

# THE EUROPEAN ACTUARY

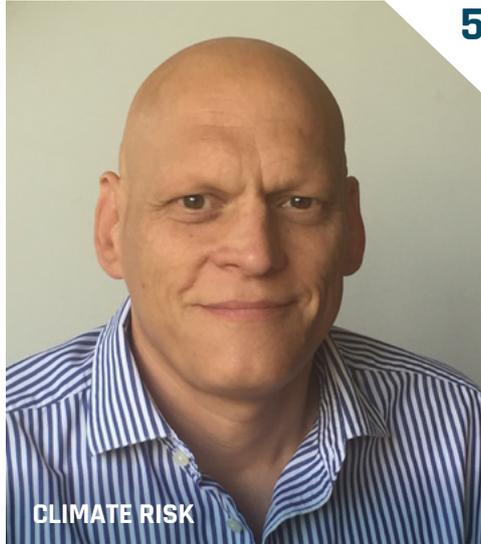
QUARTERLY MAGAZINE OF THE ACTUARIAL ASSOCIATION OF EUROPE

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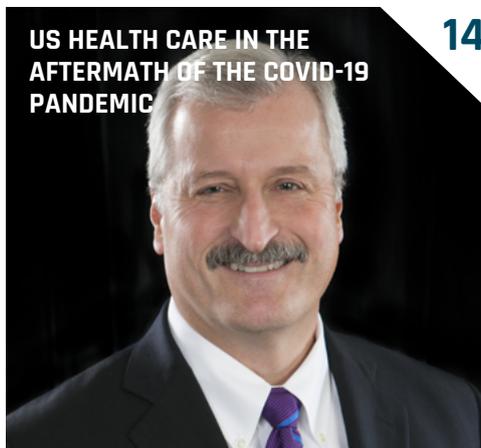


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# MANAGING PANDEMIC RISK

INTERVIEW BY  
**JENNIFER BAKER**

**Esko Kivisaari is the Immediate Past Chairperson at Actuarial Association of Europe. He sat down with Jennifer Baker to talk about the impact of the COVID-19 pandemic on the industry.**

*What exactly is a pandemic from a risk point of view, including the loss of life, interruption of business and even insolvency?*

Well, a pandemic, by definition, is a communicable disease that spreads all over the world. SARS had the potential of becoming a pandemic, but it was stopped. This time, like the Spanish flu, it has spread all over the world. So COVID-19 fulfills the criteria of being a pandemic.

The AAE did a study and it was mostly around the health risk. Even before COVID-19, it was very much understood that a pandemic is a health risk. What we are seeing with COVID-19 is that although there is a slight increase in mortality, the bigger risk is other political actions bundled with COVID-19 meaning that societies are closed down, which plays a huge role for many businesses. Therefore, certainly, business interruption is the big issue.

Nobody really understood how the situation would evolve, because if it had been understood, then

certainly there would have been more insurance. There would have been more preparation on a societal scale on how to deal with such a situation. But I must say that we need to confess it came as a surprise how this evolved. What we can learn from this is that our tightly networked societies could encounter similar issues with other causes. One could imagine cyber risk evolving like this, for example space weather or disruptions in radiation in the atmosphere stopping networks functioning. In our highly networked societies there is a risk of disruption. This time it was the COVID-19 pandemic, the next time it might be something else that stops societies from working in one area or the other.

Likewise, this time it affected mostly the service sector and the restaurants and travel industry. The next time it might be something different, but societies and businesses are not really ready for this. There was not much insurance cover on offer – only in fairly limited situations, did existing policies cover anything

like this – but had there been, there wouldn't have been much appetite from clients to get such cover.

Regarding insolvency risk, we certainly have insolvency risk within insurers, but it's been more about insolvency risk in other businesses – like the service sector having to shut down and being unable to survive. But for the insurance sector, I would say this is a minor issue. For insurers, it's something that current solvency regulation, current solvency buffers, were quite ready to withstand. Even though this summer's flooding in Central Europe and wildfires in Southern Europe were tragic events, they are not really an insolvency risk for most insurers today.

*As you said, the pandemic is pretty much unprecedented in our lifetime and we weren't prepared. Obviously, there has been a very steep learning curve. Do you see any silver lining? For example in businesses' adaptability?*

Well, yes, of course. The first thing to say might be that we are not returning to the old normal. What we thought was normal before COVID 19 will change and hopefully adaptation will be for the good. For example, remote working. Take me, I live in Finland, which means that every time I have a meeting in Brussels, Paris or Frankfurt, it's quite an effort to fly there and stay overnight and have a couple of hours meeting and then fly back. They are long days and are not



ESKO KIVISAARI

good for the climate. So, what we have seen during this period is a huge development in the facilities we can use for working and the technology we can use for remote working. So, there are good things happening.

With the risk landscape, we are seeing something similar to what happened following the 9/11 attacks 20 years ago. When 9/11 happened, no one thought that anything that extensive could happen. Societies, businesses and insurers alike were caught off guard and the initial reaction

was that this is not something you can insure. This was so exceptional, we had no statistics whatsoever, we could not assess the magnitude. But today, terrorism risk is quite well insurable.

What we need for the future is to really analyse the situation, to see what societies can do to mitigate the risks, to reduce the risks, to define the risks and to be prepared with faster output of vaccines etc. Analysis can help us work out what businesses can do, and how insurers should

develop their products. Then you can have a situation like with 9/11 when terrorism risk became manageable.

A calamity is really a calamity if you don't learn anything from it. Of course it is tragic for so many lives to be lost, but we should be able to analyse and learn what we can do better next time.

***You mentioned societies, individuals, businesses and the state. Is there anything in particular that you think governments should do to bear some of the risk?***

I think, again, we should learn from the experiences of 9/11 when, at least in the US, preparations were spread across all areas of administration with no central organisation. So they created a system where somebody is ultimately responsible for all the measures taken. Similar measures have been taken in Europe. In my mind, societies should play a very high role in developing control systems that can stay slightly ahead of the curve when something happens.

We must also define who's doing what, who is responsible and how should that responsibility be shared. As the saying goes 'How do you eat an elephant? You do it in pieces.' So, the role of states should be to cut this whole elephant, or the pandemic risk or any similar risk, into manageable pieces. Then you can define the role of the state, businesses, the individual and

the insurance sector. If you leave it whole, the pandemic is, like the elephant, too big to manage in any meaningful way.

***How much should consumers expect insurance exclusions?***

I would say, initially, quite a lot. As long as the situation is obscure, as long as we don't have the measures I think are needed, then this risk is not insurable. But in the longer run, again like the previous analogy of 9/11, we should see a development where insurance against risks like this is commonplace. Then you'll have policies – even not too expensive ones – where you can manage the thing. After all, actuarial techniques or insurance is all about sharing a risk. You must be able to understand the amount of the risk, you must be able to bundle the same risks together. Then you can make something that is initially too expensive for any individual, to be financially manageable to many.

***What is the impact on pension and social security coverage?***

Very limited. Although there is some extra mortality, it's not much more than the normal variation because other things changed. For example, traffic stopped, so there were far fewer deaths because of traffic. With respect to pension systems and social security I'm sorry to say it, but the extra mortality was primarily among the older population. You could even very cynically say that some of

it supported our social security systems. So I think the health risks associated COVID-19 were anticipated as Life and Health Insurance risks.

***What's your message on how the actuarial profession might be placed to help?***

Well the basic actuarial technique is the pooling of risks, creating sustainable ways of sharing risks that vary in many situations. In recent decades, the actuarial profession has become much more an overall risk management profession, meaning that you're dealing with the risk management aspects of not only insurers, but all other areas. So, the actuarial profession needs to be active in the areas where it has expertise – risk sharing or pooling– so that risks are managed in a good and scientific way.

# CLIMATE RISK

BY **BEN CARR**

The Paris Agreement came into force on 4 November 2016 and has been ratified by 185 countries to date. It aims to strengthen the global response to the threat of climate change by keeping global temperature rises to well below 2°C above pre-industrial levels.

**T**he Financial Stability Board's Taskforce on Climate-related Financial Disclosures (TCFD), chaired by Michael Bloomberg, published its recommendations on 29 June 2017<sup>1</sup>. These voluntary disclosures cover how companies take into account climate-related risks and opportunities in their governance, strategy and risk management, as well as the metrics and targets that they use to do this. In particular, organisations are urged to perform scenario analysis to analyse the resilience of the company's business model and strategy.

The European Commission has integrated the TCFD's recommendations into its guidelines on non-financial

reporting<sup>2</sup>, including taking into consideration the impact of different climate-related scenarios over different time horizons, including at least a 2°C or lower scenario and a greater than 2°C scenario.

