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New Zealand's COVID-19 elimination strategy

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Abstract

New Zealand has implemented an elimination strategy to control the COVID-19 pandemic. Compared with the mitigation and suppression approaches used in most western countries, elimination can minimise direct health effects and offers an early return to social and economic activity free from the constraints of circulating Sars-CoV-2 virus. Elimination requires highly effective border controls, contact tracing and quarantine measures, high levels of testing and surveillance, and an initial period of intense physical distancing (lockdown) to extinguish virus transmission. As with all COVID-19 strategies, the ultimate exit path will depend on development of effective vaccines and/or therapeutics.

On 23 March 2020, New Zealand committed to an elimination strategy in response to the COVID-19 pandemic. That was the day Prime Minister Jacinda Ardern announced that on 26 March New Zealand would commence an intense lockdown of the country (the highest level of a 4-level response framework[1]). At the time, New Zealand had just over 100 COVID-19 cases and no deaths, so this 'go early go hard' approach surprised many. However, there were compelling reasons for New Zealand to pursue elimination[2].

In this perspective article we describe why an elimination strategy made sense for New Zealand, the distinguishing features of this approach, some of the challenges and how they can be overcome, and where to from here.

Elimination and other strategic choices

Until early March 2020, New Zealand's response to COVID-19 followed its existing pandemic plan, based on a **mitigation** approach for managing pandemic influenza[3]. The plan includes steps designed to slow entry of the pandemic (keep it out), prevent initial spread (stamp it out), and then apply physical distancing measures progressively to 'flatten the curve' and avoid overwhelming health services (manage it). Because pandemic influenza cannot be contained (except by extreme measures such as total border closure), there was a presumption that case and contact based management would fail and the country would inevitably progress to having widespread community transmission of the pandemic virus Sars-CoV-2.

Most western countries across Europe and North America were following the mitigation approach. However, it was performing poorly, with COVID-19 cases overwhelming health services. Most countries were then switching to a **suppression** strategy [4]. This strategy involved intense physical distancing and travel restrictions (lockdowns) to suppress virus transmission. A few countries were continuing with a version of mitigation labelled 'herd immunity' where they planned to manage the rate of infection in such a way as to avoid overwhelming the health care system and build up enough recovered and likely immune people in the population to ultimately interrupt virus transmission. This approach proved difficult to manage and was largely abandoned (except perhaps by Sweden).

Most low and middle-income countries could do very little to manage the pandemic except apply limited mitigation measures. Vietnam was a notable exception, implementing stringent control

measures including quarantine, contact tracing, border controls, school closures, and traffic restrictions while case numbers were still low. A small number of island states, such as Samoa, Tonga and the Cook Islands, adopted an **exclusion** approach by largely closing their borders to incoming travellers.

By early March, the evidence base for **elimination** was growing, with the increasing realisation that COVID-19 is not pandemic influenza [5]. A watershed moment was the report of the WHO joint mission to China, which confirmed that the pandemic there had been contained even after widespread community transmission had commenced [6]. There was also strong evidence for the success of the elimination approach in Taiwan [7], Hong Kong, Singapore, and South Korea.

The concept of elimination is well-known to infectious disease epidemiologists [8]. It refers to the absence of an infection in a country or region. While absence of disease is the ultimate goal, elimination criteria for highly infectious diseases such as measles allow for occasional outbreaks or imported cases provided they are stamped out within a defined time period [9]. By contrast, eradication means that a disease has become extinct at the global level, at least outside laboratories.

There is no established definition for COVID-19 elimination. Preliminary thinking suggests that such a definition would need to include a defined period of absence of new cases (perhaps 28 days, which is twice the maximum 14 day incubation period)[10]. This criterion would require a high-performing surveillance system and would exclude cases detected in arriving visitors while under quarantine [10]. At the time of writing in mid-May 2020, New Zealand had passed the acute phase of the pandemic response, and could be considered to be in a pre-elimination stage. Case numbers were at low levels, with several days without new reports. Elimination status may take weeks or even months to achieve, and countries could potentially move in and out of this state depending on their success with containing the pandemic.

Benefits and costs of elimination

At the time New Zealand chose an elimination strategy, the exact nature of this response and its full justification had not been articulated[2]. The health impact of a poorly contained pandemic had been modelled using a range of scenarios [11], demonstrating clear health gains if a widespread pandemic could be prevented in NZ. There was also a concern to avoid repeating the catastrophic impact of previous influenza pandemics on Māori and to protect neighbouring Pacific Islands [12].

