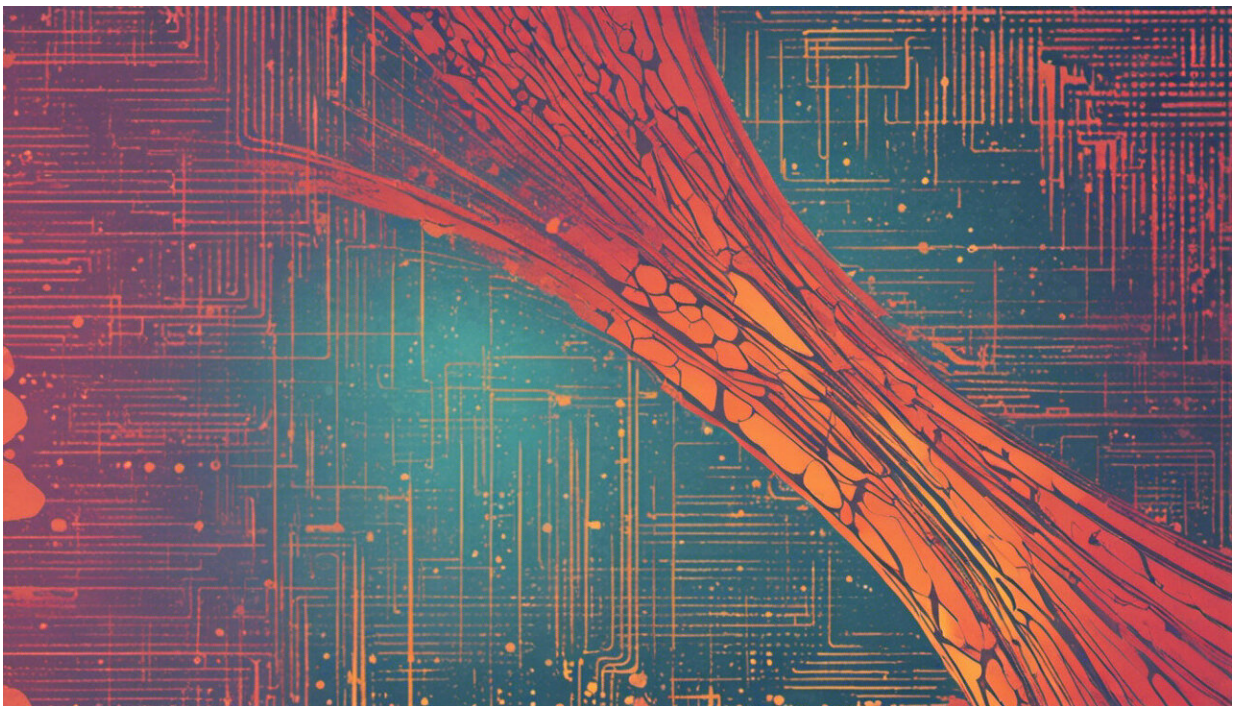# We're flattening the coronavirus curve, but modeling needs to inform how we start easing restrictions

April 8 2020, by Tony Blakely

Credit: AI-generated image (disclaimer)

Australia is on track to flatten the curve of coronavirus cases, which will allow our health system to cope with increasing demand for intensive care unit (ICU) beds, recently released modeling confirms.

The modeling, produced by the [Doherty Institute](link), was delivered to government in February but only released publicly yesterday.

In a press conference before the release, Prime Minister Scott Morrison and Chief Medical Officer Brendan Murphy emphasized the modeling was theoretical and used international data.

International data is still useful—the public health advice on tobacco, for example, is derived mostly from non-Australian studies.

But the way an epidemic plays out is context-specific. The way Australians hang out together, for instance, is different from the way Chinese people socialize. This changes fundamental parameters, such as how many people someone with COVID-19 can be expected to infect.

So what does the modeling tell us and what are we yet to determine?

What scenarios were modeled?

The more applicable of the two papers released yesterday aimed to estimate how much ICU and hospital capacity would be exceeded (in both percentage terms, and number of days) for various scenarios of how the epidemic unfolds.

The three scenarios were:

- unmitigated spread (just "let the epidemic rip"). Peak daily ICU demand would be 35,000 a day, greatly exceeding Australia's expanded ICU capacity of 7,000 beds
- quarantine and isolation of cases scenario. The number of ICU beds needed during the peak would be 17,000 a day, still exceeding Australia's expanded capacity
- a quarantine and isolation scenario, plus social distancing at two

levels of intensity. Daily ICU bed demand would peak at below 5,000.

Australia was never going to allow unmitigated spread and has implemented quarantine and isolation of cases. And in terms of social distancing, Australia has already exceeded the measures in the paper's more intense scenario.

