Why elimination should be the default strategy for future severe pandemics

Professor Michael Baker,
University of Otago, Wellington, New Zealand

Health Watch USA Webinar:
Combating Infectious Disease Challenges; Have we gone twenty steps forward or backwards?

29 Aug 2025

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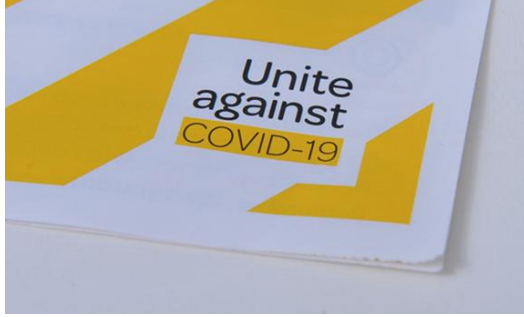
Outline



- Strategic choices for a pandemic response
- NZ experience with Covid-19 elimination
- Evidence supporting elimination
- Circumstances when exclusion/elimination may be justified
- Challenges, advantages, and disadvantages of elimination
- Implementing elimination as part of pandemic prevention, preparedness, and response (PPPR)

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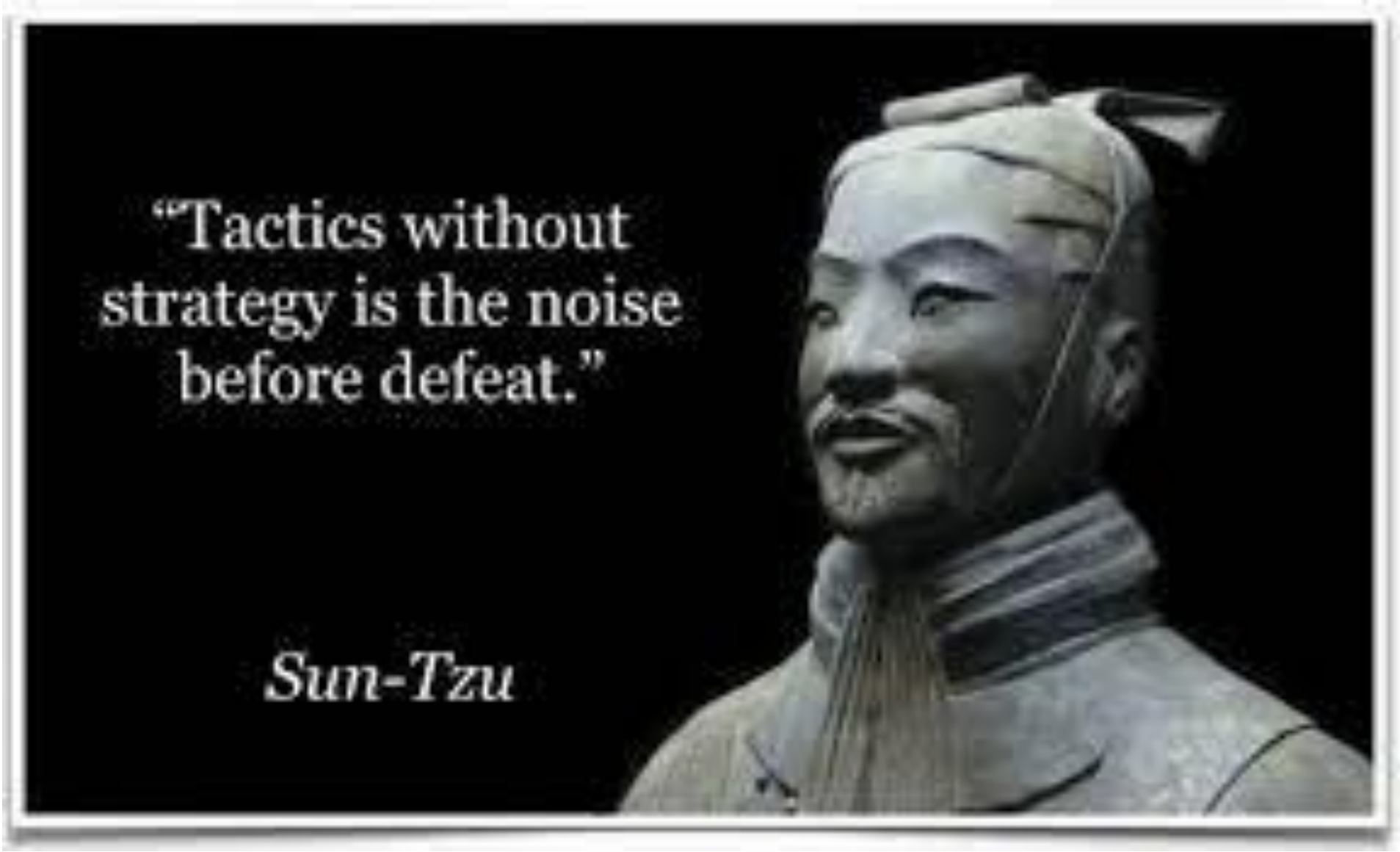
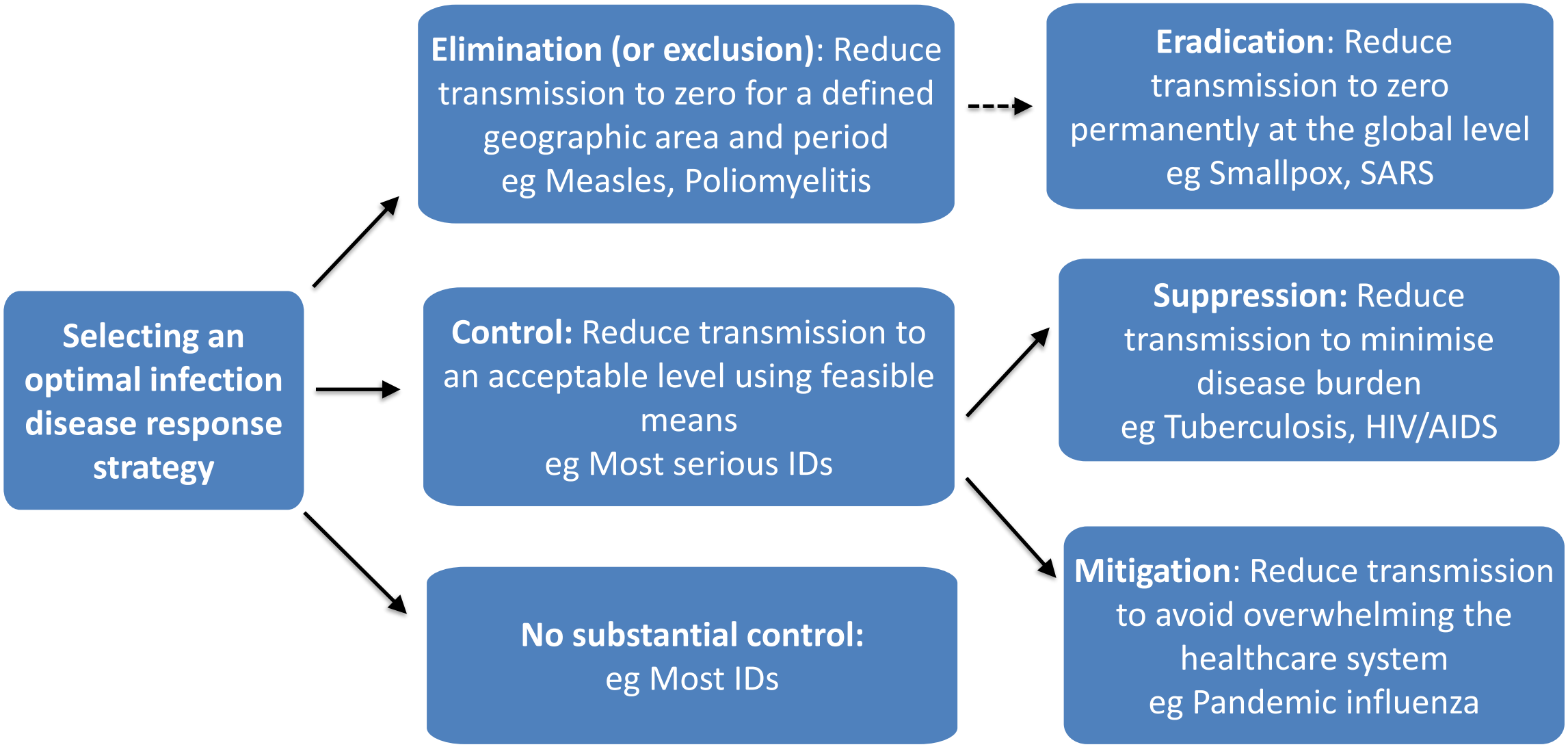
Strategy matters …



