RISK MANAGEMENT:
Pandemic scenarios and potential supply chain disruption



INTRODUCTION

Risk Management is a large part of Apiam Animal Health when it comes to our animal health and production services. We strive to identify future risks and implement strategies to assist in mitigating or reducing their impacts for both our clients and our businesses. Recently we have observed an increase in the disruption to animal health product global supply chains caused by the pandemic.

To better understand the potential impacts in Australia, we have engaged Dr Paul Higgins to research and provide foresight on scenarios that may have an impact of local supply chains to veterinary services and livestock production.

Paul Higgins is a veterinarian and a professional futurist. He has had experience as a veterinarian in large scale disease outbreaks in animal populations. In addition, he was an inaugural director of Animal Health Australia and acted on the Consultative Committee on Emergency Animal Disease during exotic disease emergencies.

His combined veterinary and foresight experience has led to him working with an extensive range of businesses dealing with the Pandemic in the last 18 months, including the National Australia Bank, GJK Facility Services, and the Tourism Industry.



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EMERGENTFUTURES

Apiam animal health

EXECUTIVE SUMMARY

Despite the language and messaging from our senior politicians on what the future looks like, things are far from certain. Casey Briggs from the ABC is fond of saying that we are heading for CLOPEN rather than open. We will be neither closed nor open, and the devil is in the detail. We face a complex interaction of the COVID-19 coronavirus, the formal plans for reducing restrictions and human behaviour. It is impossible to accurately predict what might happen. That is even more true at a local level. A state or a country that successfully navigates the next 12 months is still likely to have local or regional problems. We just do not know where they will be.

Managing the Risk of Supply Chain Disruption

The appropriate response to uncertainty from a business point of view is to examine multiple possible futures and manage the risks that we identify cost-effectively. Supply chains are critical to every part of our daily lives, and the uncertainty we face has the potential to cause ongoing supply chain disruptions. This document is intended to inform you of the uncertainty that we might face to assist you in examining your risk management options. The document cannot possibly cover all possibilities or recommend a specific strategy for your business. It should be used as part of your overall strategic thinking and not as specific advice.

What do we know?

We have come a long way in the last 18 months. We now have a much better understanding of the virus and how it spreads. We also have a range of vaccines that successfully reduce transmission and disease, and we know how protective those vaccines are.

Despite problems in the initial vaccine rollout program in Australia, we now have a pretty good picture of when we will achieve 70% and 80% double vaccination protection of the adult (16+) population. In NSW, that is likely to be in the last week in October, and in Victoria, it is likely to be by the middle of November. Apart from the ACT, the other states will achieve those targets later unless there is a significant acceleration in vaccination numbers.

We also know that we are fighting a much stronger enemy. The Delta strain of the virus is far more infectious than previous strains, as evidenced by our struggle to contain recent outbreaks despite better knowledge and improved contact tracing systems.

The fact that Australia has successfully contained the Pandemic until now means that we have much better information about what might happen by looking at the experiences of other countries. In the United Kingdom, minimal public health measures in a population with high immunity levels have resulted in cases surging. In Israel, cases surged when they reduced restrictions in June but have been brought back under control by the reimposition of limitations and a booster vaccination program. The USA has shown us what areas of low vaccination rates and minimal public health measures look like, with mortalities reaching 40% of last year's peak in September. Denmark has shown us that the Pandemic can be well managed through

a combination of public health measures, high vaccination rates, and restrictions on the unvaccinated from mixing with the general community.

All of this tells us that we are heading towards a new phase in the Pandemic once vaccination rates reach higher levels. We are heading towards a Pandemic of the Unvaccinated. We have options to moderate what happens. But there is quite a lot we do not know.

What don't we know?

We face a future of complex interactions of human behaviour, viral behaviour, and official public health measures, and complexity means uncertainty.

While our experiences vary between states, it is clear that the people in our two most populous states are exhausted by the restrictions of the last eighteen months. Working from home, homeschooling children and the limitations on our natural human social interactions have taken a tremendous toll. It is impossible to know how those populations will react in the coming months, especially if the reality of what happens does not match expectations. We also need to factor in what restrictions on the unvaccinated might mean. Will they result in more people getting vaccinated, or will they spark off protests that link up with the anger of the anti-lockdown demonstrations we have seen in the last few months? We should not underestimate the difficulty of enforcing compliance with restrictions for the unvaccinated, with the burdens falling back on businesses and families who may have to deal with significant conflict. How this worked in Denmark may not work here due to cultural differences.

We also do not know what the longer-term vaccination levels might look like, and given the virus's transmissibility, this is a critical factor in outcomes.

All of this means there is considerable variation in the models being used to inform policy decisions. The Doherty Report, which underpins the National Plan, presents a range of outcomes in its modelling. These vary from low case numbers or a new Pandemic wave, although severe disease is much more limited than last year due to the vaccination program. Also, the modelling in the report is already out of date as it did not factor in the vaccinations of 12-15 years olds which are now being rolled out. The authors were very careful to point out that they would update the models as things changed. That has been a complex message for our political leaders to deliver to a population craving certainty.
Then we have to factor in political responses, which are likely to vary based on political parties, the experiences of the last eighteen months, how close politicians are to elections, and the community's reaction to what happens in the real world. In turn, that reaction will feedback into the political decisions that are made.



THE SCENARIOS

All of this uncertainty means we cannot possibly predict what the future will be. Instead, I have described several possible future scenarios. They do not represent all the possible futures that we might face. Instead, they examine uncertainty. Instead of focusing on determining whether you believe in a scenario coming true or not, the reader should be asking themselves two questions:

1. It is possible (not necessarily likely) that this story could come true?
2. If this story did come true, what would my strategy be?

Scenario 1: A Controlled Exit

This is the best-case scenario and looks like Denmark's experience over the last few months. High vaccination rates, medium level public health measures and specific restrictions on the unvaccinated result in a moderate level of cases. In turn, this allows the Test, Trace, Isolate, and Quarantine (TTIQ) system to operate effectively, which creates a positive feedback loop to contain case numbers. Public compliance levels are good due to the success that is achieved. However, vaccination levels do not get to very high levels quickly because people are less scared. This extends the period of moderate level of public health measures to maintain cases at a reasonable level.

Paradoxically supply chain shocks could be more extensive in this scenario because well-controlled case levels create greater visibility of case clusters that could lead to super-spreader events. In a well-controlled situation, governments will be more willing to clamp down on those super spreader events to maintain stability. The extended length of time of public health measures are in place to maintain control increases the length of time where supply chain shocks could occur.

Businesses where there is a high risk of the creation of large clusters, and the spread of infection, would be more closely targeted. These businesses include large scale construction sites, manufacturing businesses, and logistics and distribution centres

Scenario 2: A Period of Grace Followed by a New Wave

In this scenario, reasonable initial control is achieved, which leads to public and governmental complacency. This reduces the level of vaccinations achieved in the medium term, placing the community at more risk of broader spread should cases increase. Public protests by the unvaccinated increase as calls for more freedoms resonate with the general population after months of low case numbers. Creating increased risk of super-spreader events attended primarily by the unvaccinated. Eventually, enough cases develop to create a new exponential wave resulting in a new set of public health restrictions.

Supply chain impacts are minimal in the initial part of this scenario, and businesses return to "normal". Complacency makes supply chains more fragile when the new wave hits because companies are less prepared, and there is the possibility of multiple failures in individual supply chains.

A sudden surge in cases increases the chances of high caseloads in unvaccinated staff at an individual business, increasing the risk of breakthrough infections in the vaccinated staff at that business. The

increased occupational and safety risk will mean risk management systems will cause site shutdowns for cleaning and extended quarantine until the danger has passed.
In addition, government action will increase the pressure for businesses to carry out these sorts of responses.

In this scenario, high levels of public health measures may have to be reimposed to prevent the public health system from being overwhelmed. As this would occur after months where life has gone back to "normal", it is likely that supply chains will be more fragile than in scenario 1, with businesses having moved back to a more "just in time" logistics mode.

Businesses that had built up inventory levels to safeguard against risk are likely to have run those inventory levels back down again to regain working capital and improve efficiency. Thus increasing supply chain fragility.

Scenario 3 – A Reversal to Caution

In this scenario, the initial road map for NSW results in far higher cases than was expected in the first few weeks, leading to a changed prediction of more significant problems for the hospital system in NSW. The ICU system in NSW is predicted to be under overwhelming pressure for months if cases do not come under control. As a result, NSW reimposes restrictions and the other states, having seen what has happened, are more cautious in their approaches. The community is more tolerant of this happening, having seen what has happened in NSW. Vaccination levels, including booster vaccinations, rise significantly as a consequence of increased fear in the community. The states emerge more slowly than anticipated but into a much higher vaccination coverage situation, and a smooth, controlled exit from the Pandemic follows.

Paradoxically supply chain shocks could be lower in this scenario because businesses are more cautious in the early stages. Higher vaccination rates in the later stages lead to fewer problems in the second half of 2022.

Scenario 4 – A Bumpy Road

While the other scenarios have focused on an overall picture to simplify the narrative, this scenario looks at what is a much more messy picture. Variations between the states and responses by the different populations in different states create a bumpy and variable picture. That picture is characterised by regional/local lockdowns and periodic reimposing of state borders as case numbers surge in one location and then another location.