Following on from this, the European Insurance and Occupational Pensions Authority (EIOPA) has issued an Opinion on the supervision of the use of climate change scenarios in the Own Risk and Solvency Assessment (ORSA) setting out its expectations on the integration of climate change risk scenarios by insurers in their ORSA<sup>3</sup> and the Network for Greening the Financial System (NGFS) have recently published the second iteration of their climate scenarios<sup>4</sup>.

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<sup>1</sup> <https://www.fsb-tcfd.org/>

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<sup>2</sup> European Commission's Guidelines on non-financial reporting – Supplement on reporting climate-related information, Communication from the Commission, OJ C 209, 20.06.2019, p. 1.

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<sup>3</sup> [EIOPA issues Opinion on the supervision of the use of climate change risk scenarios in ORSA](#)

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<sup>4</sup> [NGFS Climate Scenarios for central banks and supervisors](#)



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These scenarios have been created through a suite of models, supported by a consortium of world leading climate scientists and modelling groups. They include nearly 1,000 economic, financial, transition and physical variables. The variables are calibrated to the latest available data and all variables are made available for free on the NGFS website so that anyone can take advantage of information they provide.

Climate change risk scenario analysis enables the potential impact of transition and physical climate change risks to be evaluated by insurers. Transition risks and opportunities include the projected costs of policy action related to limiting greenhouse gas emissions as well as projected profits from green revenues arising from developing new technologies and patents. Physical risks cover the financial impact of climate change through extreme weather as well as the impact of rising sea levels and mean temperatures.

The Inter-governmental panel on climate change (IPCC) Global warming of 1.5°C report<sup>5</sup>, published in October 2018, indicates the need to take dramatic action now to keep warming below 1.5°C and the potential severe consequences if this is not achieved. The scale of change needed to meet the 1.5°C target is unprecedented; industry will have to slash their CO<sub>2</sub> by 65% to 90% by 2050 and investments in low-carbon energy technology and energy efficiency will need to increase

5-fold by 2050 versus 2015 levels. Buildings and transport will also need to shift heavily towards green electricity and tools to remove CO<sub>2</sub> emissions from the atmosphere, such as carbon capture and storage (unproven at scale), will be needed to store 100 to 1,000 gigatons of CO<sub>2</sub> over the century.

The NGFS explore a set of six scenarios covering the following dimensions:

- **Orderly scenarios** assume climate policies are introduced early and become gradually more stringent. Both physical and transition risks are relatively subdued.
- **Disorderly scenarios** explore higher transition risk due to policies being delayed or divergent across countries and sectors. For example, carbon prices would have to increase abruptly after a period of delay.
- **Hot house world scenarios** assume that some climate policies are implemented in some jurisdictions, but globally efforts are insufficient to halt significant global warming.

In hothouse scenarios one can expect increased precipitation, coastal and river flooding, periods of extreme heat and cold, wildfires and droughts. In addition, sea levels could rise significantly resulting in major displacement of populations as well as spread of diseases currently typical

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<sup>5</sup> [The Inter-governmental panel on climate change \(IPCC\) Global warming of 1.5°C report](#)

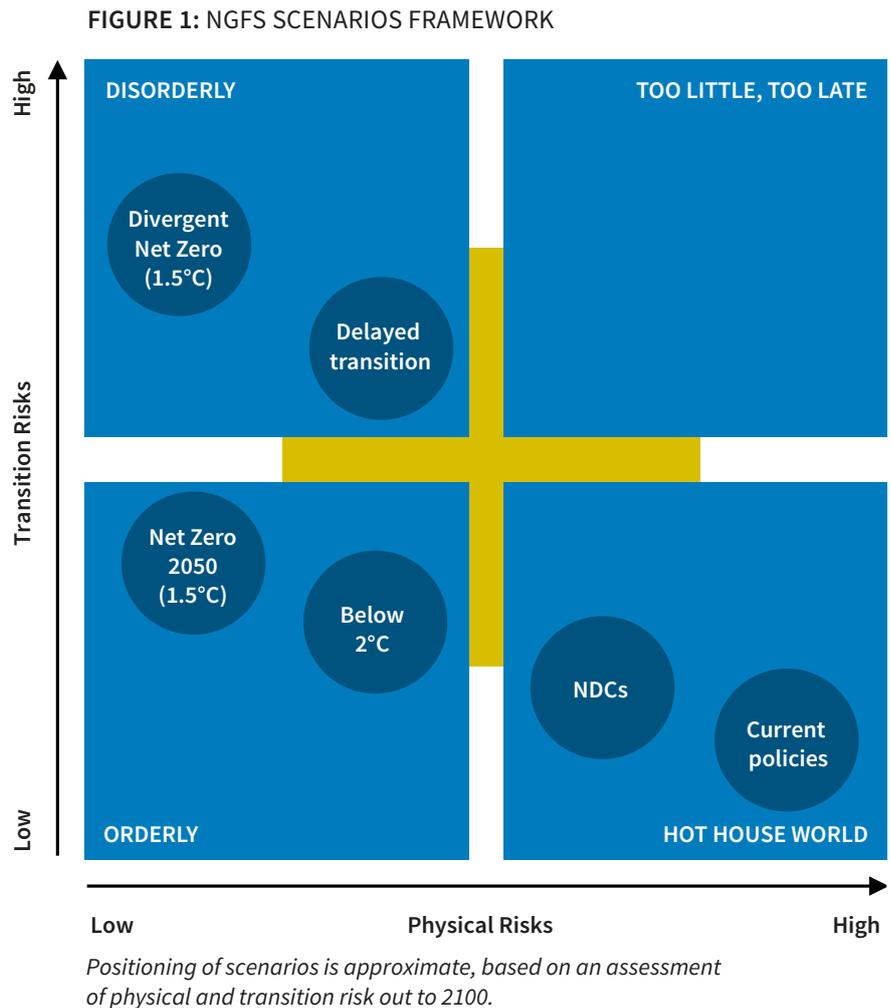
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only in tropical areas to more temperate areas and the likelihood of tipping points being reached is much higher.

Finally, particularly in the more extreme warming scenarios it is also important to consider whether climate may trigger changes in social attitudes which result in increased litigation against companies for failing to reduce emissions or to disclose climate risks transparently.

Along with nineteen other institutional investors from eleven countries, Aviva participated in a United Nations Environment Programme Finance Initiative (UNEP FI) Investor pilot project which published a Changing Course report<sup>6</sup>. In the report they presented a Climate Value-at-Risk (Climate VaR) measure developed in conjunction with Carbon Delta<sup>7</sup>. This Climate VaR measure provides a holistic forward-looking view of the impact of climate-related transition and physical risks and opportunities on investors' equity and corporate bond portfolios.

Aviva has extended the Climate VaR approach to enable it to be applied to our whole balance sheet<sup>8</sup>. To support this initiative, we set-up an internal inter-disciplinary team with representation from across the business to manage the project day-to-day and an expert panel was set-up to review and challenge the main assumptions made in the selection,



development and modelling of the scenarios.

The initial result of Aviva's Climate VaR analysis compares a plausible range of outcomes (5th to 95th Percentile) from the different scenarios considered. In this analysis, our exposure is greatest to hothouse scenarios where physical risk dominates, negatively impacting long-term investment returns on equities, corporate bonds, real estate, real estate loans and sovereign exposures.

In orderly and disorderly scenarios the physical risk impacts are much more limited but there is still downside risk

<sup>6</sup> See [www.unepfi.org/wordpress/wp-content/uploads/2019/05/TCFD-Changing-Course-Oct-19.pdf](http://www.unepfi.org/wordpress/wp-content/uploads/2019/05/TCFD-Changing-Course-Oct-19.pdf)

<sup>7</sup> Carbon Delta is an environmental FinTech research firm that specialises in identifying and analysing the climate change resilience of publicly traded companies which recently became part of MSCI.

<sup>8</sup> For further details on Aviva's Climate VaR methodology, please see [Aviva's 2020 Climate-related Financial Disclosure](#).

on long-term investment returns from carbon intensive sectors (for example utilities) as a result of transition policy actions. This is offset partially by revenues on new technologies from some sectors (for example motor vehicles).

When aggregated together to determine an overall impact of climate-related risks and opportunities across all scenarios, the plausible range is dominated by the results of the higher temperature scenarios, reflecting that neither existing nor planned policy actions are sufficiently ambitious to meet the Paris agreement goal.

