



A response to the Otago Covid-19 Research Group and Te Pūnaha Matatini on their defence of their modelling

*All models are wrong,
Some are useful,
Some can be abused*

Introduction

The Otago Covid-19 Research Group (OCRG) and Te Pūnaha Matatini (TPM) have not responded directly to our report that criticised their modelling. But there was a recent report in Newshub, where they put forward a public defence of their modelling approach.

The headlines ran.

Experts: Latest anti-lockdown paper falls short

Analysis: Public health experts say a new paper from Tailrisk Economics that casts doubt on Covid-19 modelling efforts isn't all it's cracked up to be, Marc Daalder reports

The omission of contact tracing and isolation

One of main points we made in our paper was that OCRG pandemic death results were blown up because they assumed there would be no contact tracing and isolation at all, over the full year of their model run.

The OCRG and TPM 'Newshub' response was that the Health Boards' contact tracing, at the time the OCRG report was written, was completely inadequate and was being overwhelmed by a rapidly rising number of cases. NZ had missed the boat, in terms of getting the epidemic under control, without a severe, level four, intervention. In that circumstance setting contact tracing at zero was a reasonable approximation of reality.

Michael Baker of the OCRG was reported as saying:

"The entire basis for going into lockdown before it was announced, was that New Zealand wasn't yet in a place where it could test and contact trace to the degree it needed to."

And Nick Wilson, also of OCRG, expands:

"We weren't prepared. We learnt nothing from SARS. None of the Ministry's documents even mentioned SARS. We were so far behind. In a way, if the Government wanted to get a grip on things, it had no choice other than a lockdown, in my view,"

The Newshub report goes on.

On March 23, the day that Jacinda Ardern said New Zealand would go into lockdown, just 1050 tests were completed across the country. The public health units in charge of contact tracing could trace just 70 contacts a day. But on March 26, just three days later, there were 78 new cases in the country, each of which would have numerous contacts to trace

These reported factual statements look wrong. The reporter may have confused contact tracing with case tracing. We had the capacity to trace 70 cases, not just to make 70 trace contacts. If the latter were true the 20 health boards, would on average, be making just three and a half phone calls a day. The Verrall report put case tracing capacity somewhat higher than 70, but the basic idea that the demand for case tracing could possibly soon exceed capacity was reasonable.

Te Pūnaha Matatini director Shaun Hendy also pitched in.

" We've seen countries where their ability to case isolate has been overwhelmed, just because numbers grow,"

"So, you shouldn't be assuming that your ability to do case isolation is independent of your lockdown. In fact, those two things should go hand-in-hand. If you've got low case numbers, you'd better do fast case isolation. If you've got very large case numbers, then your case isolation will be insignificant,"

The argument here is that when the capacity to trace cases is exceeded the system will be quickly overwhelmed. So if we have a capacity of 70, and 78 new cases, eight fall by the wayside. The effectiveness of the case isolation tool falls by 10 percent. The next days are worse, and after a period of weeks we could be facing 1000 cases a day, with only 70 are being investigated. If so, then, as Mr.Hendy suggests, contact tracing will become largely ineffective, if no attempt had been made to expand capacity.

But this presumes that you are doing nothing to increase your case tracing capacity and there are no measures to increase social distancing (short of a full level 4 lockdown).

OCRG response a distraction

Most of the above discussion is a distraction, because it presumes that OCRG was tasked with modelling the consequences of the whole pandemic control campaign. They were not.

The title of their report, which we critiqued, reads:

Potential Health Impacts from the COVID-19 Pandemic for New Zealand if Eradication Fails

Taking the title at face value, the OCRG modelling presumed that there has been a prior attempt to eradicate the virus (presumably with a shock lockdown attempt). It is not successful, possibly because there is a premature loosening. The report is meant to exploring the outcomes of subsequent longer term social distancing measures, which reduce the level of contacts by 25 and 50 percent.

The attempts fail, and we get a large number of deaths. This is because the model parameters are set at a level where failure is guaranteed, absent any contact tracing and isolation. The point of the exercise, we presume was to impress on the Ministry, politicians and the public that 'failure' was not an option because the consequences were dire. This buttressed the case for a more extreme form of lockdown.

