and US cause of excess death data both show a significant jump in deaths attributed to CVD, which coincide with pandemic waves. A respiratory virus would only be expected to lead primarily to excess respiratory mortality. However, COVID-19 is also suspected to play a role in cardiovascular morbidity.[3]

Given the conditions of the pandemic, it was often difficult to ascertain the primary cause of death. Differences are evident in how causes of death were reported by the place of death and the authority responsible for generating death certificates, suggesting local classification differences also affected the statistical outcomes. Additionally, a lack

[3] *J.* Zhao, et. al., "COVID-19 and cardiovascular complications: updates of emergency medicine", Emergency and Critical Care Medicine, 2023.

of testing to confirm COVID-19 diagnoses, and the accelerated deaths of vulnerable people, may have led to such deviations from long-term norms.[4]

The **US** saw a 14.9% increase in CVD deaths in 2020-23 compared to the expected pre-pandemic baseline, as reported by the CDC WONDER dataset. The data provides the primary cause of death as written on the death certificate.[5]

The **UK** reported excess mortality continuing into 2024 until the change in reporting methodology (see *Removing excess mortality – what happens when a baseline is changed*). Research finds that CVD excess mortality was the largest contributor to excess mortality in the UK between June 2022 and June 2023, with heart failure accounting for 20% and ischemic heart diseases a further 15%.[6]

[4] *The future of life expectancy: forecasting long-term mortality improvement trends for insurance,* Swiss Re Institute, 2023.
[5] *US Centers for Disease Control and Prevention, https://wonder.cdc.gov/wonder,* accessed August 2023.
[6] J. Pearson-Studdard, et. al., "Excess mortality in England post COVID-19 pandemic: implications for secondary prevention", The Lancet Regional Health Europe, 2024.

### Excess mortality rates in other developed countries show similar CVD elevation

Excess mortality has persisted across other developed nations in 2023 (see Figure 6), with similar causes to the US and UK. We continue to see heightened respiratory and CVD deaths in many countries.

Statistics **Canada** reported 36% respiratory excess deaths,[7] 9% from CVD and 5% excess deaths from cancer in 2022, based on a baseline reference period of four years spanning 2016–2019.[8] Canada's reported cancer deaths are higher than in peer countries such as the US and UK, but the classification and cause of this is unknown. CVD does not appear as a dominant cause in this country, possibly due to reclassification under a respiratory cause of death.

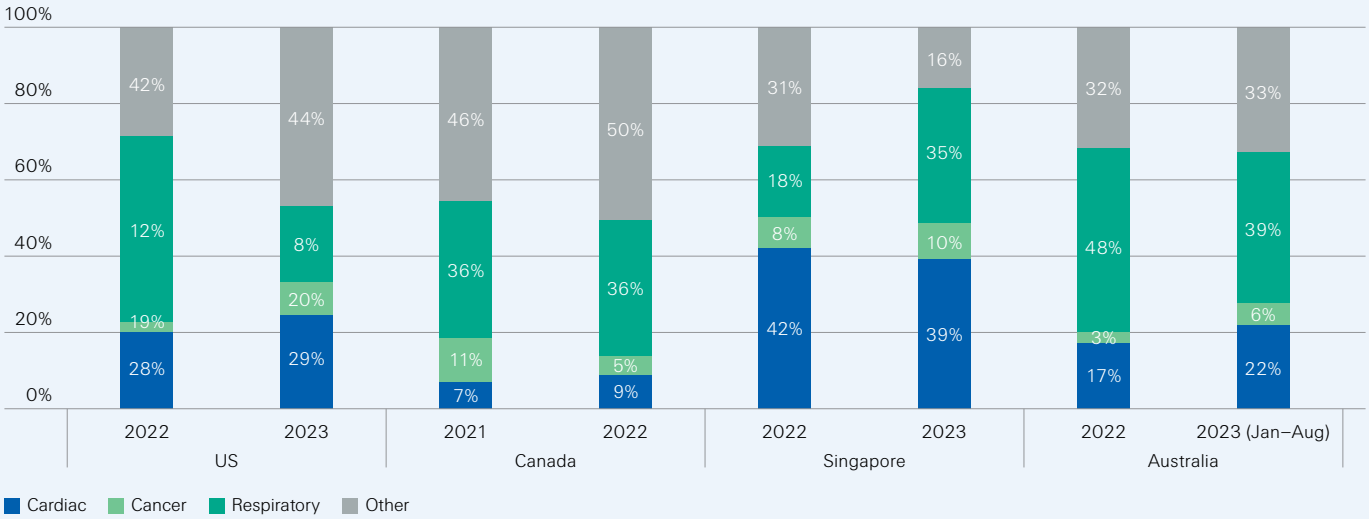
The **Australian** Actuaries Institute, using data from the Australian Bureau of Statistics,[9] reported 39% respiratory deaths above the expected 2013–2019 baseline, 22% cardiovascular and 6% cancer, for the first eight months of 2023.[10] As with other peer countries, changes to diabetes (7%) and dementia (–13%) mortality are most likely due to misclassification of COVID-19.