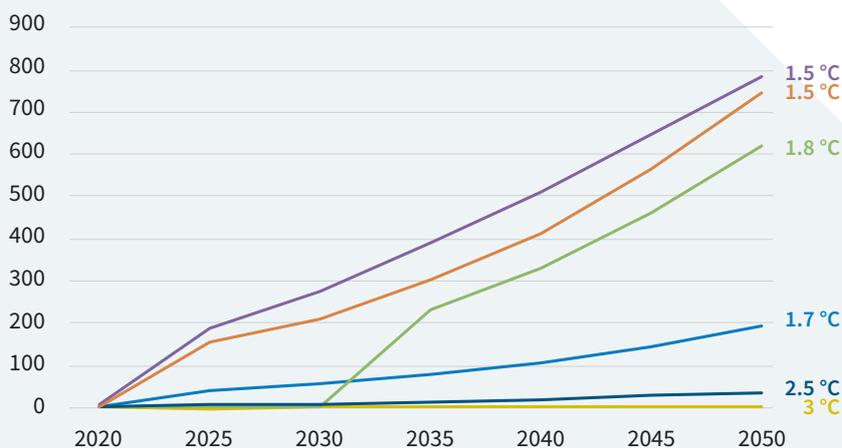
In all scenarios the impact on insurance liabilities is more limited than on investment returns. However, there is potential for some impact on life and pensions business as a result of changes in mortality rates in different scenarios either from physical effects such as more extreme hot and cold days or transition effects related to changes in pollution levels.

The impact on general insurance liabilities is relatively limited because of the short-term nature of the business and the ability to re-price annually and mitigation provided by our reinsurance programme. However, the physical effects of climate change will result in more risks and perils becoming either uninsurable or unaffordable over the longer term.

The development of tools such as Climate VaR is just the beginning of the journey to increase understanding of the impact of climate-related

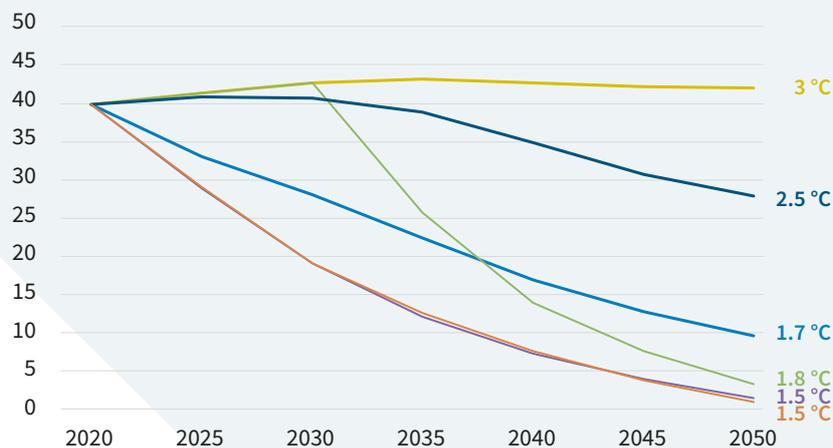
risks and opportunities and approaches will undoubtedly evolve and improve in the light of new research and data becoming available.

FIGURE 2: CARBON PRICE DEVELOPMENT USD(2010) /tCO<sub>2</sub>



Source: IIASA NGFS Climate Scenarios Database, REMIND model. Carbon prices are weighted global averages.

FIGURE 3: CO<sub>2</sub> EMISSIONS BY SCENARIO Gt CO<sub>2</sub>/YEAR



Source: IIASA NGFS Climate Scenarios Database, REMIND model. End of century warming outcomes shown.

- Below 2°C
- Current Policies
- Delayed transition
- Divergent Net Zero
- Nationally Determined Contributions (NDCs)
- Net Zero 2050 (1.5 °C)

# ARE THE DIFFERENCES IN RISK MARGINS MEANINGFUL?

BY **ANDREW HENNING**  
AND **DAVID KIRK**

The risk margins included in technical provisions for solvency reporting are not the same across different regulatory regimes.

**T**his is true even where the underlying principles guiding the regulatory approach seems quite similar. Some of these differences are subtle, but others reflect a fundamentally different view on the purpose of the risk margin.

The time is also appropriate to dig into these differences. IFRS17 has forced insurers to reconsider their risk margin and risk adjustment methodologies. European insurers operating in emerging or non-EEA markets or looking to enter emerging markets, may have opportunities to influence regulations, including those on risk margins.

This article compares the non-life risk margin under three solvency regimes, namely:

- Solvency II.
- Solvency Assessment and Management (SAM), the Solvency II derived regulations applicable in South Africa.
- Swiss Solvency Test (SST).

One item all three have in common is the 6% cost of capital rate. Despite this agreement, the rate continues to be a source of intense debate.



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Considering all views, it is too high and possibly too low, too interest rate sensitive and difficult to hedge, theoretically flawed and, according to some, entirely the wrong approach altogether.

We don't delve into these issues in this article, but it is clear that South Africa followed Solvency II's approach with little interrogation, and Solvency II was heavily influenced by early papers developing ideas for SST a decade and a half ago.

### ITEMS CONSIDERED IN THIS ARTICLE

This article is only limited to the scope of the calculation of the non-life risk margin under the three regulatory regimes.

The items covered for each of the three regimes includes:

- Calculation methodology of the risk margin.
- Projection frequency of the regulatory capital requirement.
- Capital projection starting from  $t = 0$  or 1?

We use the term risk margin to refer to the risk margin analogue Market Value Margin (MVM) under the SST for simplicity. This article will also refer to Solvency II terminology for Solvency II to allow for easier reading and understanding.

### CALCULATION METHODOLOGY OF THE RISK MARGIN

This section discusses some key differences in methodology applied in calculating the non-life risk margin under each of the three regulatory regimes considered.

### General Methodology

Under all three regimes, the non-life risk margin calculation is performed using a cost of capital approach. That is, calculating the risk margin as the discounted present value of the cost of projected regulatory capital requirement over a future time period.

### Definition of the capital requirement

The risk margin calculation under the three regimes is based on the regulatory capital requirements calculated over a future period.

However, there are some differences in definition of the regulatory capital requirement under the three regimes. The table in *Figure 1* shows a summary of these differences.

The capital requirement principle is the same for Solvency II and SAM. However, the SST uses a tail value at risk compared to the value at risk used under both SAM and Solvency II.

The value at risk measure represents the loss that will be incurred for a certain confidence level. The tail value at risk represents the expected loss given that the loss exceeds a loss at a specified confidence level.

While the tail value at risk measure will always be greater or equal to the value at risk for a given confidence level, SST and Solvency II are calibrated with different confidence levels (99% vs 99.5% respectively).

The standard formulae for deriving capital requirements are quite different between SST and Solvency II. While SAM inherited much of its structure and calibration from Solvency II, there are key differences in health underwriting risk, default risk, treatment of sovereign default risk, matching and volatility adjustments and other allowances

**FIGURE 1:** CAPITAL REQUIREMENTS

REGULATORY REGIME	DESCRIPTION
Solvency II SCR	99.5% value at risk over one year time horizon
SAM SCR	99.5% value at risk over one year time horizon
SST ZK (target capital)	99% tail value at risk over one year time horizon, excluding operational risk

for illiquidity premia, and more subtle differences in treatment of contract boundaries and volume measures for non-life underwriting risk.

Given these differences, the capital required for an identical portfolio of risks can vary dramatically. These differences in results will change non-life risk margin calculated under the different regimes.

#### Transfer scenario assumed

The risk margin calculation under all three regimes is based on a regulatory capital requirement under a prescribed transfer scenario.

The transfer scenario considers existing obligations and therefore excludes allowance for future new and renewal business for all three regimes.

#### Projection period under the risk margin calculation

The Solvency II and SAM risk margin calculation is intended to support the insurance liabilities up to their contract boundary.

The SST does not specify a concept such as a contract boundary. However, cashflows for contractually binding insurance obligations should be recognised under the SST.

Determining the contract boundary is simpler for non-life insurance than life insurance. Non-life insurance contract boundaries are typically shorter with regular re-pricing expected, compared to longer term or whole of life contracts with specific premium guarantee periods and/or limitations on re-underwriting or changing premiums within the contractual policy term. As such, the differences in projection periods between Solvency II, SAM, and the SST for non-life are not usually a primary driver of differences.