We presumed, in our modelling of the same exercise, that the Director General of Health was not incompetent and would have built up his tracing and testing capability, given the respite provided by a prior lockdown. This should have provided a reasonably high degree of assurance that the testing capacity would not be overwhelmed. And that is what is being done. The capability is now to trace 185 cases a day, building to a 'gold standard' of 300 . Tracing and isolation is a relatively cheap measure, compared to the alternatives, and the DG obviously could push a higher capacity if he wished.

So we stand by our conclusion that the tracing system would, on average, be 60 percent effective, and would work in tandem with a moderate and sustained social distancing to contain the virus. We also stand by our conclusion that the OCRG assumption that there would be no contact tracing, in the scenarios they said they were modelling, lacked credibility.

Switching the debate

Rather than respond to our critique of the contact tracing assumption in their report, OCRG have switched the debate to whether the full lockdown was justified. In their view it was, because of the inadequate testing capacity at the time of the lockdown. Growing testing capacity had lost the race with the growth in the case load, and the most extreme form of lockdown was the only alternative

There would be widespread agreement that a move to some variant of level three was appropriate, but the claim that locking down 500,000 non-essential workers was necessary is just an assertion, and is not backed by real evidence, or any OCRG modelling.

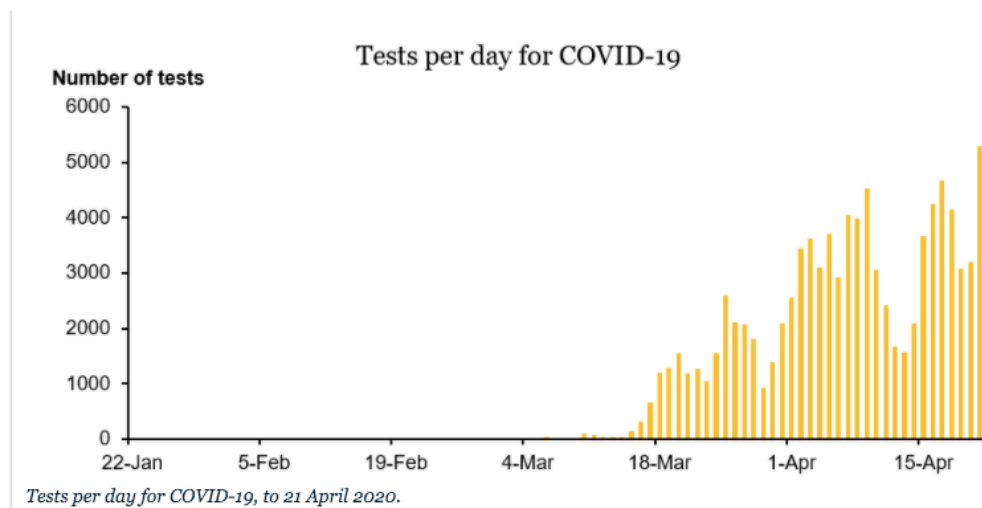
There is the argument that there are examples of contact tracing being overwhelmed elsewhere. Wilson plays up the New York outcome:

"The fact that our modelling analyses - that typically showed thousands of deaths - were quite plausible has been borne out by some overseas data. For example, if New Zealand had around the death rate from Covid-19 that New York City has had on a per capita basis - 0.17 percent of the population dying - then we would have had more than 8000 deaths in New Zealand, and the epidemic there is far from over.

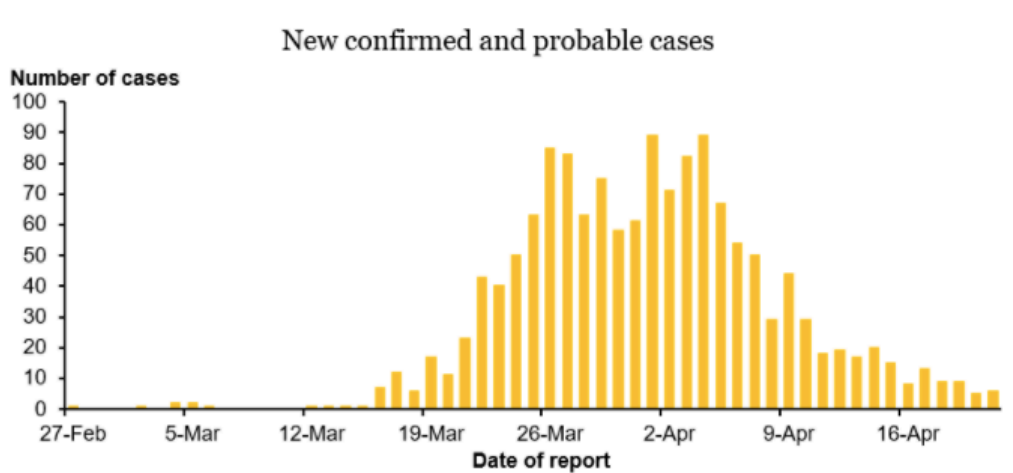
Pointing to a worst case outcome somewhere in the world, proves nothing about the robustness of OCRG's modelling, and New York is possibly the worst comparator you could choose. We don't have the population density and subway system of New York. There are many other countries that have