**Singapore** excess deaths, based on a flat baseline of mortality as observed in 2019, are now led by CVD, but the reporting authority has repeatedly changed methodology.[11] The Department of Statistics in Singapore found 39% excess mortality from cardiovascular causes, 35% respiratory and 10% cancer deaths in 2023. Singapore initially classified deaths differently to other countries at the start of the pandemic, attributing many COVID-19 deaths to non-COVID-19 causes. In 2020 this led to a higher reporting of excess mortality, with 114% cardiac deaths, 34% cancer deaths and –46% respiratory deaths. We believe that its reporting is now in line with international norms.

**Japan's** excess mortality is calculated on time series data on the number of deaths from January 2012 to January 2020. This shows far lower proportions of major causes of death, with 25% of excess mortality attributable to respiratory infections, 16% to

[7] *Leading causes of death, Statistics Canada, accessed August 2024.*
[8] *Estimation of excess mortality, Statistics Canada, accessed August 2024.*
[9] *COVID-19 Mortality Working Group – No Excess Mortality for August 2023, Australian Actuaries Institute, accessed August 2024.*
[10] *Measuring Australia's excess mortality during the COVID-19 pandemic until December 2023, Australian Bureau of Statistics, accessed August 2024.*
[11] *Population trends 2023, Department of Statistics Singapore, accessed August 2024.*

**Figure 6**
Excess mortality rates in key countries



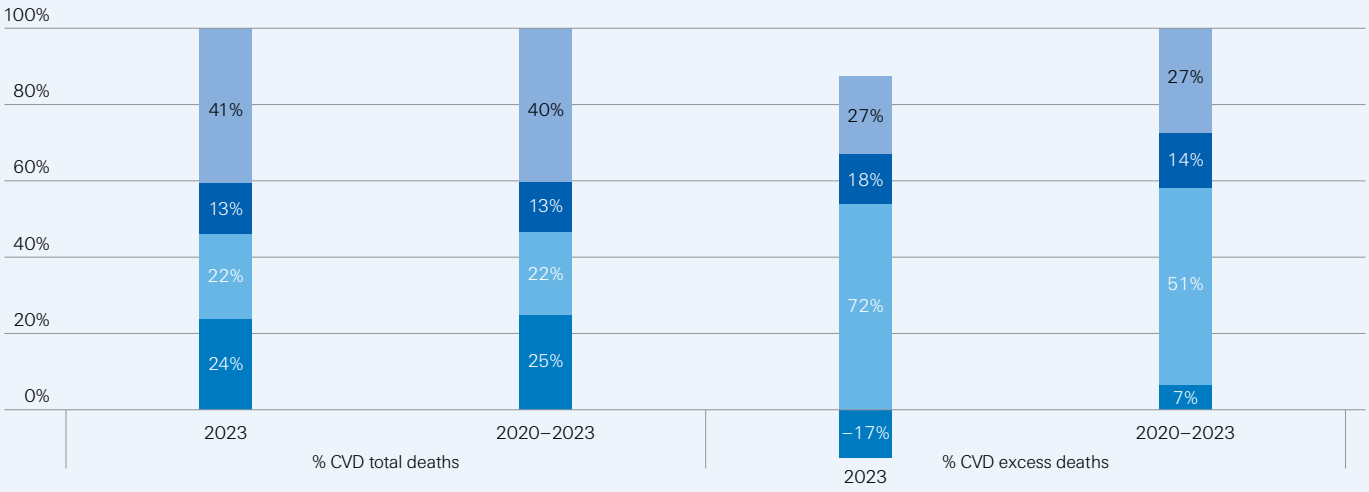

Source: Swiss Re Institute analysis of national cause of death datasets

circulatory diseases, 1% to cancer and 7% to senility (neurodegenerative diseases) from January 2020 to August 2023.

### Hypertension surprises as a major factor in US excess mortality from CVD

Within US CVD deaths between 2020–2023, ischemic heart disease (IHD) deaths were elevated throughout the pandemic. However, it was only in 2023 that most excess CVD deaths (72%) were attributed to hypertension, as compared to the CDC's 2018–2019 baseline. This was offset by a 17% year on year decrease in IHD. This is an interesting finding given hypertension is rarely seen as a primary cause of CVD death, separate from heart attacks, or from a cerebrovascular cause of death such as stroke. This may be indicative of a deterioration in more chronic CVD conditions as opposed to an acute fatal, ischaemic event. Such a deterioration may be a consequence of delayed healthcare access or avoidance over the early years of the pandemic (see Figure 7).

**Figure 7**
US causes of CVD deaths, all ages




Source: Swiss Re Institute

# The drivers of present and future excess mortality

Though COVID-19 has evolved to an endemic disease, the factors that drove excess mortality during the peak pandemic years continue to influence mortality rates today and in the future.