Supply chains that stretch across multiple states are more at risk, especially as interstate freight is seen as a significant risk of carrying and seeding new infections from regional/local hotspots.



Scenario 5 – The Wildcard

The wildcard scenario is the emergence of another variant with mutations that make it either more infectious, more able to evade immune responses generated by vaccination or more severe. Or a combination of these characteristics. While the chances of this remain low, it is a very high impact scenario. There is still a lot of circulating virus around the globe, and we have seen more mutations than were initially expected, so it remains a possibility.

If a strain emerged that could evade the immunity from current vaccines, then we are much better equipped than we were last year. We can rapidly generate new vaccines given the scientific developments that have occurred and the vaccine manufacturing capacity that has been developed. However, there would be a conflict between supplying vaccines to countries with low vaccination rates and ramping up production of a new vaccine for highly vaccinated countries. There would also be a delay of several months in vaccine development, ramping up production capacity, and the need for a whole new round of vaccinations.

The emergence of such a strain would impact countries that have already stabilised their infection levels. If this occurred once Australia had stabilised its Pandemic, then there is the potential for greater disruption of supply chains as local and international supply chains were disrupted simultaneously.









SUMMARY AND RECOMMENDATIONS

The reality is that there is a lot that we still don't know about what might happen over the next 12 months. That means that risks may be higher than most people perceive and that supply chains will be vulnerable to shocks from localised lockdowns or outbreaks in critical parts of the chain.

Just in time supply chain logistics are a very efficient and effective way to manage business supply chains when business conditions are stable and predictable. However, just in time supply chain logistics are also fragile in uncertain times for the same reasons they are efficient when things are stable. That is because all the flexibility and redundancy has been wrung out of them to achieve efficiency.

None of the scenarios described in this document is a prediction about the future. They are stories about possibilities and highlight the potential for uncertainty. The question that you need to ask yourself is

> ***"What is the best way to deal with this uncertainty?"***

There are two key areas where you can ensure that your business minimises its risks when asking yourself that question.

The first is in ensuring you maintain COVID safe plans and that all of your staff are aware of the ongoing risks. This will require continuous reinforcement because it is a natural tendency for people's attention to detail and compliance to wane over time. This is especially true in the scenarios where things look to be going pretty well until they don't. It is also true if people are overconfident about vaccination protections. In particular veterinary practices are businesses with high levels of social mixing and possible transmission exposure. In nearly every scenario, we can imagine there will be higher case numbers in the next 12 months. That means more risk to your staff and possible shutdowns or staff shortages.

The second is to look at your inventory levels and ask yourself do you have enough inventory to continue operating normally if there are supply chain interruptions. You should also be asking yourself what competitive advantage you can gain if you can operate normally when your competitors cannot. Each business will be different, but there is an excellent chance that the cash flow and working capital costs of carrying extra inventory for the next 12 months are very low compared to the costs of the potential risks.

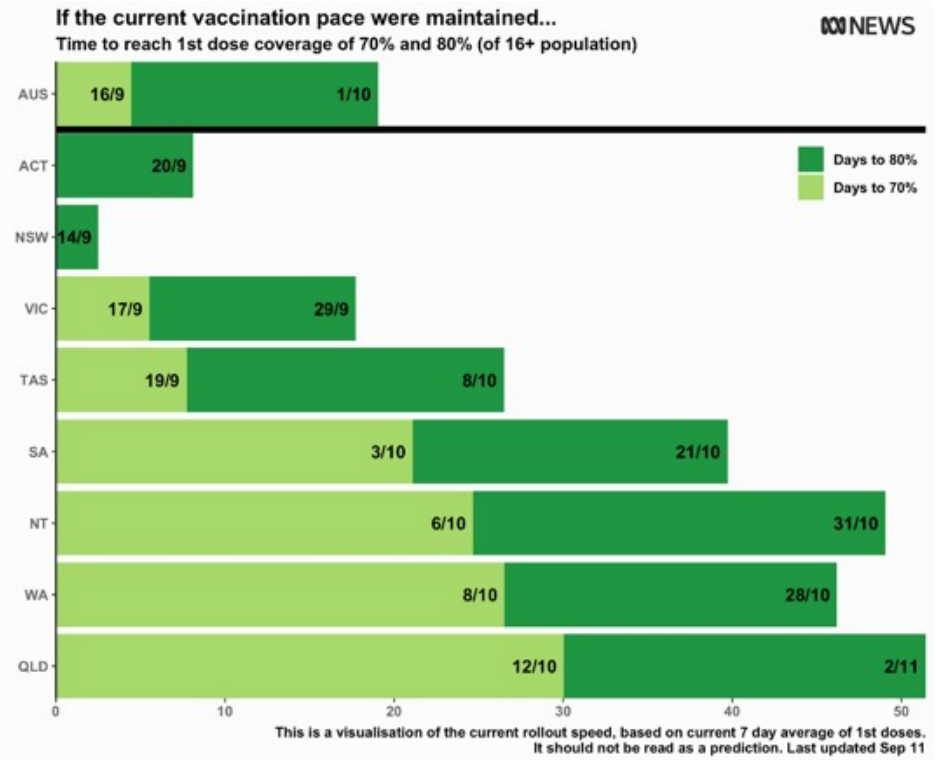
WHAT DOES THE FUTURE LOOK LIKE?

What do we know?

Vaccine Rollouts

After well-documented problems with vaccine supply, we now have a pretty good view of the vaccine rollouts. In my opinion, Casey Briggs from the ABC has been the most reliable documenter of vaccine volumes and target dates, even while being at pains to state that variations in supply and uptake will change the figures.

The following image from Casey on September 11, 2021, [1]gives a strong indication of where we are heading without being a specific prediction:



It is important to note two numbers that tell us when full two dose immunity is reached:

- The gap between first and second doses is falling as more Pfizer vaccination becomes available. The minimum interval between first and second doses for Pfizer is 21 days. It is logistically impossible for this to be achieved for everyone, and some people are still being vaccinated with the Astra Zeneca vaccine, which has a longer interval between the first and second vaccination. Therefore a reasonable estimate is that 28-35 days after the first vaccination coverage will get to 80% of the adult population (16+) double vaccinated.
- Secondly, the immune reaction to the second vaccination is not achieved for about 14 days, so 80% of adults with immunity as opposed to 80% with two vaccinations is a different date.

So if we adjust the numbers in the image for those issues, we can see that, for example, Victoria will have 80% of adults immune by about the middle of November, while NSW might be at the same target by the last week in October. The other states and territories apart from the ACT will achieve this coverage a little later. These dates will vary a little as we go forward, especially as vaccine supply increases

[1]casey briggs on Twitter: "Victoria is now doing first doses faster than anywhere else in the nation https://t.co/7q6FlejYn3" / Twitter

Delta Transmission Levels

It is evident that the Delta strain is very much more infectious than the previous strains, as evidenced by:

- the Delta strain has outcompeted other strains around the world and become the dominant strain globally
- case numbers are still growing in NSW and Victoria despite strict public health measures that controlled large outbreaks last year

What many people do not understand is that twice as infectious does not mean twice the problem. The problem is much more significant due to exponential growth. An unchecked pandemic, where four people are infected from every case gets to 1,024 cases after five rounds of transmission. In an unchecked pandemic where eight people are infected from every case, the pandemic is at 32,768 cases after five rounds of transmission.

This means that it is much harder to get the REff Number[2] under one and that if cases rise in a community or setting where there are minimal public health measures and/or compliance is low, case numbers can rise very quickly.

Vaccine Protection

The vaccines we are using reduce transmission and severity of disease, but they do not entirely prevent them. The Doherty Report[3] states that:

- the Pfizer vaccine reduces the chance of infection with Delta by 79%
- and Astra Zeneca vaccination reduces the chance of infection by 60%.

The vaccines also reduce the chances of transmitting to someone else. The combination of not getting infected and the moderation of infection if you do get infected means that the probability of household members getting an infection is 93% less when double vaccinated with the Pfizer vaccine.

This means that vaccines are highly protective but not infallible. Future cases are much more likely to be in non-vaccinated people, but a small but significant number of people will be vaccinated and still get infected. This can lead to misinterpretation by the general public. If 90% of people are vaccinated, there may be more cases in vaccinated people just because they are the overwhelming majority of the population.

Vaccination also reduces the severity of the disease. Table S2.5 in the Doherty Report shows a 61-83% reduction in symptomatic infection, an 86-87% reduction in hospitalisation rates and a 90-92% reduction in mortality for double vaccination with the Astra Zeneca and Pfizer vaccine, respectively. Therefore cases in the hospital system will be dominated by the unvaccinated.