contained the virus with various combinations of testing, behavioral changes and imposed constraints.

On the other hand there are some indications that the Ministry's approach was working. If the number of tests is a proxy for contact tracing then figure 1 shows this was being ramped up. They weren't just sitting on their hands. And then there are the daily new case results shown in figure 2. These topped out towards the end of March. This could not have reflected the impact of the level 4 restrictions. They would not have had a material impact on the numbers until early April. If the OCRG was right then the case numbers should still have been steeply increasing. Even at level 2 the Ministry might have won the race against increasing case numbers, though it might have been a near run thing, and a risk possibly not worth taking. At level 3 they should have been fine.



Tests per day for COVID-19, to 21 April 2020.



New confirmed and probable cases over time, as at 9.00 am, 22 April 2020

On the question of whether level 4 was necessary at all, we have the Australian example. They have had the roughly same new case outcome as New Zealand, but they only went to level 3.

Very recently, the NZHerald has reported on some modelling out of Otago University that claims that New Zealand actually did much better than Australia. Because of its relevance to this discussion, we assess this work below.

Fit for purpose of modelling required

Whether ramped up contact tracing and more moderate social distancing requirements can win the race with growing case numbers, is a complicated story, but appropriate modelling could have given a better understanding of possible outcomes at the time OCRG were doing their analysis. Unfortunately, all they had was 'Covidsim', an off-the-shelf online calculator, which was not fit for purpose.

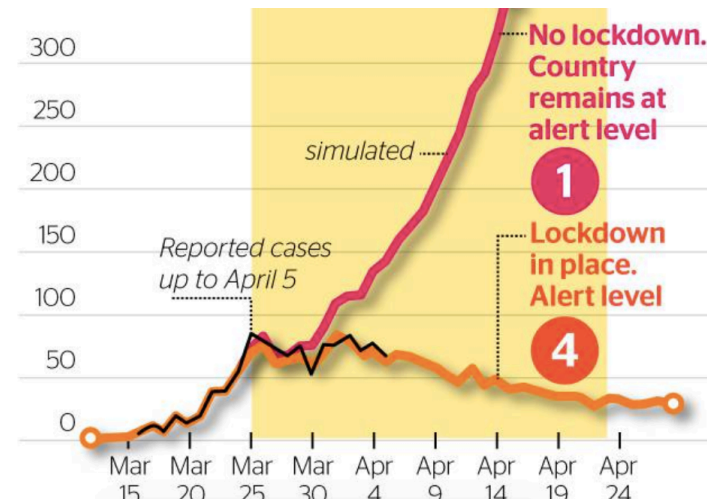
All Covidsim allows is a single setting for the two key policy instruments, social distancing and case isolation, over the whole modelling period. It does not allow the user to ramp up the level of case management (i.e., tracing/isolation), or to apply different levels of social distancing for short periods of time.

While we used Covidsim to test the robustness of the OCRG results for the issue they were modelling, we decided to build own model, CORONA-1 for policy modeling. Corona-1 addresses some of the weaknesses in Covidsim, and amongst other things, we included a capacity constraint on contact tracing, and an ability to increase that constraint, but with a lag. The results, of course, depend on the assumptions, particularly about the initial number of undiscovered cases in the community. But we found that most credible paths showed that expanded case management and a moderate increase in social distancing would contain the virus.