We analysed the historic causes of countries' reported excess mortality to identify the most significant drivers between 2020–2023. We then estimate the expected future severity and duration of each driver in our scenarios to model future excess mortality. This can be applied to developed countries in the next 10 years to 2033 (see Figure 8).

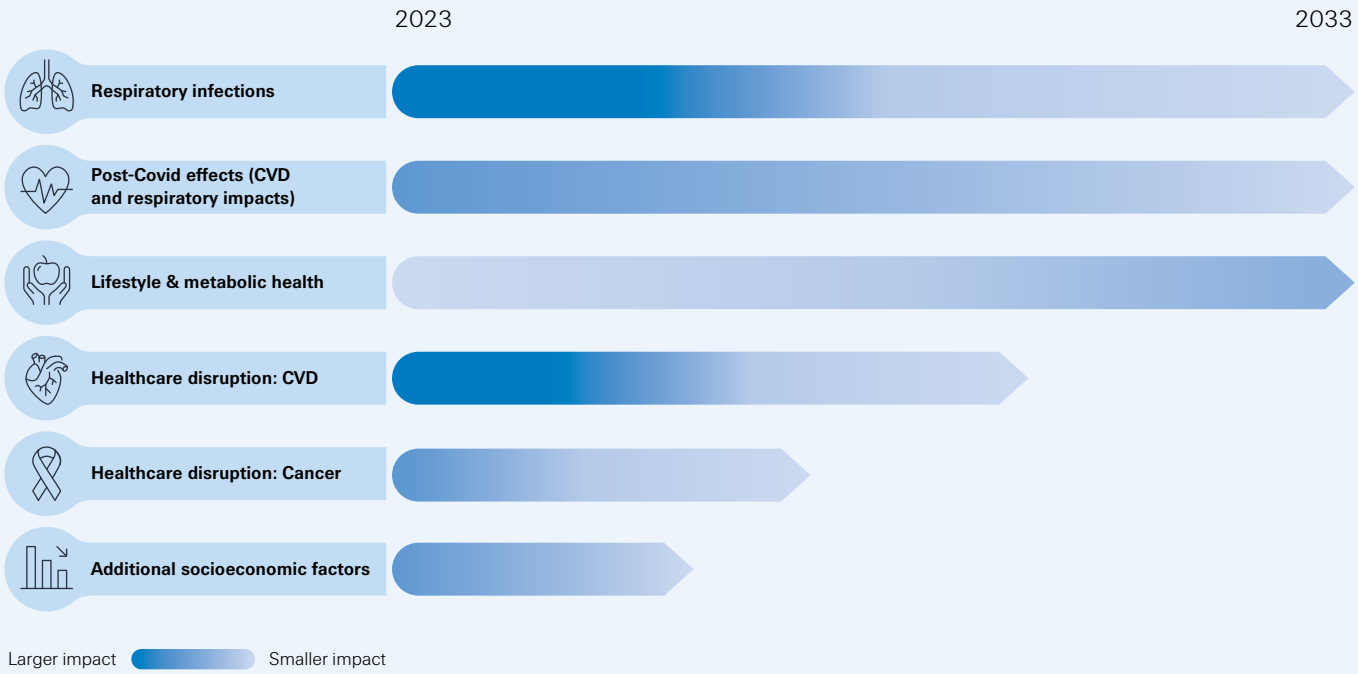
**1. Respiratory deaths likely to stay the key contributor to global excess mortality**

While testing has certainly dropped since the start of the pandemic, the vast majority of respiratory deaths are attributed to COVID-19. That is followed by influenza, and then other respiratory viruses, as determined by government reporting such as by the US CDC and UK ONS, and subsequent analysis by Swiss Re.

COVID-19 is expected to evolve much like influenza and other respiratory viruses, with variants becoming "milder" than those in 2020 and 2021 until its severity settles. Its mutations so far have created more transmissible and less lethal variants, and most people now benefit from both infection-derived or vaccine-derived immunity.

Influenza continues to drive seasonal, winter respiratory deaths. While flu deaths were greatly reduced when societal restrictions were in place for COVID-19, these have now returned. Flu vaccination rates remain high, yet social changes such as mask wearing have mostly abated, but still remain common in countries where masks were more frequently used pre-COVID-19 (for example, in East Asia). However, the risk factors for COVID-19 and flu deaths often overlap.

**Figure 8**
Drivers of excess mortality by severity and expected duration of impact




Source: Swiss Re Institute

*Duration: respiratory mortality driven by COVID-19 is anticipated to continue over the longer-term horizon, with a milder, widespread impact in the general population, and posing a greater risk to the most vulnerable groups, for whom vaccination still remains the best protection against more severe infection presentations.*

**2. Post-COVID-19 long-term impacts on respiratory and cardiovascular disease**

Uncertainty remains about the long-term or permanent damage from COVID-19. Limited studies on COVID-19's impact on long-term organ impairment are mainly comprised of multi-morbid, older individuals infected with the earliest variants. These cohorts, often hospitalised and with varying vaccination status, do not reflect the broader population in the endemic stage with high vaccine penetration.