[2]The number of people that each infected person passes the infection on to
[3]https://www.doherty.edu.au/news-events/news/doherty-institute-modelling-report-for-national-cabinet

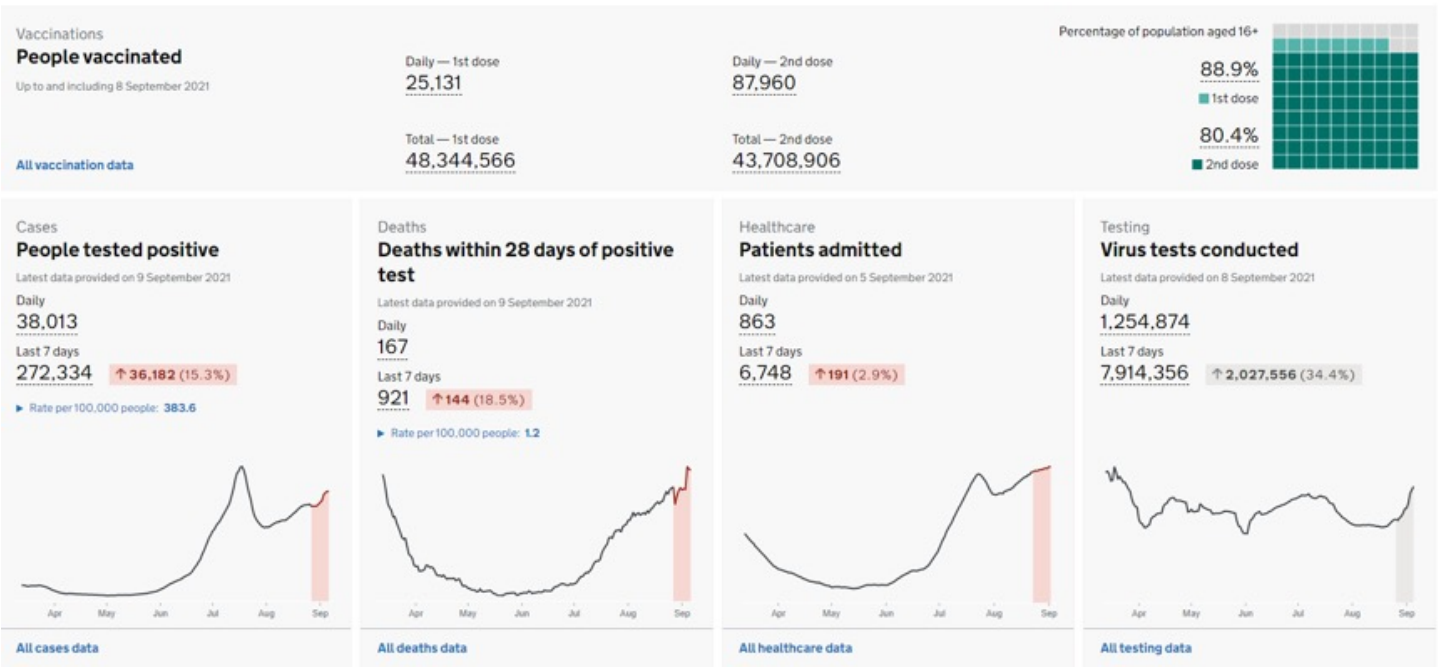
International Experiences

Looking at international experiences in countries with relatively high vaccination rates can give us a strong guide as to what might happen.

Vaccination rates have been calculated a little differently from country to country, so it is important to compare like for like. Many countries calculate the percentage of the total population that has been vaccinated. In Australia, we talk about the percentage of people 16 years and above who have been vaccinated. Approximately 20% of the population is under 16, so if we translate that calculation into the percentage of the total population, a figure of 80% of the adult population is 64% of the total population.

United Kingdom

The UK has high vaccination rates and minimal public health measures in place. The following image is what their official figures looked like on September 9 2021:



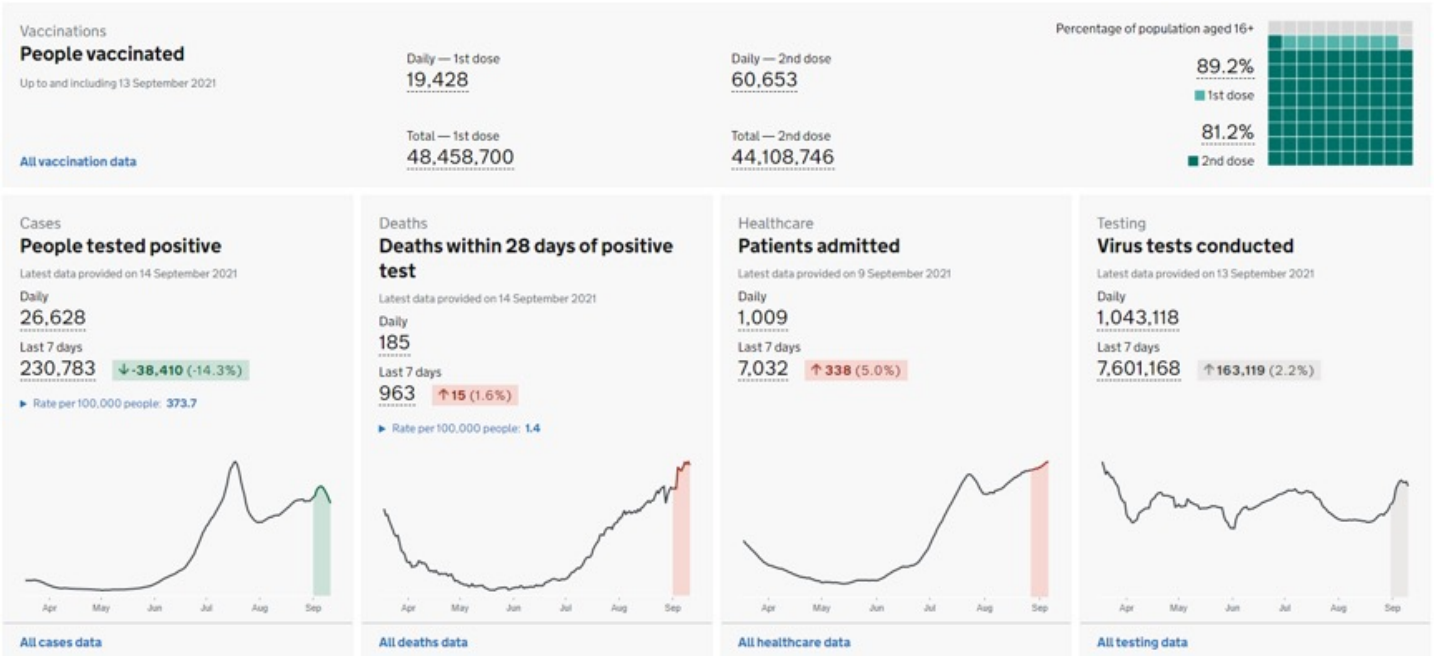
Double-dose vaccination of adults is above 80%, single-dose vaccination is almost 89%, and a significant percentage of the population has already been infected (meaning an even higher proportion are immune from vaccination and/or infection). Despite this, case numbers have been surging.

Real case numbers are likely much higher than this. Even so, they have almost 40,000 reported cases a day and nearly 1,000 people a day being admitted to the hospital.

On an equivalent per capita basis, that would be the same as Australia having 16,000 cases a day and 400 people being hospitalised daily: approximately eight times our current number of cases.

[4]Daily summary | Coronavirus in the UK (data.gov.uk) Accessed September 10th, 2021

A few days later the picture looked a little different:

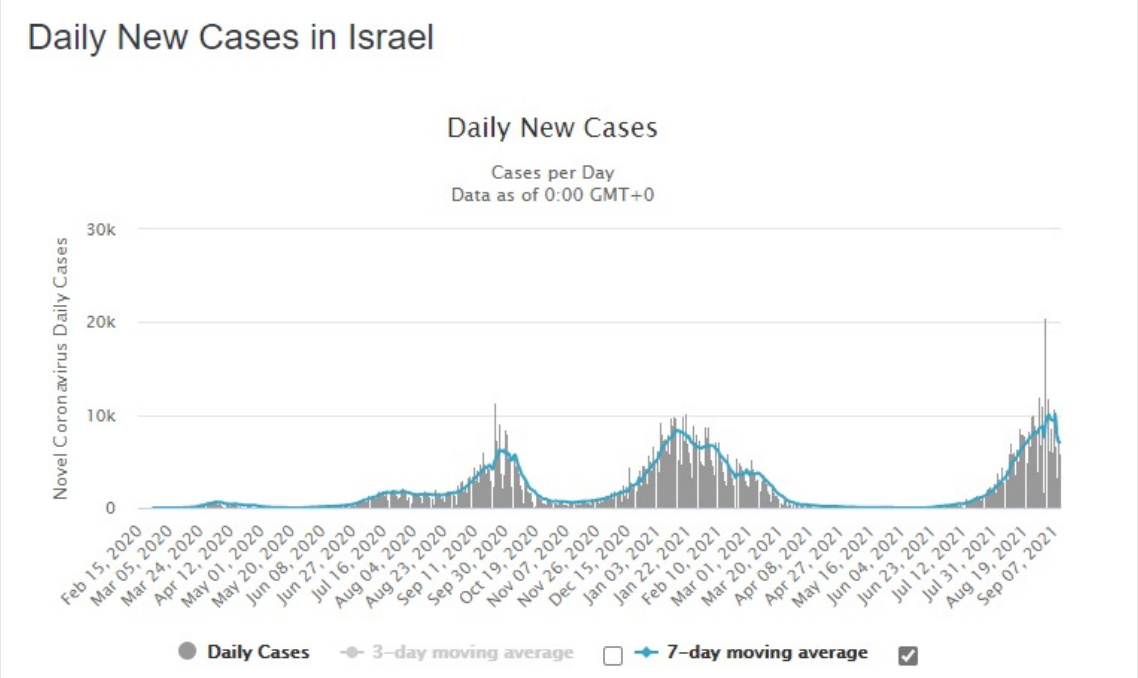


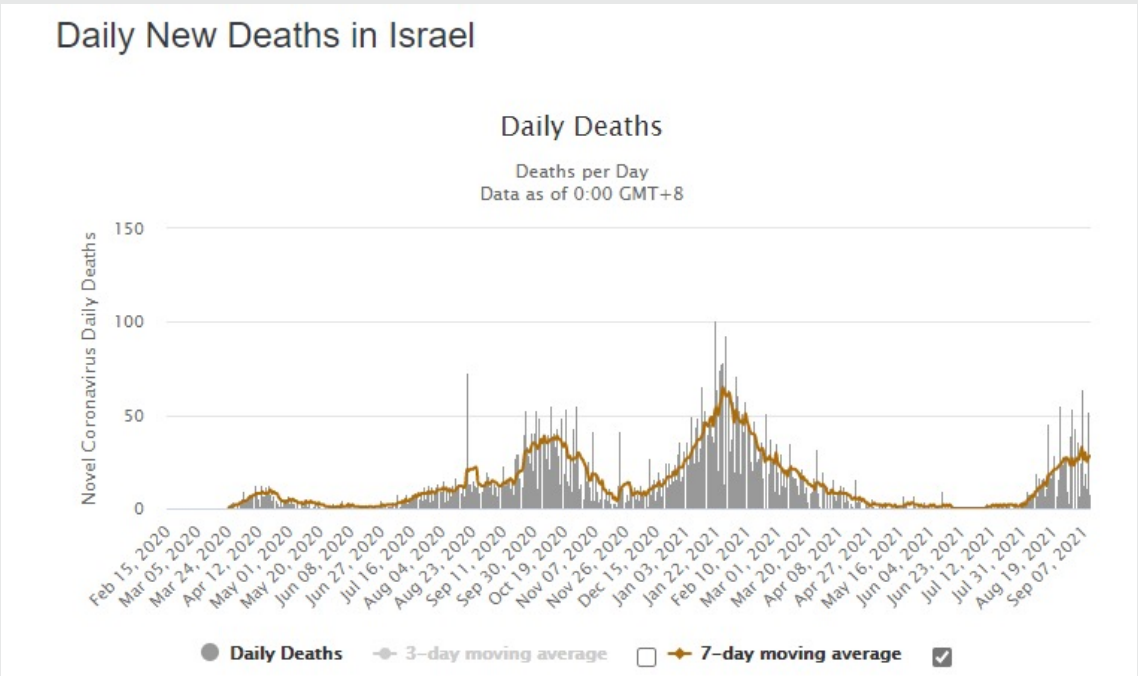
Cases started to fall in number.

It is important to remember that this has happened with higher vaccination rates than we have in Australia, and the real immunity levels are likely to be a few percentage points higher due to natural infections. Due to lower case numbers in Australia, we do not have that added immunity to any large extent.

Israel

In Israel, opening up of the country in June led to another wave of cases and mortalities, as shown in the following images[5] :

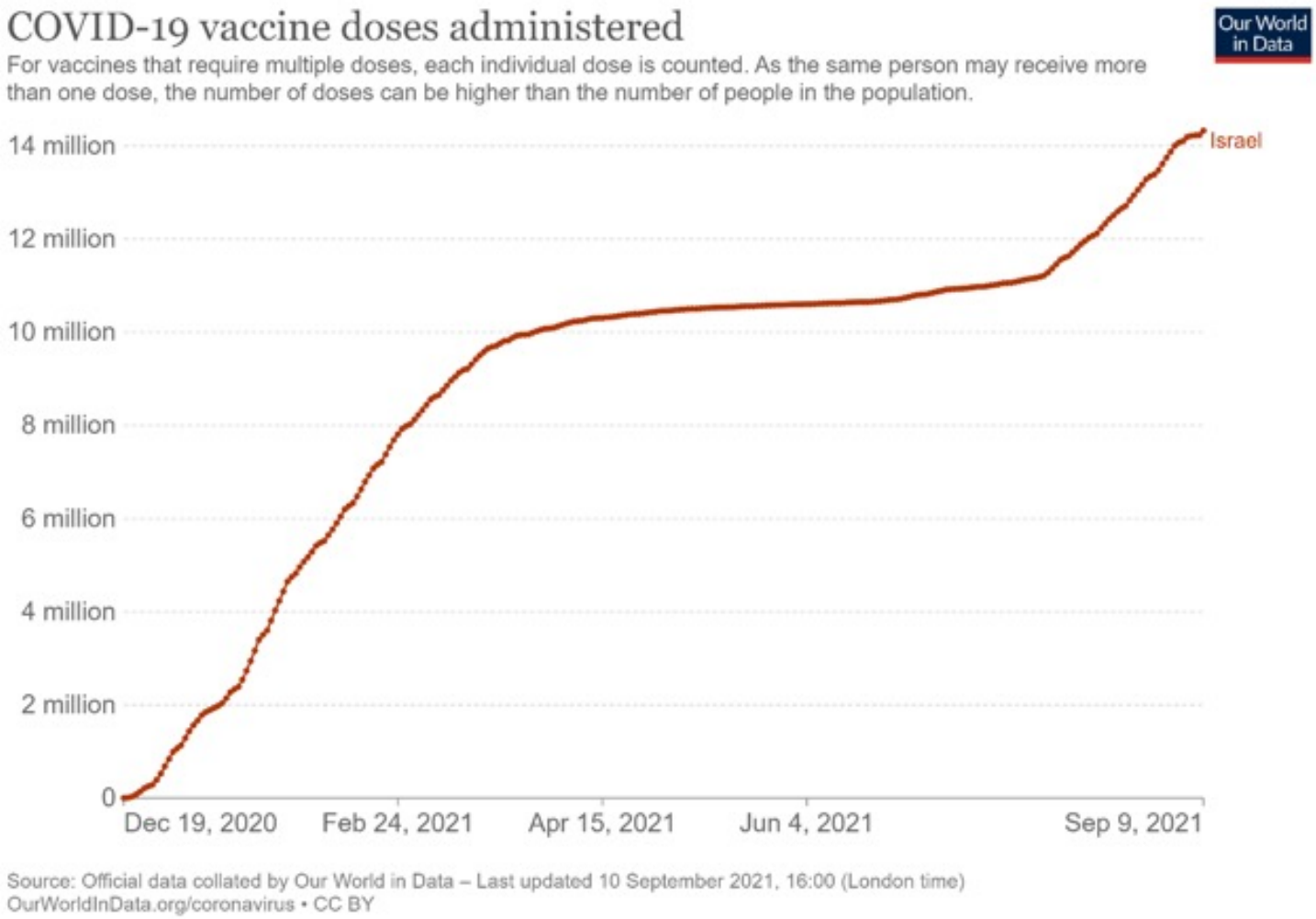




The peak in mortalities was a seven-day average of 33. Which on a per capital equivalent basis would be 93 deaths a day in Australia. Total vaccination rates in Israel plateaued in early June at about 10.6 million doses

[5]*From: Israel COVID: 1,165,682 Cases and 7,338 Deaths - Worldometer (worldometers.info)*

with about 63% of the total population fully vaccinated (similar to our 80% of adults target), and a further 5.7% single vaccinated as shown in the following image[6]:



The rise in cases is credited to the arrival of the Delta strain and the removal of almost all movement restrictions:

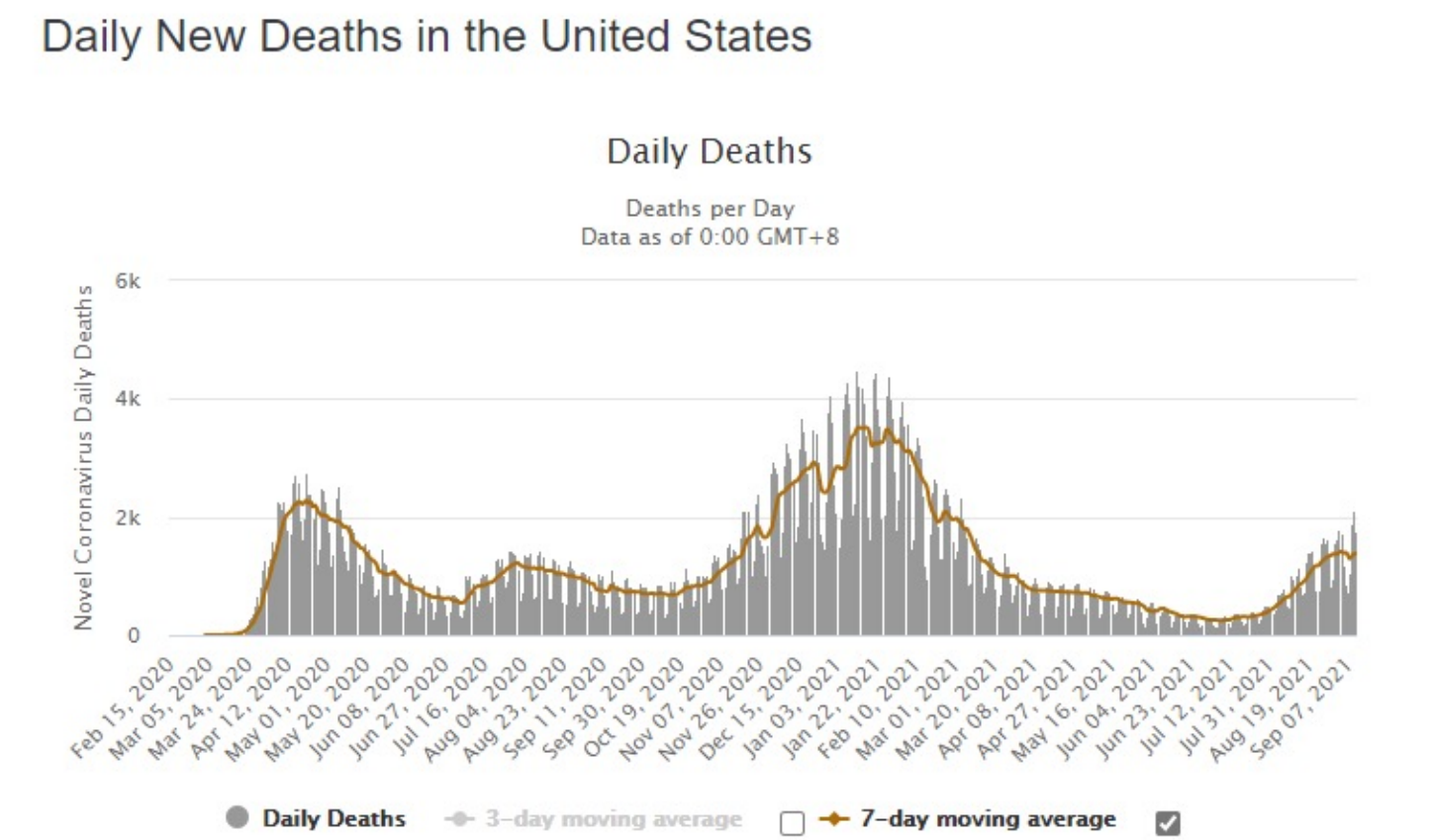
> ***"They completely dropped their guard,"***

The figure of 63% of the total population vaccinated is very close to our stated goal in Australia of 80% of the adult population being vaccinated. A report to the Israeli government credits the re-introduction of restrictions and the start of a vaccine booster program (as shown in the rise of vaccinations in the previous image) as being responsible for curbing the case and mortality numbers[8].

[6]Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data
[7]Kim Mulholland, a paediatrician at the University of Melbourne and member of the WHO's Strategic Advisory Group of Experts on Immunization. Israel is struggling with COVID-19, despite high vaccination rates. What lessons can Australia learn? - ABC News
[8]COVID boosters, restrictions stopped delta wave in Israel, expert panel says - Israel News - Haaretz.com

USA

In the US, another wave of mortalities is occurring. This is despite 53% of the total population being fully vaccinated and a further 9.3% having at least one vaccination[9] and at least 12.6% of the population having being infected already[10]. Mortalities are now at 40% of the mortalities at the peak of the pandemic in the US last year as shown in the following image[11]:

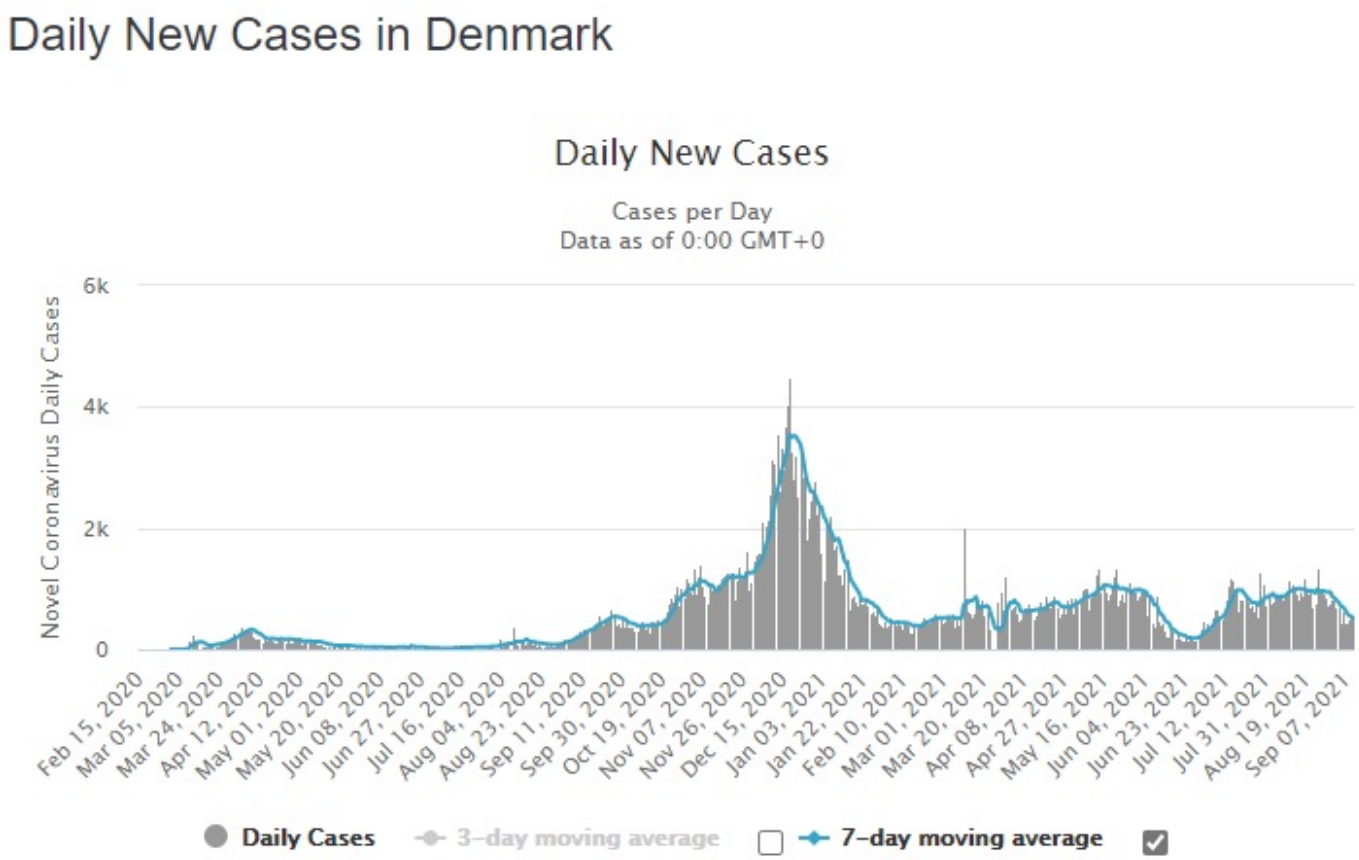


These deaths are largely concentrated in parts of the country with lower vaccination rates and low levels of public health measures. For example, Texas, with only 8.6% of the total US population, had 19.4% of the deaths in the last 7 days[12].

[9] *Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data*
[10] *United States COVID: 41,741,693 Cases and 677,017 Deaths - Worldometer (worldometers.info)*
[11] *United States COVID: 41,741,693 Cases and 677,017 Deaths - Worldometer (worldometers.info)*
[12] *Texas COVID: 3,811,941 Cases and 60,008 Deaths - Worldometer (worldometers.info)*

Denmark

In Denmark, they have had a much better experience with the pandemic since a significant wave of infections that peaked just before Christmas at 3,500 cases a day (equivalent to approximately 15,400 cases in Australia on a per capita comparison):[13]



Denmark has only averaged 1-3 deaths a day since early March compared to a peak of 32. Reports indicate that wide lockdown measures reduced case numbers from December 2020 onwards and that cautious re-opening coupled with vaccine passports (restricting access for the unvaccinated) and massive testing and tracing capacity have allowed them to keep cases under control[14]. Daily case numbers in the last couple of months have hovered around 950 daily until falling rapidly since August 30 to an average of 520 on September 10. On that date, 74% of the total population was double vaccinated, and 76% had at least one vaccination. The equivalent case numbers for Australia would be 4,170 cases a day, falling to 2,282 cases a day. Equivalent vaccination rates would be about 92% of the adult population in Australia.

Interestingly a retrospective comparative analysis of the control measures put in place by the UK, Denmark and Sweden in 2020 and published in Nature postulates that just a few days difference in implementation of control measures created large differences in outcomes[15].

[13]Denmark COVID: 351,553 Cases and 2,608 Deaths - Worldometer (worldometers.info)
[14]Denmark speeds up reopening of economy as new virus cases ease | Reuters
[15]Comparing the responses of the UK, Sweden and Denmark to COVID-19 using counterfactual modelling | Scientific Reports (nature.com)

These examples tell us several things:

- Vaccines are clearly not silver bullets for COVID control.
- Minimal public health measures do not work to reduce cases significantly without extremely high vaccination rates.
- Case numbers and mortalities will tend to occur in locations where there are lower vaccination rates, more resistance to public health measures, and less capacity for people to voluntarily social distance themselves.
- A combination of vaccination, moderate levels of public health measures and restrictions on the unvaccinated give us a chance to successfully moderate virus transmission.
- Much higher vaccination rates than we have targeted might be required for good case number control.