To illustrate, assume that the basic reproduction number, R_0 , is a 2.5, and a moderate level three intervention takes the effective R_0 down by half, to 1.25. If testing is, initially, even just 30 percent effective, R_0 comes comes down to 0.875, and is further reduced if contact tracing becomes more effective over time.

Both OCRG and TPM seem to argue that shorter-term modelling doesn't really work, because of the presence of superspreaders, who can inject a good deal of randomness into the case figures. When you are dealing with small numbers, randomness can be a factor, but that has not stopped

plenty of modellers producing short horizon projections. TPM, in particular, based their main public pronouncements on some very short-term modelling. Here is the screen shot, from their public release, again:



Case isolation misuse

OCRG argued that we somehow ‘misused’ the case isolation input in Covidsim.

Wilson also said Harrison had misused the case isolation input in his Covidsim projections. For Covidsim, case isolation indicates the quarantining of all Covid-19 patients - even if they have mild or no symptoms - away from their homes or families.

We are not sure what Wilson is talking about here. Covidsim is just an online calculator, it is not possible to misuse it, although it is possible to use assumptions that are arguable.

Covidsim assumes a fixed stock of completely secure isolation (quarantine) units, which is slightly wrong – there will always be some leakage. Once this quarantine capacity is full, patients go to home quarantine, where the model user assumes the level of security. Here is the screen shot. Covidsim doesn’t assume all isolation is away from homes and family as Mr. Wilson argues.

Contact reduction for cases in home isolation[%] 50



Mr. Wilson goes on to say

This (quarantine) is what has been done in China, Singapore and Taiwan. While some epidemiologists have said New Zealand could consider adopting this model, the country currently instructs non-severe cases to remain at home and isolate themselves from others in their household. This still leaves open the possibility of accidental infection within a bubble or deliberate non-compliance.

We suspect that what Mr. Wilson might be getting at here is that, perhaps, our policies, on quarantining should change. On the facts, however, he is mostly wrong.

Taiwan and Singapore permit home isolation (though with pretty strict enforcement), except when the home environment is unsuitable. There are a large number quarantined in Singapore at present, because of the big outbreak in the immigrant community. With large numbers of men living 8-10 to a room, the home environments are obviously unsuitable.

As for China, this is an authoritarian, and sometimes vicious state, so no doubt they resorted to some pretty harsh measures, not appropriate for New Zealand. On the other hand, we have become an authoritarian and sometimes vicious state (funeral restrictions, police dogs to intimidate travellers in quarantine in Auckland), so perhaps widespread quarantining could be next on the list.

Criticism of the cost benefit analysis

The main criticism of the cost benefit analysis from Nick Smith was that we was assumed that:

'the construction industry could operate in a business-as-usual scenario while the rest of the country was locked down.'

The reasoning was that

'there's no such thing as business-as-usual, in anywhere. I mean, Sweden [which has refused to lock down] has got a GDP hit. This is because regardless of what New Zealand does, its economic wellbeing is reduced regardless from the declines in international travel and the global economy and because some workers may choose themselves to stay more at home to avoid infection.'

The first part of the argument, that we are going to take a GDP hit, and that some of this is unavoidable, is true. But it doesn't tell us much about whether the building and construction industry could have operated close to normal during the one month of the lockdown. The industry had full order books and existing contracts. The demise of the tourist industry could only have had a limited impact on building and construction activity during the lockdown period.

The other argument is that workers would have wanted to stay home because of the additional risks of going to work. We think it is unlikely that this would have much of an effect on building activity.

Let us assume that the workers were reasonably well informed on the risks.

In their 16 March report to the Ministry of Health, the OCRG used the death rates, in the following table, to calculate the number deaths in an unrestrained epidemic. Assuming an 18-49 year old worker was aware of the data, they would take the .045 percent figure, from the right hand column; multiply it by 0.7 to account for asymptomatic cases, to get a probability of dying, if they contract the virus, of 0.032 percent. The odds are about 1:3000. The odds would be higher again if the worker did not have underlying health issues.

Then they would assess the marginal risk of contacting the virus, over one month. At home they would still run the risk of going to the supermarket, and being out and about for exercise. Some might conclude that there was no perceptible marginal risk. Or some might put it at, say, 1:10,000. After all they would have the benefit of all the other social distancing measures that would make it less likely that they would get the infection. So their assessment of the risk of death, over the month, would be 1:30,000,000. They would conclude that the risk was trivial.