Modelling the impact of social distancing on demand for ICU beds

Daily demand for ICU beds (incidence per million population) for cases with <u>median</u> severity
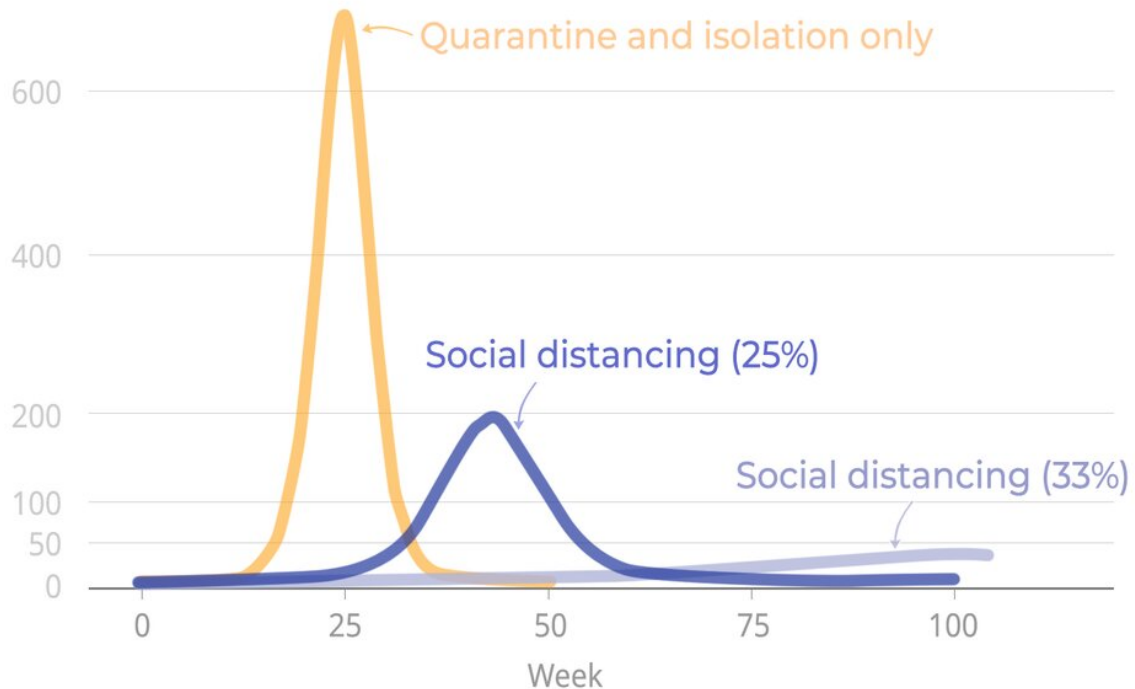
The model shows that isolating cases and quarantining contacts alone will not be enough to prevent case numbers from overwhelming the health sector. Some level of social restrictions will be needed.

The model assumes a base R0 of 2.53 and a doubling time of 6.4 days. The two social distancing scenarios model the impact of "constraining spread" by 25% and 33%, equating to R0 of 1.90 and 1.69, respectively. The effective R0 is further reduced when combined with quarantine and isolation measures.

Source: Doherty Institute

Credit: The Conversation

What do we learn from the modeling?

As we've learned over the past month from simpler models and back-of-the-envelope calculations, ICU capacity is under grave threat of overload for anything other than a carefully designed, tested and monitored package of case isolation, quarantine and physical distancing.

Physical distancing is essential to flatten the curve enough to avoid ICU overload if we elect to let this epidemic wash through society to achieve herd immunity.

Importantly, in all scenarios primary care and general hospital ward capacity were never (even remotely) threatened.

Accordingly, and correctly, the chief medical officer emphasized it's important that people with existing chronic diseases (such as heart and respiratory disease) keep getting routine medical check-ups, so their conditions don't deteriorate and require hospitalization down the track.

If someone experiences sudden shortness of breath or chest pain, they still should be ringing 000 and getting assessed.

Life goes on, as do the vast array of other threats to our health that we can mitigate. And we have the capacity to keep doing this.

What do we do next?

The bigger question is what comes next, and this wasn't addressed in the modeling papers.

The [prime minister](link) and chief medical officer urged Australians not to relax their current social distancing actions.