However, despite this knowledge, there is still significant uncertainty. Viral transmission in a pandemic is a complex process moderated by geography, season, culture, initial case numbers, political attitudes, public health measures and the transmissibility of the virus itself.

Nobody can say with certainty what measures were the key ones in Denmark controlling the case levels as they have done. It is not just a matter of copying a successful response and avoiding the pitfalls of the problem countries. In complex situations, the same starting conditions can result in different outcomes, and we are definitely in a complex situation. Cultural differences and timing can play a large role in the outcomes.



WE ARE HEADING TOWARDS A PANDEMIC OF THE UNVACCINATED

Both the real-world experience and the modelling that has been carried out are showing us that both infection rates and severity of disease are much higher for the people that are not vaccinated.

In the Victorian Government press conference on 11 September 2021 the Health Minister stated that nobody in hospital in Victoria was double vaccinated and that 89% of the hospital cases had not had a single vaccination.

The Doherty Modelling[16], which the Australian National Plan is based on, contains the following table on page 21:

Table 5.3 (cont)

	Oldest First		All Adults	
Achieved eligible population coverage	**Vaccinated**	**Unvaccinated**	**Vaccinated**	**Unvaccinated**
70%				
Symptomatic infections	93,398	523,893	58,165	335,350
Ward admissions	6,870	15,509	4,144	9,986
ICU admissions	1,693	3,309	993	2,091
Deaths	1,278	2,285	685	1,298
80%				
Symptomatic infections	67,946	403,162	40,010	238,991
Ward admissions	4,860	11,270	2,817	6,852
ICU admissions	1,163	2,331	666	1,409
Deaths	819	1,490	439	842

While this is only one of the possible models in the Doherty Report, what it is saying is instructive. The model is saying that for the period of the modelling with 80% of adults vaccinated in an all-adult strategy (the bottom right-hand numbers in the table), there will be six times as many symptomatic infections and two and a half times as many hospital admissions in unvaccinated people. This is despite the fact that in the model, there are far fewer unvaccinated people than vaccinated people[17].

[16]*Doherty Modelling National Plan - DocumentCloud*

[17]*Note the ICU admissions and mortalities differ by a smaller ratio because older people are more at risk but also have higher vaccination rates. So the vaccinated population is on average older than the non vaccinated population which results in more severe cases per symptomatic case.*

WHAT ARE WE UNCERTAIN ABOUT?

Human Behaviour

There is no doubt that many people where the lockdowns have had the most impact (Victoria, NSW) that people are exhausted and frustrated. Many small businesses in those states and the badly affected tourism areas are struggling and have balance sheets that are very much weaker than they were two years ago.

We don't know how people will respond to the various possibilities that face us over the next 12 months. Have people become so influenced by the message about reaching 80% of adults double vaccinated that any restrictions will be vigorously resisted? What will people's responses be if we see cases numbers rising well above what they expect? Will they increase social distancing or carry on socialising? What will happen if media stories start appearing of people dying because of a lack of ICU or hospital beds? Will people voluntarily hunker down and decrease mixing, or will the attitude be 'we just have to plough on through this'? What will people's responses to additional restrictions placed on by governments when they thought that would not happen? Will mass anti-lockdown protests grow in number and frequency and create super-spreader events? What influence will Christmas have?

The reality is that we do not know and that variations in human behaviour can make considerable differences in transmission events, especially while community case levels are already high.

Vaccination Levels in the Medium Term

Given the vaccination levels that are already occurring, it is highly likely that we will exceed the target of 80% of the adult population double vaccinated. The open question is by how much and how much that matters. Rising concern once case numbers have increased has undoubtedly driven up vaccination rates to date. We are seeing vaccination rates much higher than 80% first doses in some areas[18], and low vaccination rates in some areas, especially Indigenous communities. Highly infectious viruses need higher rates of overall vaccination to create control without other public health measures.

Political Responses

There is variation between our political leaders regarding the likely COVID-related responses over the next 12 months. The attitude varies from highly conservative in Western Australia to a more 'let's get people's freedoms back' attitude in NSW.

The political responses will be affected by several factors:

- how close are we to an election? Scott Morrison has to hold an election by 21 May 2022 (barring a radical move to hold Senate and House elections separately[19]). Waiting that long would mean an early April 2022 election announcement. Of course, the Prime Minister can call an election anytime until then, but he is unlikely to do so while the two biggest states are in any form of effective lockdown and the vaccine rollout is not complete. A Prime Minister faced with rising case numbers and overwhelmed

[18] *Western Sydney leads the state in vaccination uptake, Blacktown passes 90 per cent first dose milestone - ABC News*
[19] *When can the Next Federal Election be Held? – Antony Green's Election Blog*

hospitals in February and calling an election in April is likely to want a completely different reaction than a situation where case numbers are low. With the states controlling a lot of what is happening, how much control he has over that is another matter. The next Victorian election is scheduled for 25 November 2022,[20] and the NSW election is 25 March 2023[21]. That is a more comfortable position to be in. But not as comfortable as the West Australian Premier, who is not up for an election until March 2025 and holds 53 out of 59 seats in the current parliament

- the actual case numbers
- the public's attitude to the balance of restrictions and freedoms they are willing to tolerate/embrace.

How this might work in practice was highlighted in an ABC media report on 13 September 2021, when British Prime Minister Boris Johnson announced the scrapping of vaccine passports under political pressure[22].

Modelling Variations

While the politicians have been keen the talk about the National Plan as being underpinned by the Doherty Report modelling, the reality is that the modelling shows a number of very different outcomes. Professor Sharon Lewis from Doherty has been very keen to point out that the Doherty Report is not a policy document and that they did not model specific public health measures, just high, medium and low levels[23]. They took the real-world results of various public health measure settings over the last 18 months and placed them in the model. That does not mean applying the same settings in the current context will produce the same results. People are in a different mood now than in previous lockdowns. So their behaviour will differ

The better case scenarios in the modelling are reliant on:

- Test, Trace, Isolate, and Quarantine (TTIQ) systems being optimal. This is very difficult to attain when cases are in the hundreds and above because there are so many interviews and close contacts to find and isolate
- low initial cases numbers in the community
- vaccination rates at 80% of the adult population.

The Doherty modelling showed huge variations in outcomes. For example, in a 70% adult vaccination scenario, differences in public health measures and TTIQ created a 100 fold difference in the outcomes, as shown in the next image[24]:

[20] *State elections | Victorian Electoral Commission (vec.vic.gov.au)*
[21] *State Government Elections in New South Wales - NSW Electoral Commission*
[22] *Boris Johnson ditches UK's COVID-19 vaccine passport plan under pressure from his own party - ABC News*
[23] *Sharon Lewis ABC interview Friday 10th September 2021*
[24] *Doherty modelling slides - DocumentCloud P12*

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The addendum report found ongoing low level restrictions and optimal TTIQ could improve outcomes around 100 fold or more

The table below shows the cumulative symptomatic infections, ward admissions, ICU admissions and deaths over the first 180 days for the coverage threshold of 70% achieved by a 'transmission reducing' vaccine allocation strategy with **optimally effective TTIQ *and* ongoing low level restrictions** compared to **partially effective TTIQ and ongoing baseline restrictions**

		Age Group						
		<16 yrs		16-59 yrs		60+ yrs		Total
Health Outcome	PHSM and TTIQ effectiveness	Vacc'd	Unvac	Vacc'd	Unvac	Vacc'd	Unvac	
Symptomatic infections	Baseline and partial	-	226,084 (4.5%)	41,807 (0.4%)	100,607 (1.4%)	15,512 (0.2%)	6,352 (0.9%)	390,362 (1.3%)
	Low level and optimal	-	1,606 (0.03%)	286 (0.002%)	737 (0.01%)	94 (0.001%)	39 (0.005%)	2,762 (0.009%)
Ward admissions	Baseline and partial	-	1,983 (0.04%)	1,629 (0.02%)	5,233 (0.07%)	2,434 (0.03%)	2,419 (0.3%)	13,698 (0.04%)
	Low level and optimal	-	14 (0.0003%)	11 (0.0001%)	40 (0.0006%)	15 (0.0002%)	16 (0.002%)	96 (0.0003%)
ICU admissions	Baseline and partial	-	164 (0.003%)	418 (0.004%)	1,265 (0.018%)	551 (0.007%)	568 (0.08%)	2,966 (0.01%)
	Low level and optimal	-	1 (0.00002%)	4 (0.00004%)	10 (0.0001%)	4 (0.00005%)	4 (0.0006%)	23 (0.00007%)
Deaths	Baseline and partial	-	46 (0.0009%)	99 (0.001%)	422 (0.006%)	572 (0.007%)	769 (0.1%)	1,908 (0.006%)
	Low level and optimal	-	0 (0%)	1 (0.00001%)	4 (0.00006%)	5 (0.00006%)	6 (0.0008%)	16 (0.00005%)