Now not all workers would be perfectly well informed, because the MOH have not disseminated usable information on the risks. The public has also been deluged with messages to 'stay safe', implying that the everyone is at a material health risk. And uninformed sections of the media have

tended to play up the risks. However, the word is out there that the virus really only affects older and health compromised people. Our assessment is that few building and construction workers would be panicked, and work would have proceeded pretty much as normal, subject to social distancing constraints.

Table 2: Age-specific parameters for modelling health impacts for the New Zealand population from the uncontrolled spread of the COVID-19 pandemic

Age-group (years)	Census 2018 population	Population scaled to 2020	Proportion of symptomatic cases hospitalised*	Proportion of hospitalised cases admitted to ICUs*	Proportion of ICU cases requiring a ventilator*	Proportion of symptomatic cases dying (case fatality risk)*
0-4	294,921	310,718	1.25%	15.0%	35.0%	0.01%
5-17	809,576	852,940	0.50%	20.0%	30.0%	0.0075%
18-49	2,007,859	2,115,407	1.25%	15.0%	45.0%	0.045%
50-64	872,238	918,958	1.75%	20.0%	50.0%	0.10%
65+	715,170	753,477	16.0%	15.0%	45.0%	1.75%
Overall			3.00%	15.0%	45.0%	0.25%
Total	4,699,764	4,951,500				

* Estimates supplied to the authors by the Ministry of Health.

The response from Hendy on the TPM model

Hendy's main response on the TPM model was:

They don't have a good understanding of the model that we've used. And I think they've misunderstood how you can use Covidsim.

We do understand that their model outputs depend on the model inputs. Our criticisms were about their inputs.

- They used outdated information.
- Their assessments were biased.
- They didn't fully disclose the analysis behind the calibration of key inputs

The outputs TPM presented to the public were only their level 1 and level four intervention results, giving the impression that these were the only choices. They focussed on the gap between level 1 and level 4 to promote the case for the full lockdown that they were vigorously pushing.

Hendy did not respond to any of these criticisms.

Recently, the NZHerald has been producing TPM estimates of pre- and post-intervention effective reproduction rates for a number of countries. In its earlier modelling TPM assumed (based on their dated country experiences, and a biased assessment) that reproduction rates for countries on levels 2 and 3 were well above one. Only level 4 had a reproduction rate below 1, and so could contain the virus. Here are some of TPM's latest results for level 2 and 3 intervention countries, taken from the Herald. If TPM ran their model again, using this data, they would present a very different picture of the necessity to move to level 4.

Country (level)	Pre intervention Reproduction rate	Post intervention reproduction
Sweden (2)	2.8	0.9
Hongkong (2/3)	2.0	0.3
NSW (3)	3.0	0.5
Iceland (2)	2.2	0.5
Japan (2)	2.2	1.3

As for not 'understanding' their model, TPM could make it publicly available, so independent parties can review it and test its properties.

Brian Cox of Otago University on the Australian and New Zealand experiences

There is a recent report on NZherald.co.nz under the following headline:

Covid 19 coronavirus: Revealed - the data showing the success of NZ's lockdown over Australia's

There is no reference or link to the paper supporting this story, so all we have to go on is the report by Derek Cheng, a political reporter for the Herald.

The report goes as follows:

'New academic analysis shows the level 4 lockdown in New Zealand not only allowed the country to catch up to Australia, but surpass it in terms of per capita Covid-19 cases.

The daily case rate in New Zealand has been only 59 per cent that of Australia since the start of a 33-day lockdown, according to Otago University Associate Professor Brian Cox, a medically-trained epidemiologist and specialist in public health.