But Morrison noted there was a financial and societal limit to endless mitigation. In other words, we need to get through this, but within
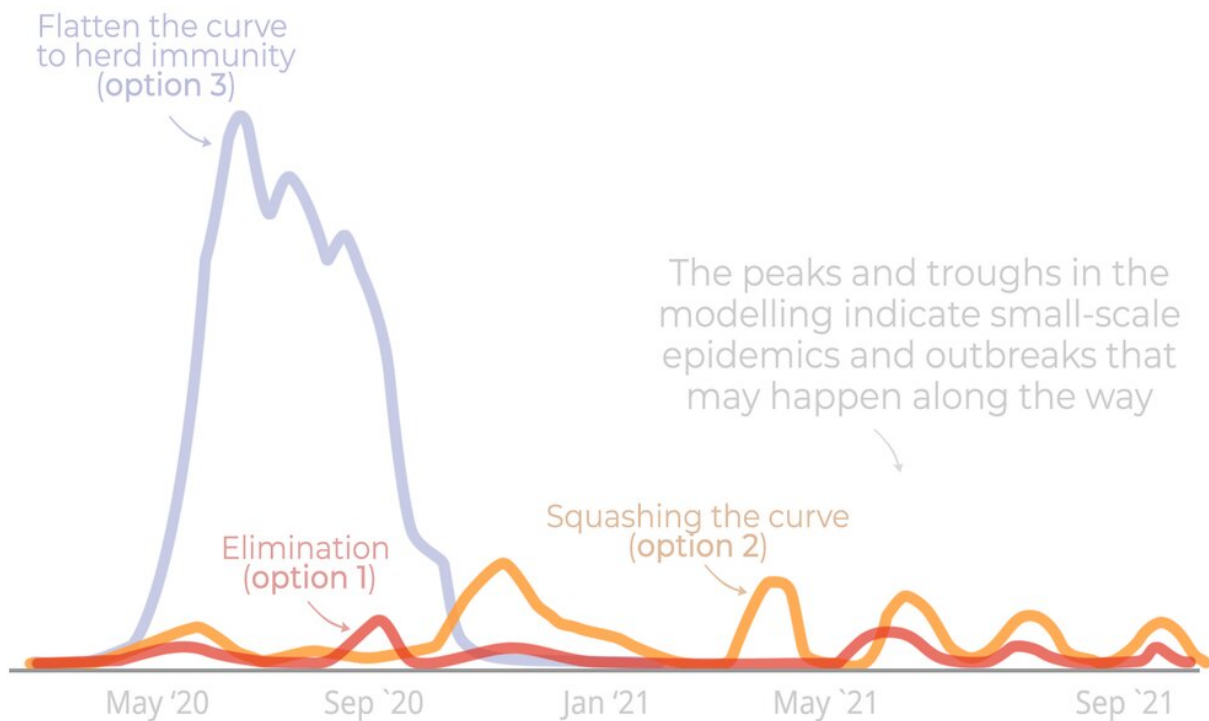
sensible resource limits.

The government wants to use this position of "relative calm" to make decisions about where to next. As Brendan Murphy said: "We are on a life raft. We now have to chart the course of where we take that life raft. The National Cabinet wants considered advice on all the directions. We don't have those answers yet."

Three options for tackling COVID-19

Three scenarios for tackling COVID-19 over <u>18 months</u> (until a vaccine is assumed ready)

The chart below shows stylised patterns of daily COVID-19 infections rate we might see over 18 months in the three scenarios.

Flatten the curve to herd immunity (option 3)

The peaks and troughs in the modelling indicate small-scale epidemics and outbreaks that may happen along the way

Squashing the curve (option 2)

Elimination (option 1)

May '20   Sep '20   Jan '21   May '21   Sep '21

Under attempted elimination and squashing the curve, break-through cases are inevitable with mini-epidemics, which are assumed to be a bit larger with squashing the curve (option 2) than elimination (option 1) due to different intensity of testing, contact tracing and isolation.

Source: Tony Blakely, University of Melbourne

Credit: The Conversation

How can modeling help us decide?

Essentially, we need different, better and more models than we saw yesterday. Some of this work for the government is underway and will be released in coming weeks. But we also need two things:

1. Agent-based modeling

This is modeling of individuals bouncing around society like balls in a pin ball machine.

Yesterday's model used equations applied to groups of people. But it can't easily model the impact of separate interventions, such as school closures versus reducing gathering sizes.

Agent-based models offer more options. If we know, for example, that citizen A reduces their social contacts with people from 15 contacts a day of more than five minutes duration within 1.5 meters, to two such contacts while working from home, then we can (and should) model that.

We need many different agent-based models from many different research groups. Australians aren't going to stay in lockdown indefinitely so the more models and sources of information, the better.

2. To broaden the scope of modeling

We need models that include more than just the COVID-19 transmission dynamics. We need models that weigh up the consequences of both the epidemic, and our potential societal cures to the epidemic.

There is a real risk the societal cure we choose may do more harm. Lockdowns, for example, cause drops in GDP and increases in unemployment. That feeds back on to changes in suicide and heart disease. We need to quantify that, and weigh it up.

What are the options going forward?

My team and many others around the country are building simple but useful models to help Australia decide on the way forward. There are three main options:

1. should we go all-in and aim for elimination (with the fall back of option 2 or 3 if this fails)?
2. should we keep squashing the curve, as we are doing successfully now, and wait 18 months for a vaccine?
3. should we meticulously plan for a relaxation of distancing measures (while protecting our elderly and those with chronic conditions), let the case numbers rise so our ICU can cope, and ride this flattened curve out to herd immunity within, say, the next six months?

This is what we need to work our way through.

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