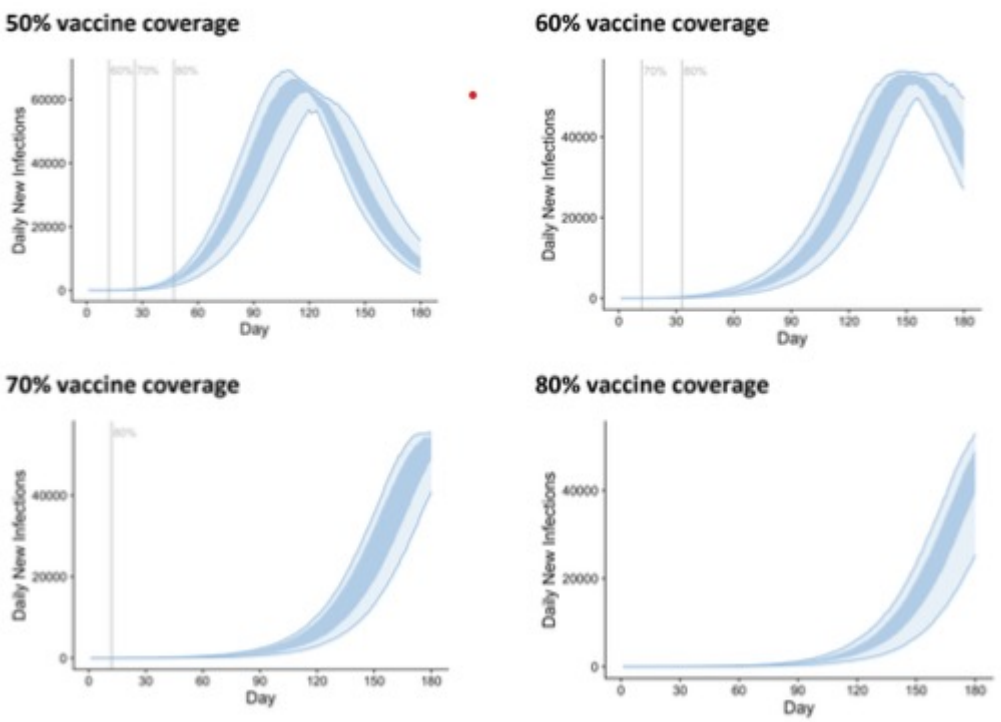
The bracketed figures show the percentage of individuals with health outcomes (symptomatic infections, ward and ICU admissions and deaths) relative to their total population by age cohort and vaccination status

* At this advanced stage of the rollout, because the number of vaccinated people is now a lot higher than those unvaccinated (70% vs. 30% of adults aged 16+) there may be more vaccinated individuals with symptomatic or severe infections in absolute terms (particularly in the cohort aged 60+ which has a very high vaccinate rate around 90%), but the unvaccinated account for a disproportionately large share of symptomatic and severe cases, especially ICU admissions and deaths relative to their total population.

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They also modelled situations where there could be another pandemic wave. Figure 2.3 from the Doherty Report shows the following curves for various levels of vaccine coverage:

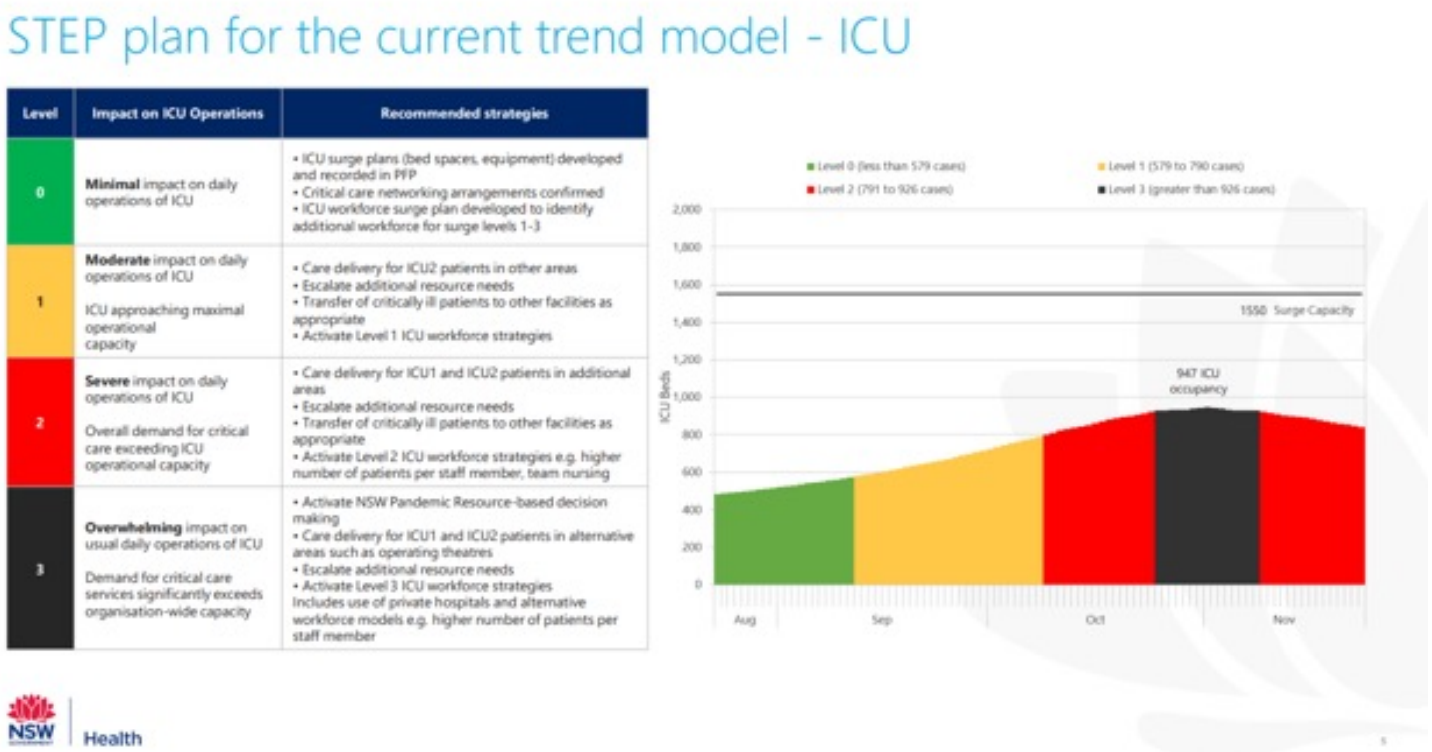
Figure 2.3: As for Figure 2.1 but for the 'All adults' strategy (*note different y axes)



Note that in the 80% vaccine coverage model, cases are still rising at 180 days as the curve starts later, and in the 60% coverage and 70% coverage models, 80% vaccine coverage is reached well before case numbers begin to surge. In the 80% coverage model, case numbers are above 40,000 a day and still rising when the model cuts off at 180 days.

None of this is a criticism of the Doherty work, which is excellent. It highlights the differences in the models when different assumptions are plugged in and reinforces the uncertainty we face.

NSW has released modelling of what the hospital ICU system might look like over the next few months, as shown in the next image[25]:



Anyone in the NSW hospital system must look at this model and be very concerned. However, it is predicated on case numbers in NSW peaking in the middle of September and falling from there. Hopefully, it is true, but worse pressures on the ICU system are obviously possible given the various Doherty models. Again, this is not critical of the planning work done here, which is excellent.

Where and When

While we can say that it is highly likely that there will be local clusters and hotspots as we move forward, it is impossible to say where and when they might be. We can speculate that clusters are more likely in lower socioeconomic areas and lower vaccination rate areas but that only increases likelihood in those areas. It does not predict where and when. Luck will play its part.

[25]*NSW Health ICU Capacity Planning*

THE SCENARIOS

It is important to note that scenarios are not predictions. They are possible but not necessarily accurate stories about the future.

The scenarios described here are a selection from a much broader set of possibilities, but they illustrate what might happen.

Instead of focusing on determining whether you believe in a scenario coming true or not, the reader should be asking themselves two questions:

1. It is possible (not necessarily likely) that this story could come true?
2. If this story did come true, what would my strategy be?

SCENARIO 1: A CONTROLLED EXIT

The Story

This is the positive scenario if everything goes right.
It is the story of the roadmap that NSW announced in the week commencing September 6, 2021 being successful[26].
It is the picture that we have seen in Denmark over the last few months.
It is also the story at the better end of the Doherty modelling.

The NSW roadmap is based on:

- High vaccination rates.
- Moderate public health measures with density and number limits, mask-wearing for all indoor public venues
- More freedom for the vaccinated in terms of shopping, venues they can access, etc.
- Restrictions on the unvaccinated. For example, unvaccinated people will only be able to access critical retail such as supermarkets, banks and post offices.

It also has one important caveat:

> ***NSW Health Minister Brad Hazzard said the government will continue to be guided by the health advice, and may still require targeted restrictions to deal with outbreaks[27].***

The plan also assumes a reasonable level of compliance from people. For instance, the roadmap states that once the 70% of adults target is reached that:

[26]NSW COVID-19 roadmap out of lockdown — here's what will change when restrictions lift - ABC News
[27]Roadmap to freedom unveiled for the fully vaccinated (nsw.gov.au)

> ***Up to five visitors will be allowed in a home where all adults are vaccinated (not including children 12 and under).***

Given that there are consistent media reports of people gathering in households during lockdowns while public health orders preclude that and the difficulty for family members trying to police the restrictions, this assumption may prove naive.