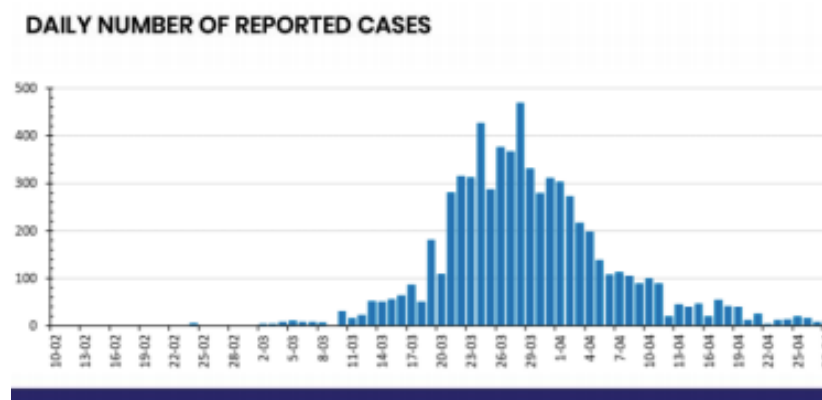
His analysis shows that New Zealand's rate of confirmed cases per capita was far higher than Australia's at the start of the lockdown, but drew level after about three and a half weeks and is now well below Australia's.

These findings are at odds with common understandings of the Australian and New Zealand epidemics, so it is useful to set out some of the facts first.

The distribution of daily case numbers

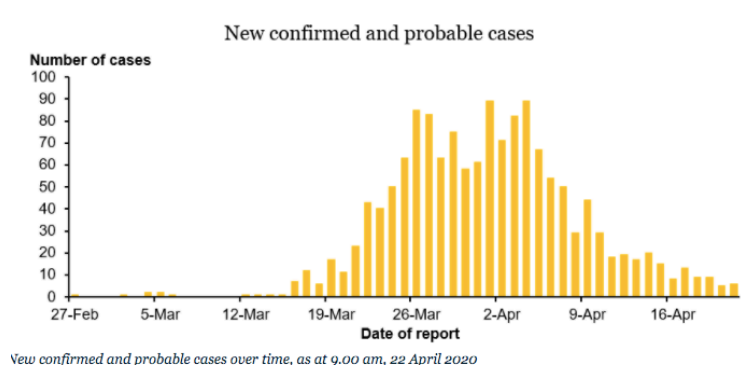
The distributions of daily cases is shown below. On a per capita basis they appear almost identical, except Australia's epidemic was a few days ahead of New Zealand's.

Figure 1: Australia daily newcase distribution.



Source: heath.gov.au 29 April

Figure 2: New Zealand new daily cases Source: MOH 29 April 2020



The situation at 26 March

When New Zealand went into lockdown on 26 March, New Zealand had 78 new reported cases. On that day Australia had 374 reported cases (source health.gov.au). On a population adjusted basis the positions on the 26 March were almost identical. Though note, there is an issue with the comparability of New Zealand and Australian data, which we address below.

The Cox analysis

So how does Cox come to the conclusion that New Zealand's cases were 'far higher' than Australia's on 26 March? There were a number of steps in his analysis.

First, he defines the start of the epidemics as when there are cumulatively four cases in New Zealand, and weighted by population, 20 in Australia. Four cases is chosen because it is 'suggestive of community spread'. This is wrong. We know that the first four reported cases in New Zealand were picked up overseas, or from a partner who had just return from overseas. There was no measured community spread (as community spread is commonly understood) at that date. The World Health Organisation currently recognises three classes of transmission statuses in its regular Situation Reports. They are: sporadic; clusters of cases; and community transmission. New Zealand and Australia are currently rated as clusters of cases.¹

¹ The WHO defines Community transmission as:

Countries/area/territories experiencing larger outbreaks of local transmission defined through an assessment of factors including, but not limited to: - Large numbers of cases not linkable to transmission chains - Large numbers of cases from sentinel lab surveillance - Multiple unrelated clusters in several areas of the country/territory/area
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On Cox's definition, Australia's epidemic started on 22 February and New Zealand's on March 6. The reason for Australia's earlier triggering of the 'epidemic' test is that there were sporadic cases in late January and early February from overseas. Then there was a gap, with one case on 21 February, and the 20 mark was passed on 22 February. By the time New Zealand passed 4 cases on 6 March, the Australian 'epidemic' had been underway for 12 days. Over that time this 'raging' epidemic accounted for about 40 cases. We are not familiar with the fine detail, but we suspect that most, or all, of these were imported or close to an imported case.²

Second, he calculated the number of days since the start of New Zealand's 'epidemic' to the lockdown, which is 20 days, and then calculated the number of Australian cases on 14 March, which is day 20 of their 'epidemic'. As can be seen in his figure below, this is a small number, less than 1 case per million.