Strategic choices for responding to infectious diseases



Source: Baker et al. BMJ, 22 Dec 2020; Baker et al. NZMJ, 26 Nov 2021; Baker et al. The Lancet, 13 Jan 2023

Application of elimination to infectious diseases

Eradicated diseases

- Smallpox, Rinderpest, SARS

Global eradication underway

- Poliomyelitis (polio), Dracunculiasis, Yaws

Regional elimination established or considered

- Measles, Rubella
- Hepatitis C, Hepatitis B, HIV
- Hookworm, Lymphatic filariasis, Onchocerciasis, African trypanosomiasis, Malaria, Rabies, Syphilis, nvCJD (from BSE)

NZ experience with Covid-19 elimination: Light-bulb moments

1. January 2020 - It's a serious global pandemic

2. February 2020 - It can be contained/eliminated

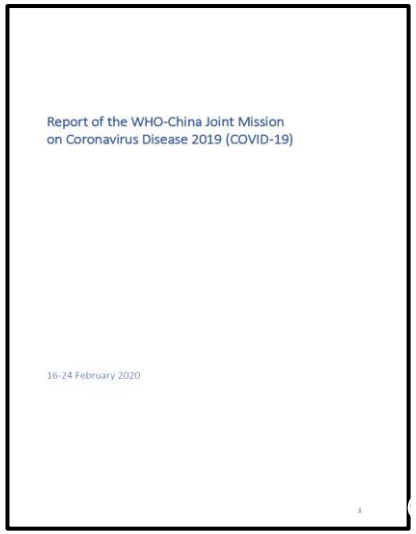
3. March 2020 – Its circulating in NZ – rapid, vigorous response needed to eliminate it


Articles

Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study

Summary

Source: Wu et al. Lancet 31 Jan 2020


Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19)

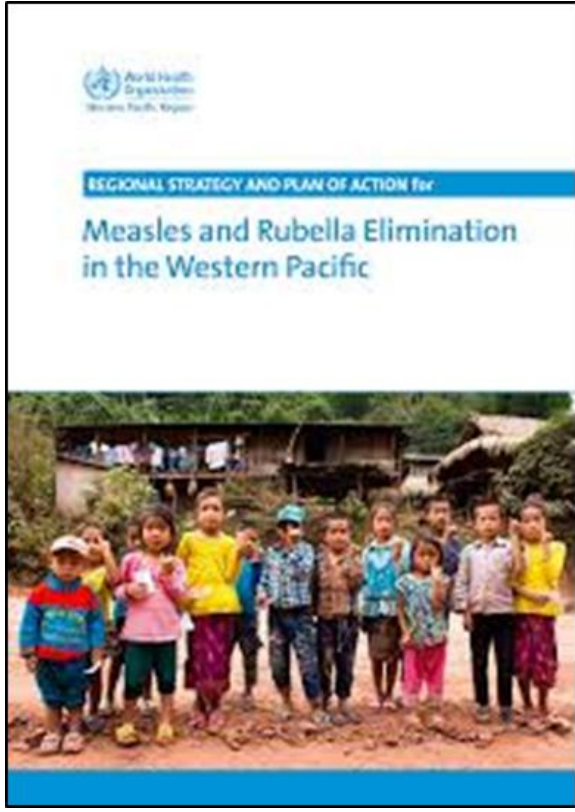
16-24 February 2020

Source: Aylward et al, WHO, 28 Feb 2020

NZ Experience with Covid-19 elimination

Elimination strategy effectively adopted by NZ Government on 23 March 2020

Introduced rapid ‘stay at home order’ (‘lockdown’) with ~100 Covid-19 cases, no deaths



New Zealand’s elimination strategy for the COVID-19 pandemic and what is required to make it work

Michael G Baker, Amanda Kvalsvig, Ayesha J Verrall, Lucy Telfar-Barnard, Nick Wilson

In this editorial we summarise the threat posed by the COVID-19 pandemic, the justification for the elimination strategy adopted by New Zealand, and some of the actions required to maximise the chances of success.

What is the size and nature of the threat?

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has shown a relentless ability to infect the world’s population. The virus is highly infectious, with each case typically infecting 2–3 others (a reproduction number [Ro] of about 2.5). Consequently, it has the potential to infect the fact that populations take measures to protect themselves.[3] Under one of the more likely scenarios if the country’s current elimination strategy fails, New Zealand could expect approximately 14,400 deaths.[3] In addition, large numbers of people who are ill and hospitalised could swamp health services at all levels and prevent the delivery of elective services and preventive care.