It is a story of case numbers in the 2,000-4,000 range across Australia and deaths averaging 1-14 a day across the country. To put that in the context of a comparison to the current NSW outbreak, if the cases were equally spread across the whole country, NSW would have 640-1,280 cases a day and average 1-4 deaths a day.

At those sorts of levels, the message of 'living with COVID' would likely resonate with the general population and Test, Trace and Isolate systems would be able to maintain a level of control.

Supply Chain Impacts

Paradoxically, while life would largely return to a new sort of normal, the potential for sudden supply chain impacts may be higher in this scenario.

Test, trace and isolate would still be working well. This would mean high visibility of case numbers and locations. Therefore there would still be a high level of scrutiny on individual businesses and local areas where clusters of cases occur.

Public opinion would probably be on the side of government action on these local clusters to maintain a degree of control, and with the view 'it will probably not happen to us'.

Businesses where there was a high risk of the creation of large clusters, and the spread of infection, would be more closely targeted. This would include large scale construction sites, manufacturing businesses, and logistics and distribution centres.

SCENARIO 2: A PERIOD OF GRACE FOLLOWED BY A NEW WAVE

The Story

This scenario will look like scenario 1 for a while, maybe even months, and then all of a sudden, we will see a rapid wave of new cases as described in one of the models in the Doherty report.

In this scenario, there is:

- initially, low levels of community transmission going on and no major surges or snap lockdowns occurring
- a reduction in the likelihood that very high vaccination rates will be achieved because people take the view that the risk is low and the pandemic is over
- further relaxation of public health measures by governments that become complacent about the risk
- a return to everyday life where people mix freely and fail to comply even with the low levels of public health measures like wearing masks in public transport because 'it is all over'
- reductions in social distancing and mask-wearing creating a return of cold and flu infections in the general community, reducing the likelihood that people will get tested because they will think 'they just have a cold'. Slowing down the reaction time to any new surge of cases
- anti-vaccination and anti-lockdown protests growing in size and frequency, with people fretting against the restrictions that have been placed on people that have not been vaccinated. This creates the perfect situation for multiple super-spreader events once community transmission rates start to rise
- a reluctance for governments to act as cases grow in the first instance because they are close to elections, and most of the community believe that restrictions should not be put in place
- all of this results in a sudden exponential growth in cases. The initial cases are primarily in the unvaccinated but cases in the vaccinated start to grow as people in households and businesses experience increasing numbers of breakthrough transmissions
- finally, the government panics as hospitalisation rates start to rise dramatically, and models show the hospital system and the ICU system, in particular, will be overwhelmed within weeks. This results in the reimposition of broader and harsher public health measures and state border closures

The Supply Chain Impacts

A sudden surge in cases increases the chances of high caseloads in the unvaccinated staff at an individual business and that there will be breakthrough infections into the vaccinated population at that business. The increased occupational and safety risk will mean risk management systems will cause site shutdowns for cleaning and extended quarantine until the risk has passed. Staff quarantine requirements will cause staff shortages.

In addition, government action will increase the pressure for businesses to carry out these sorts of responses.

In this scenario, high levels of public health measures may be required to prevent the public health system from being overwhelmed. As this would occur after months where life has gone back to 'normal', it is likely

that supply chains will be more fragile than in scenario 1, with businesses having moved back to a more 'just in time' logistics mode. Businesses that had built up inventory levels to safeguard against risk are likely to have run those inventory levels back down again to regain working capital and improve efficiency, thus increasing supply chain fragility.

SCENARIO 3 – A REVERSAL TO CAUTION

The Story

In this scenario, the initial road map for NSW results in far higher cases than was expected in the first few weeks, leading to a changed prediction of more significant problems for the hospital system in NSW. The ICU system in NSW is predicted to be in the overwhelming pressure phase for months if cases do not come under control.

Initially there is a reluctance from the NSW government to reimpose strict lockdown measures due to political pressures. This leads to tragic stories in the media of higher numbers of deaths, people not being able to get proper ICU care, temporary morgues being set up, and more stories of medical staff breaking down under pressure.

NSW finally reverses course on many of its opening-up plans, reimposes stricter lockdowns and looks to re-open later once vaccination rates are much higher.

The other states view NSW as 'the canary in the coalmine' and, as a result, are far more cautious in the plans to open up. The community is more tolerant of this happening, having seen what has happened in NSW. The majority of public sentiment reverses and is more supportive of extending lockdown measures until higher vaccination rates are achieved.

Higher vaccination rates, including booster vaccinations, are achieved as a percentage of the 'vaccine-hesitant' are scared into getting vaccinated.

The states emerge more slowly than anticipated but into a much better vaccination situation, and a smooth, controlled exit from the pandemic follows.

After the initial turmoil, case numbers stabilise and fall, leading to a situation from the second quarter of 2022 onwards of a far more stable environment.

The Supply Chain Impacts

Paradoxically supply chain shocks could be lower in this scenario because businesses are more cautious in the early stages, and higher vaccination rates lead to fewer problems in the second half of 2022.

SCENARIO 4 – A BUMPY ROAD

The Story

While the other scenarios have focused on an overall picture in order the simplify the narrative, this scenario looks at what is a much messier picture. Variations between the states and responses by the different populations in different states create a bumpy and variable picture. That picture is characterised by local/regional lockdowns and periodic reimposing of state borders as case numbers surge in one location and then another location.

Supply chains that stretch across multiple states are more at risk, especially as interstate freight is seen as a major risk carrying and seeing new infections from regional hotspots.

The Supply Chain Impacts

Supply chain impacts are more unpredictable and highly supply chain specific due to the more random nature of interruptions and restrictions. Protests on border changes, and vaccine mandates could create more supply chain impacts.

SCENARIO 5 – THE WILDCARD

The Story

The wildcard scenario is the emergence of another variant with mutations that make it either more infectious, more able to evade immune responses generated by vaccination or more severe, or a combination of these characteristics. While the chances of this remain low, it is a very high impact scenario. There is still a lot of circulating virus around the globe, and we have seen more mutations than were initially expected, so it remains a possibility.

If a strain emerged that could evade the immunity from current vaccines, then we are much better equipped than we were last year. We can rapidly generate new vaccines given the scientific developments that have occurred and the vaccine manufacturing capacity that has been developed. However, there would be a conflict between supplying vaccines to countries with low vaccination rates and ramping up production of a new vaccine for highly vaccinated countries. There would also be a delay of several months in vaccine development, ramping up production capacity, and the need for a whole new round of vaccinations.

The Supply Chain Impacts

The emergence of such a strain would impact countries that have already stabilised their infection levels. If this occurred once Australia had stabilised its pandemic, then there is the potential for greater disruption of supply chains as local and international supply chains were disrupted simultaneously.





Apiam animal health

SUMMARY AND RECOMMENDATIONS

The reality is that there is a lot that we still don't know about what might happen over the next 12 months. That means that risks may be higher than most people perceive and that supply chains may be vulnerable to shocks from localised lockdowns or outbreaks in critical parts of the chain.
Just in time supply chain logistics are a very efficient and effective way to manage business supply chains when business conditions are stable and predictable. However, just in time supply chain logistics are also fragile in uncertain times for the same reasons they are efficient in stable times. That is because all the flexibility and redundancy has been wrung out of them to achieve efficiency.

None of the scenarios described in this document is a prediction about the future, they are stories about possibilities, and they highlight the ongoing potential for uncertainty. The question that you need to ask is:

> ***"what is the best way to deal with this uncertainty?"***

There are two key areas where you can ensure that your business minimises its risks when you are responding to that question.

The first is in ensuring you maintain COVID safe plans and that all of your staff are aware of the ongoing risks. This will require continuous reinforcement because it is a natural tendency for people's attention to detail and compliance to wane over time. This is especially true in the scenarios where things look to be going pretty well until they don't. It is also true if people are overconfident about vaccination protections. In particular veterinary practices are businesses with high levels of social mixing and possible transmission exposure. In nearly every scenario, we can imagine there will be higher case numbers in the next 12 months. That means more risk to your staff and possible shutdowns or staff shortages.

The second is to look at your inventory levels and ask yourself, do you have enough inventory to continue operating normally if there are supply chain interruptions? You should also be asking what competitive advantage you can gain if you can operate normally when your competitors cannot. Each business will be different, but there is an excellent chance that the cash flow and working capital costs of carrying extra inventory for the next 12 months are very low compared to the costs of the potential risks.

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Paul Higgins is a veterinarian and a professional futurist. He has had experience as a veterinarian in large scale disease outbreaks in animal populations. In addition, he was an inaugural director of Animal Health Australia and acted on the Consultative Committee on Emergency Animal Disease during exotic disease emergencies. His combined veterinary and foresight experience has led to him working with an extensive range of businesses dealing with the pandemic in the last 18 months, including the National Australia Bank, **GJK Facility Services, and the tourism industry.**