### PROJECTION INTERVAL OF THE REGULATORY CAPITAL REQUIREMENT

#### Impact of projection interval used in estimating the risk margin

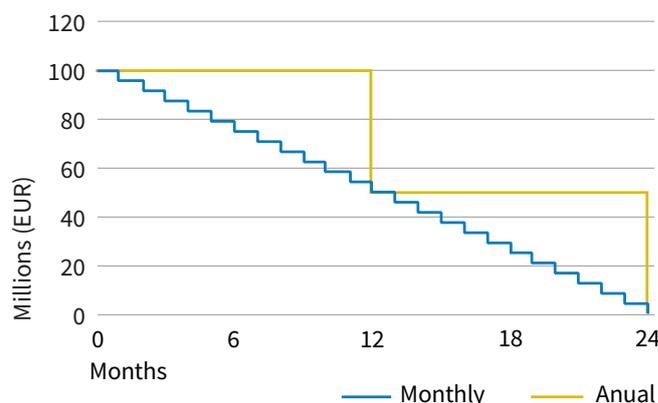
The calculation of the risk margin is based on the discounting of future cost of capital on required capital under the respective regulatory regime.

However, there are some differences in the prescribed projection interval for the regulatory capital requirements i.e., whether it's projected monthly, quarterly, or annual.

To illustrate this difference, let's consider an example where an insurer has a regulatory capital requirement of EUR 100 million. For the purposes of this calculation, we made a simplifying assumption that when calculating the full projected regulatory capital, it will run off linearly over a two-year period. The impact of discounting is also ignored for this example.

The area below the graphs in *Figure 2* demonstrates the impact on the calculated risk margin.

**FIGURE 2:** CAPITAL REQUIREMENT RUNOFF BY PROJECTION FREQUENCY



The table in *Figure 3* illustrates the calculated risk margin using different projection intervals. This table assumes that the risk margin calculations include the projected regulatory capital from time 0 onwards in the calculation.

The cost of capital rate for each of the scenarios above was calculated converting the cost of capital rate to an effective rate for the relevant period. That is, the quarterly cost of capital rate was calculated as  $(1 + CoC)^{\frac{1}{4}} - 1$  and the monthly cost of capital rate was calculated as  $(1 + CoC)^{\frac{1}{12}} - 1$ . (The results are not materially different if other approaches are used to convert the annual cost to monthly and quarterly.)

**FIGURE 3: RISK MARGIN BY PROJECTION FREQUENCY (EUR MILLIONS)**

SCR PROJECTION INTERVAL	RESULT
Annual	9.0
Quarterly	6.6
Monthly	6.1

The table in *Figure 3* illustrates that the calculated risk margin differs based on the choice of regulatory capital projection interval. The differences will increase under shorter capital runoff patterns. The impact is significant for non-life insurers writing mostly business with short contract boundaries where much of the SCR runs off after the first few months.

**SAM prescribed Projection frequency**

The SAM regime does not unambiguously specify the SCR projection frequency to use in calculating the risk margin.

Deeper inspection suggests that the SAM technical specifications are most consistent with an annual projection of regulatory capital in calculating the risk margin. Evidence to support the argument for an annual SCR projection frequency includes:

- The technical specifications state that the regulatory capital for the reference insurer is calculated every year under the proportional approach (level 2 of the simplification hierarchy).
- The technical specification refers to ‘the years’ where the assumptions of the duration approach are outlined (level 3 of the hierarchy).
- The annual Quantitative Regulatory Return explicitly refers to the annual runoff in regulatory capital on the ‘TP2.4S’ tab.
- The cost of capital rate, stated as 6%, is defined as an annual rate and therefore the risk margin

- formula as specified can only directly be interpreted as requiring an annual frequency.
- Annual intervals are prescribed under Solvency II in calculating the risk margin. The risk margin calculation and parameterisation were taken directly from Solvency II.

On the other hand, recent guidance issued by the South Africa Prudential Authority on the Iterative Approach for determining risk margin states ‘The projection period can use monthly, annual or as a simplification, greater than annual intervals.’ The iterative risk margin has been adopted in South Africa exclusively by life insurers, where the impact of the choice between an annual or monthly projection interval is far smaller given the much slower runoff of the SCR.

**Solvency II and SST prescribed Projection interval**

The Solvency II and SST technical specification explicitly states that the risk margin should be calculated using annual projection intervals of the regulatory capital. Our understanding is that non-life insurers reporting under Solvency II almost universally use annual projection intervals in calculating their risk margins.

**Capital projection starting from t = 0 or 1?**

Under SAM and Solvency II, the risk margin calculation applies a cost of capital rate to the

**FIGURE 4: RISK MARGIN BY PROJECTION FREQUENCY AND T = 0 OR 1 (EUR MILLIONS)**

SCR PROJECTION INTERVAL	RESULT: PROJECTION FROM START OF FIRST YEAR	RESULT: PROJECTION FROM END OF FIRST YEAR
Annual	9.0	3.0
Quarterly	6.6	1.8
Monthly	6.1	1.6

projection of future regulatory capital starting at time 0.

In the authors' experience, this practice is universal in South Africa. It is also consistent with Solvency II. However, some otherwise excellent papers on the Solvency II risk margin have specified calculations from  $t = 1$ , possibly not appreciating the practical implications of this difference.

This rationale under SAM and Solvency II, however, stands in contrast to the calculation of the market value margin under the Swiss Solvency Test.

SST assumes that the regulatory capital requirement at time 0 absorbs losses up to a 1-in-200 loss over a one-year time horizon. After suffering the losses, the insurer will have no risk-bearing capital at the end of the first year. The transfer of the portfolio of assets and liabilities is assumed to take place, under which the reference insurer requires compensation for raising additional capital during runoff of the insurance portfolio.

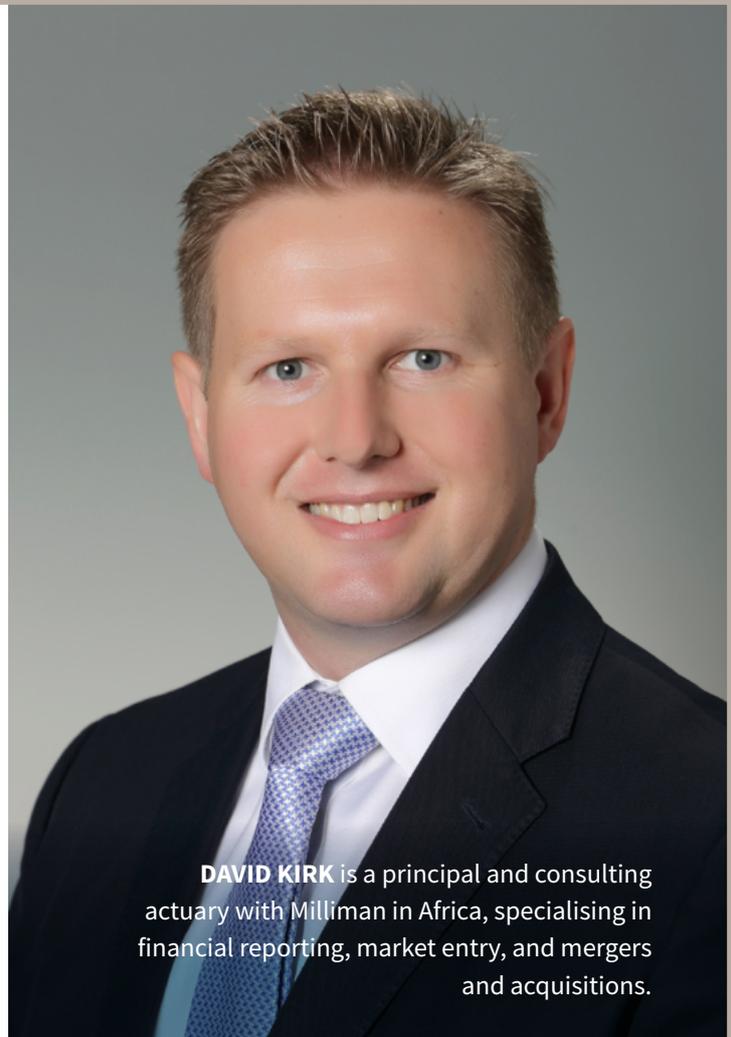
As such, the MVM under SST only considers the cost of capital of the regulatory capital requirement from time 1 onwards. The impact of this difference will be significant in a non-life context where the regulatory capital has a short runoff period, due to short contract boundaries and due to the capital requirement at time 0 typically driving the size of the risk margin held.

The table in *Figure 4* shows the risk margin calculation assuming a capital projection starting at the end of the first year, contrasted to *Figure 3*.

Starting the projection from the end of the first year resulted in a reduction of 67% and 74% in the risk margin calculation using annual and monthly projection frequencies respectively compared to that starting at the valuation date.

## CONCLUSION

In theory, the risk margin is a well understood component of the balance sheet. In practice, different interpretations and imprecision can easily result in a sixfold difference between results for



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similar insurers—even before allowing for a range of simplifications and their potential misuse.