Long Covid involves persistent symptoms across multiple body systems for weeks or months post-infection. Early pandemic reports noted the lack of standardised diagnostic criteria, hindering treatment. Risk factors include complex disorders, poor mental health, metabolic issues, age, and lower socioeconomic status. However, vaccination, previous infection, and later variants are associated with reduced incidence.

Despite a decrease in Long Covid reports as the pandemic progressed, the risk persists even with the emergence of Omicron sub-variants.[12]

A UK MRI study on over 250 patients hospitalised with COVID-19 patients found that 61% showed multi-organ abnormalities. Five months post-discharge, COVID-19 patients had more lung, brain, and kidney abnormalities. These abnormalities were linked to older age, pre-existing conditions and COVID-19 severity.[13]

A US Department of Veterans Affairs' study on 150 000 COVID-19 patients highlighted increased CVD risks. Symptomatic patients, 30 days post-infection, had higher CVD events and mortality rates across all demographic groups and regardless of pre-existing conditions. Even non-hospitalised patients had higher CVD rates than controls, with increasing infection severity likelihood of a cardiac event.[14] However, it did not account for demographics, COVID-19 variants, vaccination status, or treatment regimens, limiting wider applicability.

Post-infection symptoms of COVID-19, similar to other viral infections, include persistent fatigue and cognitive impairment, akin to post-viral fatigue syndrome and post-ICU syndrome.[15] These symptoms can occur without a confirmed COVID-19 diagnosis. Respiratory viruses, including COVID-19, can cause chronic inflammation and multi-systemic organ damage. This is particularly concerning for individuals with chronic coronary diseases, diabetes, and obesity, leading to worse clinical outcomes and higher mortality. High residual viral load, slower viral clearance, and immune dysregulation contribute to ongoing health issues and poor cardiovascular outcomes, regardless of vaccination status.

Long-term cardiovascular complications of COVID-19 need further investigation, but severe post-COVID-19 impacts mainly come from early variants. Healthy, highly immune populations may experience fewer long-term effects.

*Duration: post-COVID effects have so far mirrored COVID-19 infection severity levels. We expect the impact of these to decrease if variants of COVID-19 remain mild and are well managed with vaccination.*

[12] *Y. Xie, et. al., "Postacute Sequelae of SARS-CoV-2 Infection in the Pre-Delta, Delta, and Omicron Eras", The New England Journal of Medicine, 2024*

[13] *Multiorgan MRI findings after hospitalisation with COVID-19 in the UK (C-MORE): a prospective, multicentre, observational cohort study, The Lancet Respiratory Medicine, 2023.*

[14] *Y. Xie, et.al., "Long-term cardiovascular outcomes of COVID-19", Nature Medicine, 2022.*

[15] *C. E. Hastei, et. al., "Outcomes among confirmed cases and a matched comparison group in the Long-COVID in Scotland study", Nature Communications, 2022.*

### 3. Lifestyle: metabolic health and chronic health deterioration

COVID-19 has led to direct and indirect secondary and long-term impacts on populations that are not yet fully understood. Changes in nutrition and physical activity levels, such as an increase in working from home, may have worsened morbidity. Metabolic ill health, driven by insulin resistance, is the primary cause of non-communicable diseases, which today make up over 74% of deaths globally.[16] Poor metabolic health components like hypertension, obesity, diabetes or poor cholesterol are interconnected, with insulin resistance playing a role in long-term morbidity. These factors can be modified by a combination of diet, sleep, physical activity, alcohol consumption and other behavioural changes.

In 2021, the CDC reported that ~60% of Americans have a chronic condition such as heart disease, cancer or diabetes, which accounts for seven out of 10 of the leading causes of death and disability in the country.[17] The treatment and management burden of these chronic diseases increases with age. Additionally, during the pandemic some reports emerged to highlight adverse lifestyle-driven health trends, such as higher alcohol consumption and associated morbidity and mortality from alcohol-linked liver disease.[18] Pandemic-linked social pressures also exacerbated the opioid crisis, disrupting support networks while increasing mental health struggles.[19] Government bodies continue to monitor the longer-term health impacts of addiction.

*Duration: likely a long-term consideration. Swiss Re is strongly committed to supporting better metabolic health, as demonstrated by our dedicated knowledge-sharing events and pilot interventions.[20,21] Continuous positive mortality improvement trends rely on improving baseline characteristics, alongside medical and technological advancements, which impinge on all causes of death. While lifestyle and metabolic health trends have been in decline in recent years, new drugs, societal and government policy interventions are expected to encourage people to make better health choices in the future.*

### 4. CVD: drawn-out healthcare disruption may have long-term health impacts

The pandemic significantly changed Accident and Emergency (A&E) and primary care/general practice (GP) presentations in many advanced countries, resulting in fewer patients being seen. In England, the number of people going to A&E dropped by 30.3% from 25 million in 2019–2020 to 17.4 million in 2020–2021.[22] This led to a backlog in cardiac care, with essential heart tests and procedures seeing a 67% increase by April 2023 compared to February 2020.[23] Despite improvements in healthcare efficiencies since the height of the pandemic, some impacts will remain.