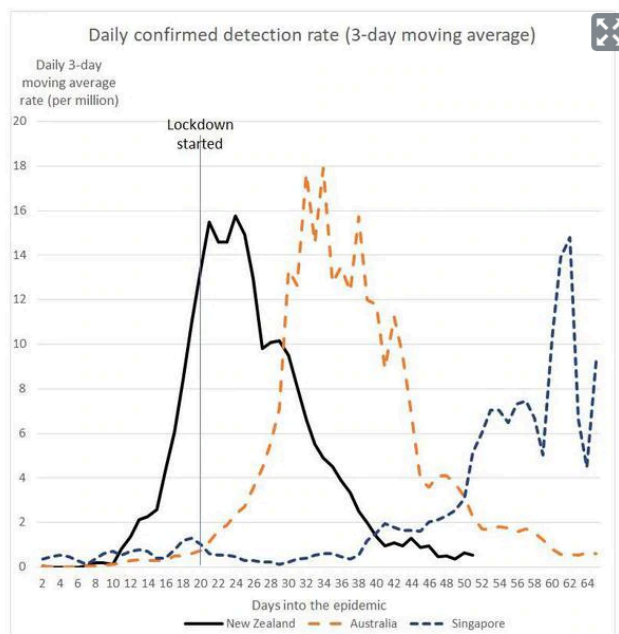
This is compared with New Zealand's cases per million on March 26, which is just under 18 per million. On this basis he claims that New Zealand was dealing with the tougher task on 26 March. We were dealing with 78 cases a day, but the Australians were dealing with only about three or four, adjusted for population. Hence Gox's claim that *'New Zealand's rate of confirmed cases per capita was far higher than Australia's at the start of the lockdown'*. The fact that the actual Australian new cases, adjusted for population, on 26 March was also about 78, is not relevant in his world.

This simply doesn't make sense, and flows from Cox's arbitrary definition of what constitutes the start of an epidemic. He defines four people picking up the virus, all from overseas or from a partner who has just returned, as indicating community spread, when on the case evidence this simply wasn't true. If a much higher trigger point had been selected, which might be more fairly indicative of the presence of community spread, then the analysis would have produced a completely different outcome.

And sporadic transmission as: Countries/territories/areas with one or more cases, imported or locally detected

² On 6 March the WHO recognized only two transmission classes: Imported cases only, and local transmission. Because one of New Zealand's four cases was the partner of an imported case, New Zealand was rated as local transmission. As almost all countries became local transmission, the classification was not very informative and was subsequently changed

Figure one: Cox's New Zealand Australia comparison



Performance post lockdown

The reported number of cases per capita since 26 March is higher in New Zealand than Australia. To get to his claim that the number of New Zealand cases was 59 percent of the Australian number, Cox appears to have deducted the number of probable cases from the New Zealand total. Australia does not report probable cases. But comparing just New Zealand and Australian confirmed cases the New Zealand count is lower. This appears to be Cox's argument.

What this leaves out is a probable difference in New Zealand and Australian case reporting. Cases are described as confirmed when there is a positive laboratory test. But from 3 April, in New Zealand, people living with someone who had tested positive were not tested. They were just assumed to be a probable case and subject to home isolation. This had the effect of boosting the number of probable cases, and reducing the number of confirmed.

Without a detailed understanding of the testing procedures and reporting in both jurisdictions, it is not possible to say whether New Zealand's total number of cases (per capita) was below Australia's, and if so, by how much. There is no evidence that Cox did this detailed work.

Cox's conclusions

From his analysis Cox claims to have rescued the New Zealand response from accusations that it was an overreaction, and that Australia got the same results at lower cost. He concludes:

"If we hadn't locked down when we had, it would have just taken off and we would have been way above Australia"

He simply ignores the fact that New Zealand's epidemic had peaked before the lockdown had an effect.

"Our lockdown was more effective".

The results appear to be almost identical.

Our conclusion

Cox's conclusions are based on some jiggery-pokery with the data, But he has not succeeded in refuting conclusions based on the evidence. The New Zealand and Australian epidemics were almost the same, and the epidemiological results of the intervention were almost the same. But Australia's interventions were less costly.

This appears to be another instance of an Otago University academic wanting to present their hardline views to the public, using a 'shock' expose' of some numbers to do so. In this case the research has not been made available so it can be reviewed and critiqued.

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