In South Africa, there is not yet industry consensus on which of these combinations of practices is required or permitted.

As other countries adopt Solvency II style risk-based capital regimes, regulators will hopefully understand these differences and define the intended calculation precisely.

For European insurers operating in other markets, it would be worth confirming the local practice and treatment rather than assuming it is identical to home territory treatment. Unintentional compliance breaches or inefficient deployment of unnecessary capital are both possible.

Finally, given the differences already highlighted and separate ongoing and complex debates, the dream of consistent risk margins across territories, and across regulatory and IFRS17 reporting, are likely to be permanently several projection periods in the future.

# US HEALTH CARE IN THE AFTERMATH OF THE COVID-19 PANDEMIC

American baseball player, Yogi Berra, once quipped ‘*It’s tough to make predictions, especially about the future*’. The effect of the pandemic over the past 18 months have been most challenging for health care actuaries and it’s not expected to get easier to predict costs over the next 12-24 months.

BY **EDWARD  
M. PUDLOWSKI**

**M**ost Americans obtain comprehensive health care coverage through their employer, including the program for federal employees. Other government-run safety-net programs exist for veterans (Veterans Affairs), the aged (Medicare), those at or below the Federal Poverty Line (Medicaid), and the otherwise uninsured (The Affordable Care Act Marketplace). For the most part, the system is unregulated and health care costs have increased 3 to 4 times that of general inflation for at least the past four decades<sup>1</sup>. The fact that health care costs on a per capita basis declined in 2020 versus 2019 is truly a sign of how COVID-19 has complicated anyone’s ability to make predictions.

This article is written as a guide for actuaries and other professionals in their consideration as they attempt to predict the direction and level of health care costs. While based on experiences in the United

States, much of what is shared here will have application in other countries around the world.

## **RECOUPMENT OF DEFERRED CARE**

Numerous sources have reported a clear pattern of declining access to the US health care system in 2020 and early 2021 as a result of the desire for social isolation during the spread of the virus. Inpatient hospital admissions dropped nearly 30% in April, 2020 versus the year prior while outpatient and emergency room visits dropped nearly 47%<sup>2</sup>.

Some of the ‘lost’ care will be forgone entirely, like annual physicals and screenings, while other care will be deferred until 2021 or later, such as elective surgeries. Recoupment of some this deferred care in addition to a return to normal utilization levels will, therefore, begin to put pressure on the health care system, limited by what capacity providers

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<sup>1</sup> [Petersen KFF Health System: Tracker](#)

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<sup>2</sup> Strata Decision Technology. National Patient and Procedure Volume Tracker TM Version 12.21.2020

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have to handle any surge in requested care.

### TELEMEDICINE

The use of telemedicine increased dramatically during 2020 due to greater acceptance of its use by providers given their desire to maintain some form of interaction with their patients. Visits via the telephone or the internet peaked at 13% of all medical claim lines in April, 2020 but has dropped to under 5% by April, 2021<sup>3</sup>. Telemedicine can avoid costly visits in other settings (like the emergency room for truly non-critical care) but overuse along with any increase in reimbursement levels at, or close to, in-office visits could create a more costly component in an already expensive health care system.

### MENTAL HEALTH

The stresses from the presence of the virus in the communities, social isolation, and the impact on the economy likely contributed to greater levels of anxiety and depression in the United States. The US Center for Disease Control and Prevention's (CDC) Pulse Survey showed the share of adults reporting symptoms of anxiety or depression disorder is significantly higher in 2020 and 2021<sup>4</sup>. An American Psychiatric Association (APA) poll reported similar results<sup>5</sup>.

The scale and complexity of the pandemic is potentially creating a public mental health burden that could deplete Americans' physical and mental



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health for years, leading to more depression, substance abuse, suicidal thinking, sleep disturbances, heart disease, cancer, high blood pressure and impaired immune function.

### BEHAVIORAL ISSUES AFFECTING HEALTH CARE

Changes in human behavior as a result of the pandemic may have implications on long-term health and the associated costs. A recent survey of about 3,000 US adults by the APA found that 42% of respondents reported undesired weight gain<sup>6</sup>. That same survey reported higher levels of alcohol use to cope with stress during the pandemic.

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<sup>3</sup> Fair Health Monthly Telehealth Regional Tracker

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<sup>4</sup> [www.cdc.gov/nchs/covid19/pulse/mental-health.htm](https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm)

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<sup>5</sup> [www.psychiatry.org/newsroom/news-releases/anxiety-poll-2020](https://www.psychiatry.org/newsroom/news-releases/anxiety-poll-2020)

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<sup>6</sup> [www.apa.org/news/press/releases/stress/2021/one-year-pandemic-stress](https://www.apa.org/news/press/releases/stress/2021/one-year-pandemic-stress)

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These, and other pandemic-induced behavioral concerns, are likely to create health care issues that will need to be addressed in 2021 and beyond.

### **CHRONIC CONDITION MANAGEMENT**

Encounters for diabetes, preventive wellness, and hypertension were well below the utilization levels in 2020 as compared to 2019<sup>2</sup>. The lost visits for chronic conditions may signal a significant health care crisis in the US as 6 in 10 adults have a chronic disease, according to the CDC<sup>7</sup>. The increased level of care required to treat these unmanaged conditions will likely play a part in increased utilization and cost of services in 2021 and beyond.

### **LONG-COVID**

A study of adults in Switzerland who had contracted COVID-19 found that a quarter of them still had symptoms for six to eight months following their illness<sup>8</sup>. There is a wide array of symptoms that can appear. How long will these patients require treatment? What side effects will be permanent? Will the permanent side effects require continuing care? Answers to these questions will afford us better insights into the needed treatment and cost for care of these conditions.

### **HEALTH CARE PROVIDER IMPLICATIONS**

Financial pressures on providers during the pandemic may lead to further consolidation. In fact, physicians continued to leave independent practices to join

hospital systems at a faster pace during the pandemic in 2020 than occurred in 2019<sup>9</sup>. Health care providers may leverage the increased buying power in negotiations with payors.

### **PROJECTIONS**

In addition to the cost of testing and vaccinating for COVID-19, as well as the direct cost of treating COVID-19 patients, the issues outlined in this article are likely to apply upward pressure on health care costs in 2021 and 2022. The cost for treating COVID-19 patients should diminish as more people get vaccinated. However, pandemic induced demand from mental health claims, behavioral health issues, lack of chronic condition management, continued treatment for Long-COVID conditions, and provider pressures on payors will add to the normal underlying increases in health care costs.

Modeling of health care costs and the associated trends, using a combination of the 2021 Health Care Cost Model produced by the Society of Actuaries<sup>10</sup> and models developed by MorningStar Actuarial Consulting, suggest that health care costs will experience trends in excess of the expected underlying trend in the absence of the pandemic in 2021 and 2022. It is not out of the range of reasonableness for 2021 average per capita costs to be as much as 15% greater than the costs experienced in 2020. Claim cost trends for 2022 are expected to be milder by comparison to 2021 but still above typical health care trends.<sup>11</sup>

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<sup>7</sup> US Center for Disease Control and Prevention  
[www.cdc.gov/chronicdisease/index.htm](http://www.cdc.gov/chronicdisease/index.htm)

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<sup>8</sup> PLOS ONE 'Burden of post-COVID-19 syndrome and implications for healthcare service planning: A population-based cohort study'

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<sup>9</sup> Physician Advocacy Institute 'COVID-19's Impact on Acquisitions of physician Practices and Physician Employment 2019-2020', June 2021 Prepared by Avalere Health

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<sup>10</sup> [www.soa.org/resources/research-reports/2020/covid-19-cost-model/](http://www.soa.org/resources/research-reports/2020/covid-19-cost-model/)

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<sup>11</sup> This article and these projections were made prior to the recent surge in COVID-19 in the US resulting from the Delta variant. This may affect expected usage of non-COVID related care that forms the basis of these estimates.

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# THE CORONA VACCINATION DILEMMA

BY **SERVAAS HOUBEN**

**Servaas Houben takes a new look at the classical prisoner's dilemma and an application to COVID-19 vaccination**

Although the benefits of vaccination for a society as a whole are obvious, a non-negligible part of mostly young and healthy people will refuse this protection against COVID-19. In game theory, the prisoner's dilemma provides individual decision makers with a similar problem: choosing an optimizing strategy for individual players does not result in an optimal outcome for society as a whole. Game theory can also explain the current refusal of individuals to get vaccinated and show the impact of incentives.