Many cardiac conditions need long term monitoring, and disruption here can have consequences over many years. In the UK, GP referrals to specialist care saw an 87% increase in failed referrals between February 2020 and November 2021, adding pressure on primary care providers.[24] In France, the average wait time for a GP appointment has increased from 4 days to 10 days, from 2019 to 2024[25]. In Australia, elective surgeries also declined, with reports indicating the lowest admissions in a decade for 2021–2022. Similarly, Canada experienced a 13% drop in all types of surgeries over the first 2.5 years of the pandemic. The decentralised nature of the US

[16] *"Why NCDs?", NCD Alliance, accessed August 2024.*
[17] *COVID-19 and Chronic Disease: The Impact Now and in the Future, CDC Preventing Chronic disease, accessed August 2024.*
[18] *Risky Alcohol Use: An Epidemic Inside the COVID-19 Pandemic, National Institute of Health (NIH), accessed August 2024.*
[19] *Drug Overdose Death Rates, NIH – National Institute on Drug Abuse, accessed August 2024.*
[20] *Metabolic Health: Tackling wellbeing from the inside out, Swiss Re, 2023.*
[21] *Under pressure – the growing problem of insulin resistance,* The Actuary, 2024.
[22] *New figures released for A&E attendances in 2020–21, NHS England Digital, accessed August 2024.*
[23] *Excess deaths involving CVD in England since the onset of the COVID-19 pandemic: and analysis and explainer, British Heart Foundation, accessed August 2024.*
[24] *NHS backlog data analysis, British Medical Association, accessed August 2024.*
[25] *Wait to see health specialists grows in France: here is what to expect, The Connexion, accessed August 2024.*

healthcare system likely allowed for more specialised care to continue, however cardiologists in major hospital systems have also flagged the shifting priorities of the pandemic as a concern[26]. Even countries with highly funded and well-regarded healthcare systems like Singapore also reported severe delays with accessing GP appointments in the peak waves of the pandemic, with patients turning more to telehealth.[27]

This backlog led to long-term delays in medical care, which countries are still working to recoup.[28,29,30] These issues have been compounded by healthcare staffing burnout and shortages, Europe is short of 1.8 million healthcare workers, projected to rise to 4 million by 2030, with high burnout rates and an ageing workforce.[31] The US anticipates a shortage of about 200 000 nurses and 124 000 doctors by 2030, impacting primary care accessibility.[32] We anticipate that as healthcare systems catch up with pandemic backlogs and return closer to pre-pandemic service levels, excess mortality will likely decrease.

*Duration: we expect the number of patients affected by delays to decrease and any health impacts to become clearer as the pandemic becomes more distant. The impact of healthcare disruption on CVD outcomes should decrease substantially in the coming years.*

### 5. Cancer: short-term care disruption, but reinstated the fastest

The pandemic impacted cancer screenings, referrals and diagnoses. For example, in England, cervical screening services were reduced from spring to summer 2020, leading to a 6.4% decrease in screening samples between March 2020 and April 2021 that may have impacted cancer diagnoses.[33] Likewise, 78 breast screening units in England were closed through to June 2020. These services were reinstated almost immediately, due to the critical nature of priority screening services. All breast cancer screenings normalised between July and September 2020, and the backlog of the total eligible population was invited to resume screening.[34]

In the US, claims data from health insurer Independence Blue Cross show that from March to July 2020, 58% of routine screening mammograms and 38% of diagnostic mammograms were not conducted. Another study showed a 62–96% drop in screening for breast, lung, cervical, and colorectal cancers in April and May 2020 among 11 million people. The compartmentalised nature of the US healthcare system allowed for this backlog to be quickly addressed by 2021.[35]

*Duration: cancer screening and treatment were prioritised globally. We expect backlogs to have been cleared urgently. As such, we anticipate a limited and gradual mortality impact from cancers with a lower reported incidence of the pandemic.*

[26] *R. Schaffer, "Routine cardiology care 'suffered greatly' for many during pandemic", Cardiology today, 2022.*