The net economic benefits of an elimination strategy were uncertain and extremely difficult to estimate. An additional challenge was that both the pandemic and its response were likely to have a disproportionate impact on disadvantaged populations. While an elimination strategy had huge economic and social costs, the alternatives (counterfactuals) were almost certainly far more damaging. One advantage of an elimination strategy was that it provides a medium-term exit path for return to domestic economic activity without the constraints of circulating Sars-CoV-2 virus. Neither mitigation nor suppression provided a certain exit strategy, particularly given major uncertainties about coronavirus immunity and the potential for ongoing epidemic transmission for months to years under some scenarios [13]. As with all COVID-19 strategies, the ultimate exit path will depend on developing effective vaccines and/or therapeutics.

Components of elimination and their implementation

Elimination requires an array of control measures tailored to local needs and to the transmission characteristics of the organism concerned. For COVID-19, the major components are similar to those used for pandemic control more generally. The main difference is the intensity and timing with which they are applied (see table).

COVID-19 elimination requires a very strong emphasis on border management to keep the virus out. That intervention would usually be combined with case and contact management to stamp out transmission, along with highly developed surveillance and testing to rapidly identify cases and outbreaks. If started early these measures may be sufficient for elimination without the need for lockdowns, as was achieved in Taiwan.

An elimination strategy requires highly functioning public health infrastructure. Increasingly, traditional approaches are supported by newer tools such as the use of digital technology to speed up contact tracing [14]. Additional surveillance approaches can be used to provide increased assurance of elimination (eg, sentinel surveillance, sewage testing). However, even in the presence of a highly sophisticated surveillance system, transmission will continue to occur if isolation and quarantine adherence is suboptimal.

Table: Components of pandemic control and features which distinguish the elimination strategy from mitigation and suppression

Component of pandemic control system	**Feature that distinguishes the elimination strategy from mitigation and suppression**
Border management, including exclusion, quarantine	Increased intensity as critical to creating and sustaining elimination
Case, contact and outbreak management, including case isolation and contact tracing and quarantine, with digital assistance	Increased intensity as critical to creating and sustaining elimination
Disease surveillance, including high volume testing and sentinel surveillance	Increased intensity as critical to creating and sustaining elimination, including strong emphasis on rapid, sensitive case identification and additional methods to confirm elimination
Physical distancing and movement restriction at various levels (up to lockdown)	Ability to introduce early and intensely to suppress community transmissions and outbreaks
Public communication to improve hand washing, cough etiquette, mask wearing, physical distancing	Probably no change, but will need to be increased if 'lockdown' is required (under any scenarios)
Coordination and logistics	Potentially increased to manage intense elimination measures
Protecting vulnerable populations	Similar, but duration will be shorter if elimination is successful
Health system capacity eg expansion of ICU and ventilator capacity	Similar, but duration will be shorter and demand less intense if elimination is successful
Protecting healthcare workers	No change

Research and evaluation	Potentially increased given limited evidence base for elimination measures

Barriers to successful elimination and how to overcome them

The COVID-19 pandemic was halted in China, demonstrating that there are no absolute biological barriers to its elimination [6]. Having no important animal or environmental reservoirs is a necessary condition, and this appears to be the case for COVID-19 (though its actual origin in nature has not been determined so cases could in theory arise from this source). The combination of high infectiousness and presymptomatic transmission poses challenges for control[15]. Fortunately, its relatively long incubation period (about 5 days) makes contact tracing and quarantining effective, unlike influenza [5].

Changing human behaviour to reduce COVID-19 transmission is challenging for a virus that is as transmissible as COVID-19. That is why mandated extreme physical distancing and movement control (lockdown) may be needed. The intense lockdown carried out in New Zealand suppressed transmission and gave the country time to expand border controls, improve contact tracing, and undertake large-scale testing. Coming out of lockdown (which began progressively on 28 April) has to be managed carefully, as the goal is to emerge into a country that is free from community transmission (unlike the lockdowns in countries pursuing mitigation or suppression). Widespread use of face masks was not a feature of the New Zealand strategy but might in future reduce the need for this intervention [16].

Successful implementation of an elimination strategy requires early risk assessment, effective response planning, infrastructure, resources and political will. The global response to Sars-CoV-2 has been described as the 'greatest science policy failure of our generation' [17]. An elimination strategy could potentially have been widely used to contain COVID-19 and protect populations in countries across the globe.

Conclusion and where to from here

New Zealand and Australia appear to have joined a small group of countries and jurisdictions pursuing an explicit, or implied, COVID-19 elimination goal, the others including mainland China, Hong Kong, Taiwan, Singapore, South Korea and a number of small island states and territories. This set of countries is likely to expand in the future. It is not hard to imagine travel between these countries being relaxed in the future once the risks are well understood and can be managed. It may be time for these countries to actively share knowledge and evidence about the approaches that are supporting them to contain and eliminate COVID-19.

There are multiple potential future scenarios. By pursuing and maintaining an elimination strategy, countries can prevent disease and death from COVID-19 and avoid further exacerbation of existing health inequities. They also move from having to manage ongoing pandemic transmission within their population to being able to make informed strategic choices about prevention and control options such as vaccines and antivirals as they become available.

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