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This article also appeared on the UK Actuary

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## PRISONER'S DILEMMA REVISITED

The prisoner's dilemma is one of the most famous examples of Game Theory. In this game, two prisoners (Abi and Ben) are suspected committing a crime. The prisoners can either remain silent (S), or confess (C) and betray the other prisoner. The police does not have sufficient evidence to prosecute either of them on the principal charge without a confession from either prisoner, however there is sufficient evidence to convict them on a lesser charge. Therefore, the prisoners are offered an incentive by the police in the form of a reduction in their sentence if they confess. Abi is not allowed to communicate with Ben throughout.

Let's suppose the payouts for the prisoners are as follows:

- Benefit of confessing is +1 for the reduction in penalty
- When neither confesses, there is a small penalty of -1 for the lesser charge
- When there is sufficient proof (the other prisoner chooses Silence) there is a large penalty of -10 for the principal charge
- If they both confess then the each of them are penalised -9.

**TABLE 1: ORIGINAL PRISONERS DILEMMA**

		Ben	
		Silence	Confession
Abi	Silence	(-1, -1)	(-10, 0)
	Confession	(0, -10)	(-9, -9)

Looking at the payoff matrix in Table 1 it is clear the best option for both prisoners is to remain silent (top left). In this case each of them receives a small penalty of -1 and the total negative benefit for the both of them is -2. However, when looking at the optimizing choice for each individual one can see that it is always beneficial to choose confession (C):

- Case 1, the other person stays silent: choosing S receives -1, while choosing C receives 0, hence C is the better option;
- Case 2, other prisoner also confesses: option S receives -10, while option C receives -9, hence option C is the better option.

Therefore rational players will choose their optimizing strategy to confess, and the result will be the right bottom option with a total negative benefit of -18, worse than the total of -2 if they had both chosen to cooperate and stay silent.

## PRISONER'S DILEMMA IN COVID-19 CONTEXT – 1 PERSON

The example above in the 2-person game can also be used for the choice for vaccination (V) or refusal (R). For an individual however the game needs to be adjusted slightly: instead of having a game with 2 persons, there is now a game between:

- the individual (I), and
- the rest of the society (S).

We assume the following payouts:

- benefit for getting the vaccine is -1 (because some people suffer vaccination side effects);
- benefit of no lockdown is 0;
- however, lockdown costs are severe at -10;
- lockdown occurs when most of Society chooses Refusal; and
- importantly, the choice of a single individual cannot result in lockdown regardless.

The game then looks as follows:

**TABLE 2: PRISONER DILEMMA**

COVID-19 dilemma – individual versus society

		Society (S)	
		Vaccine	Refusal
Individual (I)	Vaccine	(-1, -1)	(-11, -10)
	Refusal	(0, -1)	(-10, -10)

The game is still the same from the individual perspective in the original prisoner's dilemma: the better option for I is to play R as it is the higher payout in each of the scenarios. However, the choice of S is independent of the choice of I. The choice of a single individual (person I) does not have a material effect on society as whole: no lockdown, evening curfew, or closure of schools occurs when only a single person decides not to take the vaccine. Hence

the payouts to S will not be impacted by the choice of I, and choosing V is best for S independent of the choice if I.

This example shows that when a single individual decides not to get the vaccine, this does not negatively affect the payout to society as the impact of the individual's choice on the outcome of the game is immaterial.

### PRISONER'S DILEMMA IN COVID-19 CONTEXT – GROUPS

Now suppose that instead of a single person, an entire substantial group (G), say 50% of the population, refuse the vaccine. This alters the game as a bigger group will have a material effect on the outcome for the rest of society (S). The game is now as follows:

**TABLE 3: PRISONERS DILEMMA**  
COVID-19 dilemma – group versus society

		Society (S)	
		Vaccine	Refusal
Group (G)	Vaccine	(-1, -1)	(-6, -5)
	Refusal	(-5, -6)	(-10, -10)

As G has now a material impact on S, when G decides to play R this will now have an effect for the entire society implying there is a higher chance (50%) of lockdown.

This example shows that when a group decides not to get the vaccine, this does negatively affect the payout to society as the impact of the groups' choice on the outcome of the game is material.

### THE INDIVIDUAL VS GROUP PARADOX

The discussion above shows that society can end up with in a worse equilibrium (no-one taking the vaccine) if it lets individuals decide themselves on whether to take the vaccine or not. Clearly one individual by herself does not impact the society as a whole. The optimizing strategy for an individual person is thus not to take the vaccine (R):

- The individual by herself will not impact the possibility of lockdown

- By not taking the vaccine, the individual avoids the drawbacks of taken the vaccine and saves 1.

However when a substantial part of society decides to play this strategy then the outcome of society as a whole worsens: in Table 3 when all individuals in group G decide not to take the vaccine (R) (based on their individual preference in Table 2) the best possible response from S is it play V to limit the impact on society resulting in an overall loss of -11 (left bottom), however this is a worse outcome than the one in the left top corner of -2. How can we induce individual people in a free society to make the right choice for society instead?

### Conclusion – use incentives in a free society to get to the optimal equilibrium

As in a free society there is no option of compulsory vaccination, and it is up to the individual to make the vaccination decision, incentives have to be provided to make the choice for option V more attractive (additional benefit of 2 when choosing option V) so that the original Table 2 now changes as follows:

**TABLE 4: PRISONERS DILEMMA**  
COVID-19 dilemma – Individual vs. society with incentives

		Choice S	
		Vaccine	Refusal
Choice I	Vaccine	(+1, -1)	(-9, -10)
	Refusal	(0, -1)	(-10, -10)

The choice for I has now changed in row V for which the outcomes are now changed with +2 compared to the outcomes in Table 2. As a result, the optimizing strategy for I has changed from playing R to playing V resulting in a better overall outcome in Table 3 as now the top left is the new equilibrium.

We therefore conclude that the current policies for providing positive incentives (easier travelling, access to events) to people taking the vaccines will benefit the outcome of the decision-making process resulting in better outcome for society as a whole. The end stage could be that the group of people not taken the vaccine (G) is decreasing to such a size that the choice of G does not impact the outcome of society as a whole.

# AUSTRALIA: FROM ELIMINATION TO LIVING WITH THE VIRUS

BY **KIRSTEN ARMSTRONG**

**U**ntil just a few months ago, most Australians thought they'd avoided the worst of the COVID-19 pandemic. In March 2020, we closed our international borders and soon after instituted mandatory quarantine for returning Australians. A strategy of virus suppression and, in some states, elimination has been systematically pursued. Occasional outbreaks have been managed through testing, contact tracing, home isolation, state border closures, a range of public health measures including social distancing, closure of high-risk businesses and masks, and one of the longest and toughest lockdowns in the world during Melbourne's second wave. The people of Melbourne emerged from 112 days of lockdown in 28 October 2020 having successfully eliminated the virus.



## FEW COVID DEATHS AND LOWER MORTALITY ACROSS AUSTRALIA

The result is that just over 1,000 people have died in Australia from COVID-19 since the pandemic began (Figure 1). And with no COVID-19 circulating in the community for much of the past 18 months, between lockdowns life in Australia has felt relatively normal.

In a recent [research report](#)<sup>1</sup> published for the Actuaries Institute Australia, authors Karen Cutter, Jennifer Lang and Richard Lyon examined mortality in Australia throughout 2020, comparing overall mortality to prior years, as well as COVID-specific mortality. Predicted deaths were modelled based on prior years' experience and factoring in a general trend of mortality improvements of 3.5% over five years.

Overall, Australian mortality was much lower than recent trends, with around 3,900 (2.7%) fewer deaths in 2020 than predicted (Figure 2).

This is a remarkable contrast to much of the rest of the world and largely due to lower deaths from respiratory illness - around 3,200 fewer than predicted (Figure 3). The public health measures used throughout 2020 meant that common respiratory illnesses like influenza simply weren't able to spread. Indeed after border closures in 2020, just 3 people died from influenza. Dementia deaths were also lower, perhaps because respiratory illness can contribute to dementia-related deaths.