[27] *COVID-19 Makes Singapore's Digital Health "On-Demand", Oliver Wyman, accessed August 2024.*
[28] *What happens when we fund hospitals to perform, Australian Medical Association, 2023.*
[29] *Surgery backlogs, staff shortages, no family doctor: New report highlights Canada's health-care crisis, Canadian Broadcasting Corporation (CBC), accessed August 2024.*
[30] *2024 healthcare services outlook: Challenges and opportunities, McKinsey & Company, accessed August 2024.*
[31] *Health and care workforce in Europe: time to act, World Health Organization, 2022.*
[32] *Doctor shortages are here—and they'll get worse if we don't act fast, American Medical Association, accessed August 2024.*
[33] *A. Castanon, et. al., "COVID-19 disruption to cervical cancer screening in England", Journal of Medical Screening, 2022.*
[34] *NHS Breast Screening Programme, England 2020–21, NHS England Digital, accessed August 2024.*
[35] *Cancer Screening During the Coronavirus Disease-2019 Pandemic: A Perspective From the National Cancer Institute's PROSPR Consortium, Gastroenterology, 2021.*

### 6. Additional social and economic factors

In addition to the major drivers, we considered some other short-term impacts in our modelling, including the harvesting effect and economic pressures. The harvesting effect is a temporary increase in mortality among older and vulnerable populations. Elderly people are particularly susceptible to COVID-19 due to their frailty, comorbidities, and weaker immune systems, and were at additional risk during the peak of the pandemic. However, social restrictions during the pandemic helped protect these vulnerable groups during the early years of the pandemic. These 'delayed' deaths now appear to be filtering through in older age mortality.

Economic downturns can increase mortality rates over time, leading to spikes in non-communicable diseases, poor mental health, and infectious diseases. Other factors, such as poor medication adherence and struggles with medical costs, may also play a role.[36] The economic volatility of the pandemic and high inflation years from 2020–2022 may have contributed to a degree of negative health outcomes in the lower socioeconomic groups of the general population. This may be recovered by the stronger economic environment in 2023–2024 when countries restored their lost output.[37]

*Duration: as social behaviours returned to pre-pandemic norms, any residual protection afforded to the elderly and vulnerable groups has ended. As such, we expect a short-term increase in elderly mortality as previously delayed deaths occur. The pandemic caused significant economic fluctuations which likely had a moderate impact on the general population, with lower socioeconomic groups being more affected. The improved economic conditions in 2024 may help reduce some of these effects.*

### 6. Medical advancements during the pandemic add to future mortality improvements

Medical advancements continued to flourish despite the pandemic, and also factor into our considerations for the future. The most prominent breakthrough is the GLP-1 weight loss drugs used to treat obesity. These can help individuals living with obesity to shed 15–25% of their body weight.[38] The Novo Nordisk-produced Wegovy® and Ozempic® (semaglutide) have also resulted in a 20% reduction in heart attacks, strokes and CVD deaths in non-diabetic patients with obesity and established CVD, in a large population trial in a real world setting.[39] Recent studies, such as the 41-country SELECT clinical trial, have demonstrated that the use of semaglutide resulted in continued weight loss over 65 weeks and was sustained for up to four years (208 weeks).[40] Other drugs and manufacturers such as Eli Lilly's Moujnaro® (tirzepatide) are also contenders. With demand vastly outstripping supply, and backed by positive clinical trial results, this field will likely continue to grow. For optimal long-term health, an equal focus on lifestyle factors is necessary for better management of underlying risk factors for several causes of death. These collectively should add to mortality improvements of the future.

CVD mortality gains, driven by smoking cessation and wide rollout of effective pharmacotherapies, have slowed or plateaued in recent decades. There is now a degree of decline in people's underlying health in many developed countries, and a deceleration in positive mortality improvements.

Steady advancements in cancer detection and treatment are likely to follow in the coming decades.[41] The growing use of minimally invasive multi-cancer early detection (MCED) blood tests known as liquid biopsies can potentially increase early detection

[36] *J. R. Falvey, et. al., "Association of Financial Strain With Mortality Among Older US Adults Recovering From an Acute Myocardial Infarction", JAMA Internal Medicine, 2022.*
[37] *sigma 3/2024 – World insurance: strengthening global resilience with a new lease of life, Swiss Re, 2024.*
[38] *J. P.H. Wilding, et. al., "Once-Weekly Semaglutide in Adults with Overweight or Obesity", New England Journal of Medicine, 2021.*
[39] *A. M. Lincoff, et. al., "Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes", The New England Journal of Medicine, 2023.*
[40] *D. H. Ryan, et. al., "Long-term weight loss effects of semaglutide in obesity without diabetes in the SELECT trial", Nature Medicine, 2024.*
[41] *The Future Of Life Expectancy, Swiss Re, 2023.*

rates of some cancers, improving survivability. MCEDs are still in early stages of development as companies seek to improve their ability to detect cancers at early stages and the specific cancer site of origin.[42]

Cancer treatment is also progressing, with advancement into personalised therapies. The up-and-coming CAR-T cell therapies and personalised mRNA vaccines involve sampling an individual's tumour or cancerous cells to enable the patient's immune system to attack the cancer. The highly specific nature of this technology, based on the individualised identification of cancer mutations and the underlying biology of a patient's cancer, means it may have broad spectrum application. Clinical trials have been limited to a few cancers so far, but outcomes appear promising. Individualised vaccines have been used against pancreatic cancer[43] and melanoma[44] for targeted cancer treatments alongside other established antibody drug conjugates.