FIGURE 1: COVID DEATHS BY WEEK, AUSTRALIA 2020

Weekly scaled actual doctor-certified deaths

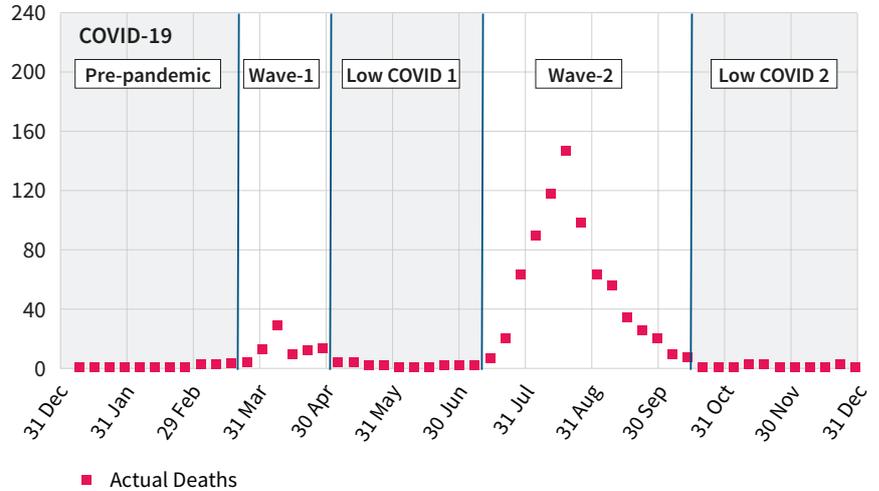


FIGURE 2: ALL DEATHS BY WEEK, AUSTRALIA 2020

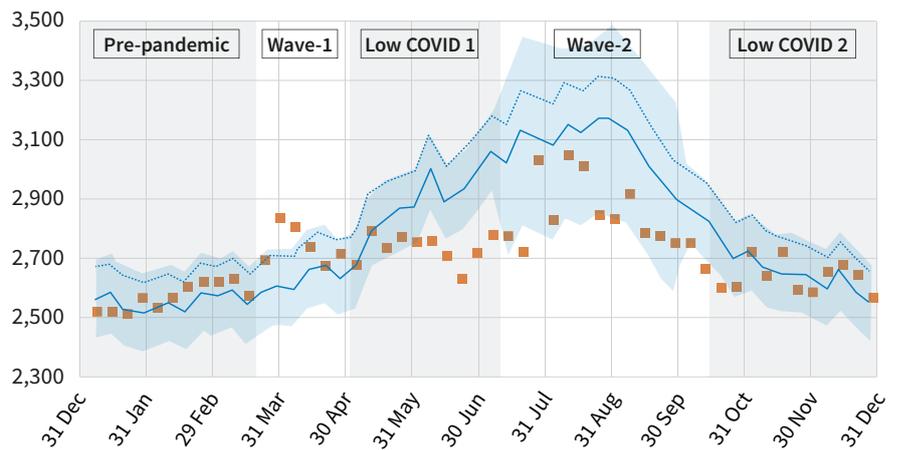
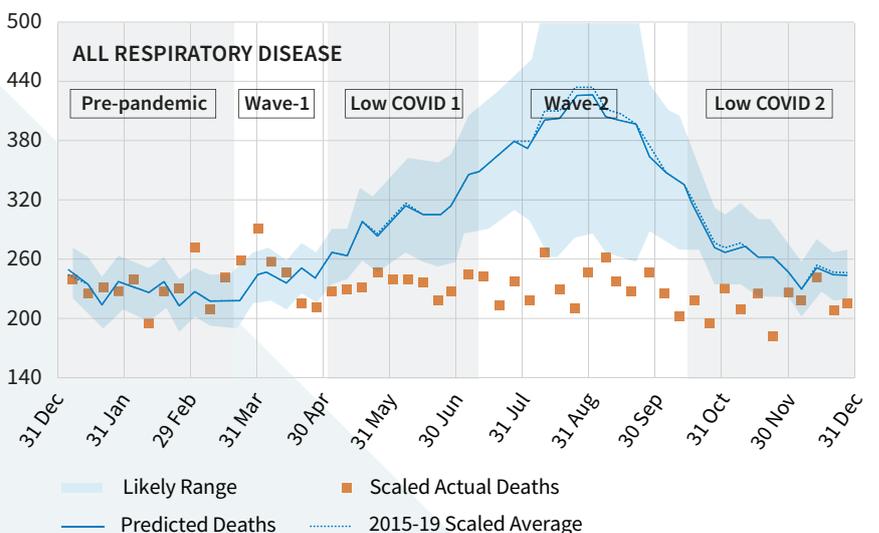


FIGURE 3: WEEKLY SCALED ACTUAL AND PREDICTED DOCTOR-CERTIFIED DEATHS



Actual deaths are scaled to 2020 allowing for population growth and change in age profile; 2020 deaths include allowance for late reporting. Predicted deaths come from the linear trend in each week's scaled deaths in 2015 to 2019.

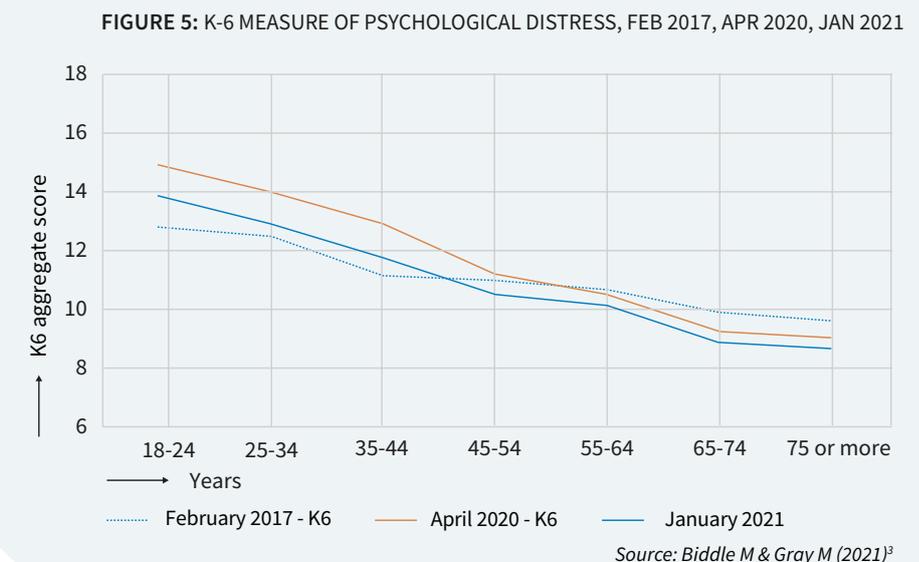
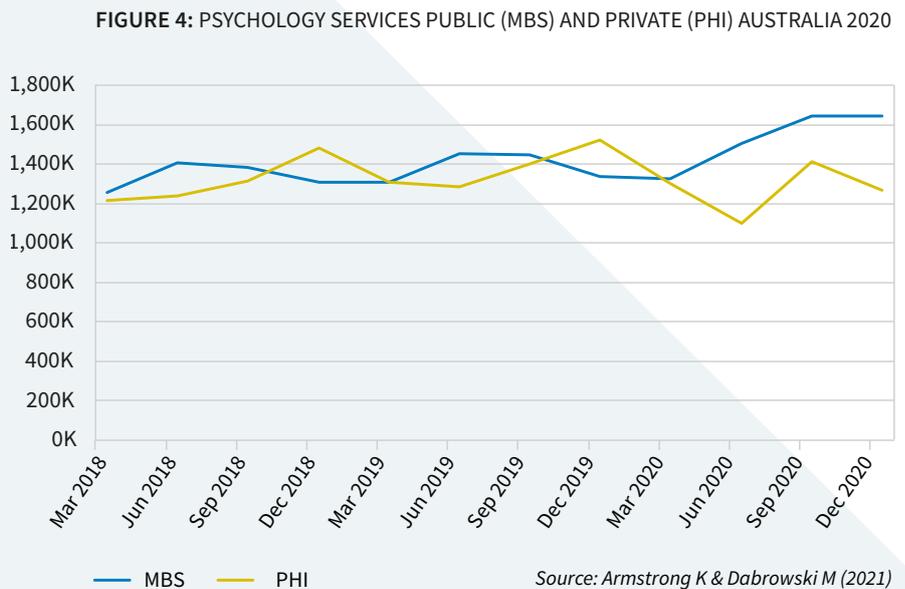
Source: Cutter K et al (2021)

**MENTAL HEALTH SERVICES HAVE INCREASED SIGNIFICANTLY AND TO DATE SUICIDES HAVE NOT RISEN**

Throughout 2020 and 2021, significant investments have been made to boost crisis mental health services, increase publicly-funded psychology services and provide easy access through telehealth. Mental health lobbyists raised alarm bells early that social isolation, uncertainty and economic downturn could all increase mental health risks and suicides if not addressed early. I explored this issue with Matt Dabrowski in a [presentation](#)<sup>2</sup> to the Actuaries Summit 2021.