Artificial intelligence (AI) is likely key to the future of healthcare, but it requires large volumes of high-quality health data to reach full potential. Research organisations are increasingly building large, diverse biobanks and datasets to improve healthcare. The Harvard School of Public Health estimated that utilising AI to diagnose patients could reduce treatment costs by up to 50% and improve health outcomes by 40%.[45]

[42] *Multi-Cancer Early Detection, Swiss Re, 2024.*
[43] *Investigational mRNA Vaccine Induced Persistent Immune Response in Phase 1 Trial of Patients With Pancreatic Cancer, Memorial Sloan Kettering Cancer Center, accessed August 2024.*
[44] *First patients getting individualised risk-reducing therapy for melanoma, NHS University College London Hospitals, accessed August 2024.*
[45] *AI healthcare benefits, IBM, accessed August 2024.*

# The future of excess mortality

Excess mortality today presents an unresolved challenge for healthcare and society in many countries. To understand this better we assess expected general population excess mortality in the US and UK over the decade to 2033.

For each of the key drivers of excess mortality identified earlier we explore optimistic and pessimistic trajectories over the next 10 years. We combine this with our excess mortality data calculations and cause of death analysis to forecast the potential outcomes over the next decade. These findings have potential implications for governments and the insurance industry, particularly as insured population demographics may differ from the general population.

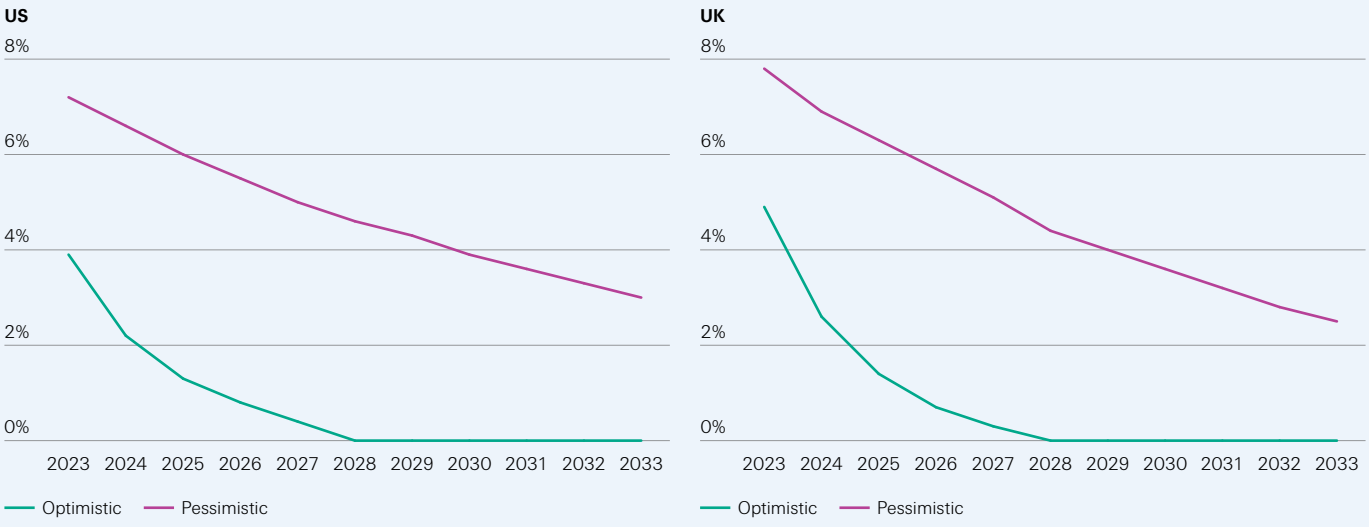
**Our scenarios envisage general population excess mortality in the US of between 0–3% by 2033, and 0–2.5% in the UK population.** These are predominantly driven by COVID-19 and its related impacts. We use the Lee-Carter Cohort model and cause of death data based on 2018–2019 years to estimate expected mortality, as well as attributing underlying cause of death data for 2023 as a start point.

We see a degree of excess mortality persisting for several years under both the optimistic and pessimistic scenarios (see Figure 9).

We estimate a degree of excess mortality in a post-pandemic state for the US and UK general populations.

| | Optimistic scenario (from 2028) | Pessimistic scenario (2033) |
|---|---|---|
| **US** | 0% | 3% |
| **UK** | 0% | 2.5% |

**Figure 9**
Scenario forecasts for the US and UK, general population excess mortality, to 2033




Source: Swiss Re Institute

## Common factors of US and UK future excess mortality

**Optimistic scenario**

- In an optimistic scenario, all of our drivers are expected to perform better than current levels.
- COVID-19 is the predominant driving force resulting in excess respiratory mortality. Although COVID-19 and respiratory deaths still cause some excess mortality, it will likely decline faster than previously expected. This scenario only considered COVID-19, excluding the activity of any other infection.
- We expect post-COVID-19 effects that elevate CVD as a cause of death to be minimal. These deaths will likely decline over time as further research improves our understanding of the underlying risk factors.
- Healthcare disruption from the pandemic is minimised, and the rapid recover of cardiac and cancer serves minimises any long-term consequences.
- Better resourcing, faster and more accurate diagnosis technology, strong supply lines and a larger workforce quickly resolves healthcare system delays.
- A renewed focus on personal health, and lifestyle improvements lead to a happier outlook as people now live longer, healthier lives.
- Medical advancements continue to improve health and bring research into clinical practice for the benefit of many people.