Psychology services funded through the national public insurance system Medicare (MBS) increased by 10% in 2020 compared to 2019 while private health insured (PHI) services declined by 8% (Figure 4). This was a result of expanding Medicare-funded services from 10 to 20 per person, first in Victoria and nationally in October 2020. Overall, the net increase in services was 9% compared to 2019.

Throughout the pandemic, psychological distress as measured through the Kessler-6 scale has remained higher for young people but surprisingly lower for older people – surprising because it is older people who are most at risk from COVID-19 (Figure 5). The public health measures used in Australia have undoubtedly led to higher levels of distress amongst younger people,



though thankfully this has not to date translated into higher suicide deaths (Figure 6).

**DELTA HAS CHANGED OUR STRATEGY**

Australia’s suppression strategy had been challenged by the delta variant and 2021 is looking very different to 2020. As I write, 60% of Australians – some 15.3

million people - are in lockdown as a result of outbreaks of the delta strain that originated when the virus was transmitted from international flight crew to a Sydney-based limousine driver.

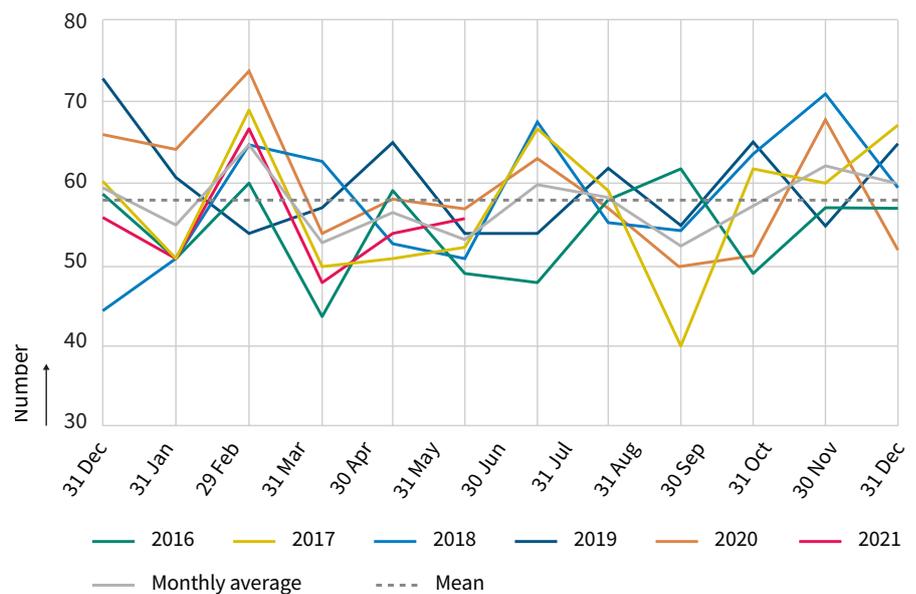
Vaccination coverage was until recently the lowest in the OECD, due to inadequate vaccine supply, poor access and a reticence to get vaccinated

with so little risk of COVID in the community. That's changed with a significant increase of vaccine supply, the arrival of the delta variant and recent vaccine mandates for some workers. Indeed, Australia is currently increasing vaccination coverage at a rate not seen elsewhere in the world (Figure 7). It is hoped that lockdowns and other public health measures will be adequate to keep this latest outbreak in check until 80% of the adult population is vaccinated.

It remains to be seen whether mortality in 2021 will be higher or lower than previous years. Deaths from COVID-19 are currently running at about 3-4 per day, but large increases in cases in Sydney in the past week are yet to filter through and more cases are predicted in the coming weeks. 87% of over-70s have had at least one vaccination, and we have not seen the major outbreaks in residential aged care facilities that punctuated Australia's first and second wave.

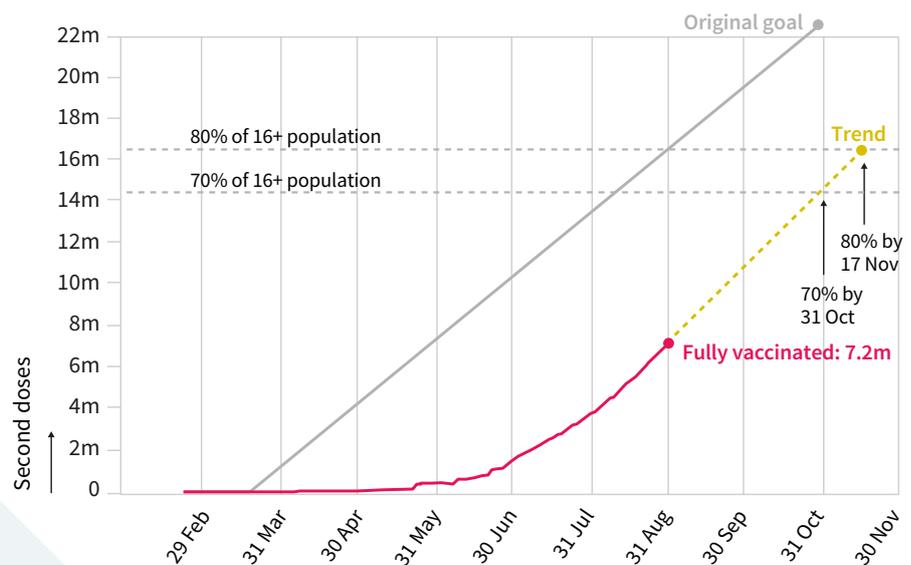
Debate has shifted to what it means to live with the virus and how many COVID deaths we might be willing to accept in order to return to some sort of normal living. Three large purpose-built quarantine centers for returning international travelers have been approved in the past two weeks, suggesting international quarantine will continue to be a feature of our plan. For the time being, lockdowns continue, schools in several states remain closed and debate continues.

FIGURE 6: SUSPECTED DEATHS BY SUICIDE VICTORIA 2016-JUNE 2021



Source: Australian Institute of Health & Welfare (2021)<sup>4</sup>

FIGURE 7: ACTUAL AND PROJECT FULLY VACCINATED AUSTRALIANS, 1 SEPT 2021



Source: The Guardian

- 1 Cutter K, Lang J & Lyon R (2021), Impact of COVID-19 on Mortality and Morbidity in 2020, Actuaries Institute, June 2021
- 2 Armstrong K & Dabrowski M (2021), Mental health and COVID, presentation to 2021 All-Actuaries Virtual Summit, Actuaries Institute, May 2021
- 3 Biddle N & Gray M (2021), Tracking outcomes during the COVID-19 pandemic (January 2021) – Cautious optimism, Australian national University, February 2021
- 4 Australian Institute of Health and Welfare (2021), [Suicide and Self-harm monitoring](#), accessed August 2021

## KEEP LEARNING NEW SKILLS AND COMPETENCIES

The AAE believes that as long as actuaries keep learning new skills and competencies, performing professional services competently and with care, the community of European actuaries will be able to adapt to new challenges more quickly and to become stronger together. The current version of actuarial professional requirements is not the last one as the need to raise the bar seems inevitable in future. AAE is preparing a proposal for European Continuous Professional Development (CPD) Guidelines to assure that actuaries continue further development to maintain and develop skills and knowledge at an appropriate level.

AAE sees it as an important task to provide possibilities for actuaries to maintain and develop skills and knowledge. In June AAE hosted the first virtual European Actuarial Days 2021. The program featured 4 high-ranking Plenary Sessions with renowned guest speakers and over 20 additional presentations. Topics ranged from latest developments in traditional actuarial work areas to new fields of activity like emerging risks, data science and wider fields. The presentations were recorded and made available for those who could not participate in the live event.

AAE also hosts webinars, publishes position papers, and is answering consultations. The activity level is high, and you can follow it either at our website or follow us at Twitter and LinkedIn. The magazine you are reading is also a channel offered for developing your skills and to share knowledge. The last channel to be mentioned is actview. This is a video streaming platform which offers live broadcasts and recordings of (online) events on all actuarial topics as well as additional content provided by actuarial associations, universities, companies and other partner institutions, as well as by individual experts from around the world. Since 2020, AAE is the central European partner allowing all Member Associations and their members, students and affiliated academics to join actview for free. If you do not have access to actview please contact your Member Association.

I hope that you find useful the material offered from AAE to maintain and develop your skills and knowledge.

*Gunn Albertsen*

*AAE Board member*

*Member of the Editorial Board of TEA*

## COLOPHON

The European Actuary (TEA) is the quarterly magazine about international actuarial developments. TEA is written for European actuaries, financial specialists and board members. It will be released primarily as e-mail newsletter. The views and opinions expressed in TEA are those of the authors and do not necessarily reflect the official policy or position of the Editorial Board and/or the AAE.

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Suggestions can be e-mailed

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The deadline is 1 November 2021.

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