**Pessimistic scenario**

- In a pessimistic scenario we would expect a continuation of existing excess mortality levels from 2023 to persist over a longer period of time, with a much slower decay rate.
- Variants continue to pose a higher risk of severe disease, and patients are reluctant to get regular vaccinations. COVID-19 will remain a significant cause of death, with only modest yearly improvements. This scenario only considered COVID-19, excluding the activity of any other infection.
- Consequently, post-COVID effects on CVD are likely to persist. Impacts on CVD as a cause of death take many years to improve, in a speculative consideration. Persistent longer-term impacts are expected to decline over time, but still require close monitoring.
- Under these conditions, healthcare systems struggle to recover from pandemic backlogs. This results in fewer appointments, missed screenings, and delayed treatments and surgeries. Consequently, there are higher risks of increased morbidity and mortality due to delayed care.
- A continued decline in population metabolic health worsens existing comorbidities. Any residual economic challenges also persist.
- In a pessimistic scenario, no additional benefit would be given to short-term mortality improvements.

However, we expect there will also be differences between the two countries.

We allow for some further impact from the pandemic on the US healthcare system but expect medical access issues to resolve in about three to four years. Some lifestyle and long-term deterioration of health is expected, given the CDC's publicly available data on the general US population that indicates worsening obesity and physical activity rates.

As per government reporting, the UK has higher respiratory excess mortality than the US. The lower levels of poor metabolic health in the UK population, compared to the US, offsets this partially. Using this information, we start at a higher level of respiratory excess mortality, although we expect the reduce over time, similar to the US. With a socialised, universal national healthcare system (NHS), the UK is more likely to suffer from a slower recovery of pandemic backlogs, compounding existing concerns including staffing shortages. The system is expected to bounce back albeit at a slower rate than the US privatised system. In the UK medical advancements are likely to apply more universally as socioeconomic background is not a limiting factor in access to healthcare.

# Conclusions for L&H re/insurance

The COVID-19 pandemic was a significant mortality shock for the global L&H insurance industry. The persistence, today, of general population excess mortality above pre-pandemic expectations is a potential challenge for claims trends going forward.

Over the course of the pandemic, a range of mortality patterns were observed globally. The varied experiences of COVID-19 were driven by a multitude of underlying factors. We brought together disparate data from across the world, compiled a comprehensive review of medical literature by causes of death, to calculate excess mortality using the Lee-Carter with cohorts model.

We forecast persistent excess mortality in the general population in the US and UK, for up to 10 years, under three plausible scenarios. This contrasts with general societal expectations that pandemic-driven excess mortality has either already ended or will decline to zero imminently. We highlight that a consistent definition and methodology is key to accurately monitor excess mortality.

The impact on life insurance companies will depend upon how population level excess mortality forecasts translate into insured populations. Our analysis of the drivers of excess mortality today show that respiratory and cardiovascular disease are still likely to be key factors for excess mortality in the general population in developed countries in the coming years. Lifestyle factors are also expected to play a role, especially over the long term.

As an industry with long tail mortality exposures, it is important to carefully monitor and measure excess mortality in the years to come and consider how to factor this into pricing and reserving. Scenario based modelling is a useful approach to forecast trends and estimate a likely range of outcomes for insurance portfolios.

Persistent excess mortality should lead to revised mortality expectations, usually by adjusting short-term mortality improvement assumptions. Due to pandemic-related disruptions, it is currently hard to determine underlying mortality improvements, so the focus is on forecasting excess mortality against a pre-existing estimate. Eventually, excess mortality is expected to revert to using mortality trends to set expectations, and will then be used to decide when to revise those expectations.

Changes in the shares of major causes of death, and lifestyle alterations after the pandemic, may require that insurers adapt their underwriting philosophy or even their risk appetite for certain lines of business, in case of material risk shifts associated with the new trends. Understanding the underlying causes of excess mortality can bring valuable input to insurers and other industry players to modify their prevention programmes, in the joint effort to support longer, healthier lives for their policyholders.

There is also the potential for positive developments to influence excess mortality in the years to come. We see several of these triggered by the pandemic, such as the rise of AI in medicine, and new developments in cancer mRNA treatments following the COVID-19 vaccine success. In a scenario where developments like these are effective and widely available, we envisage excess mortality trends becoming far more favourable.

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