A poorly controlled pandemic will greatly increase health inequities. Like seasonal influenza in New Zealand, risk is particularly concentrated in older people and those with severe comorbidities.[4] Therefore Māori and Pacific peoples could be more

Source: Baker et al. NZ Med J, 3 April 2020
First published Covid-19 elimination strategy

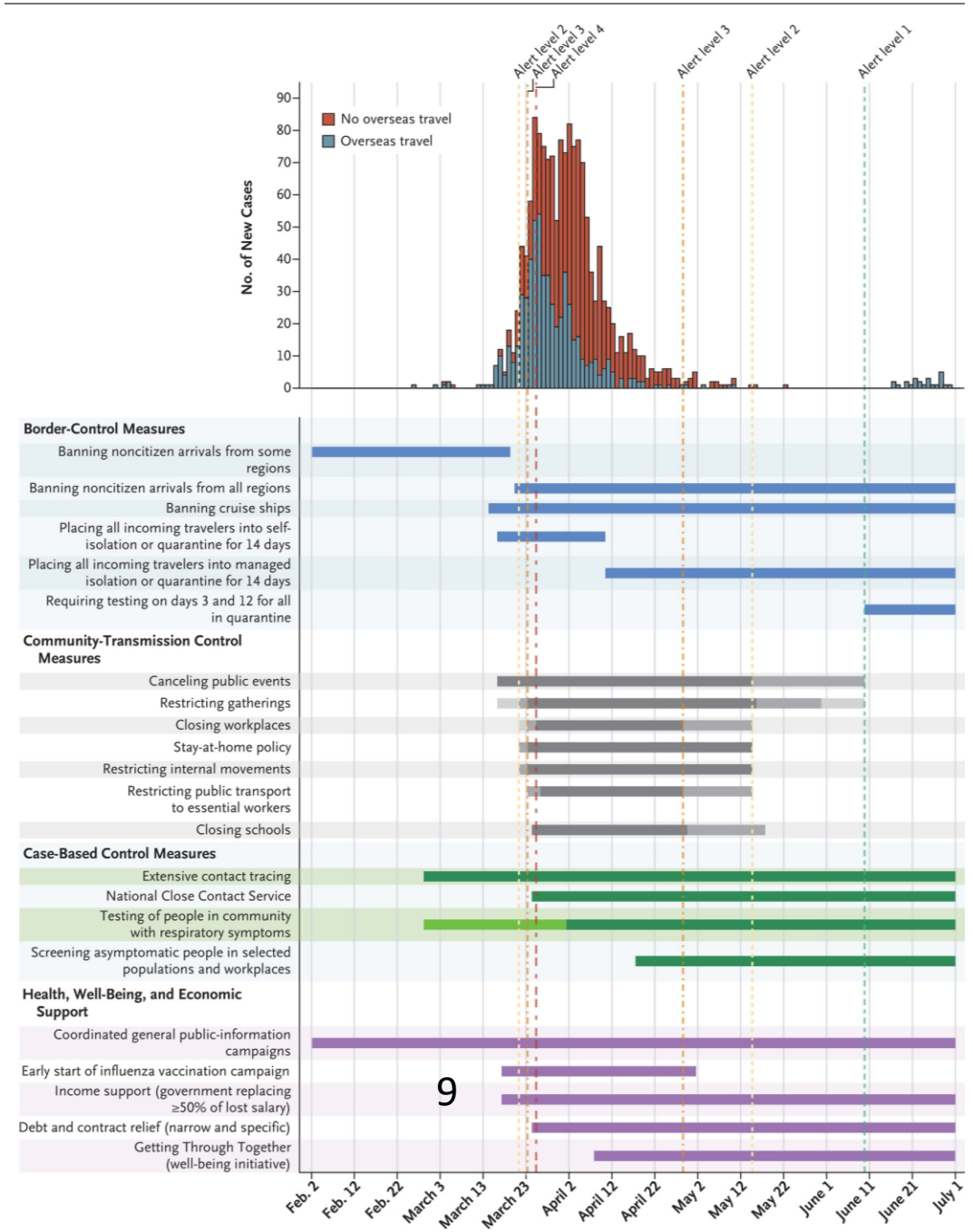
NZ Experience with Covid-19 elimination

Elimination Strategy Components for Covid-19:

1. **Exclusion of cases**
   - *Keep it out* – Border Management
2. **Case and outbreak management**
   - *Stamp it out* – Testing, contact tracing, isolation/quarantine
3. **Preventing community transmission**
   - Hygiene measures, masks
   - Physical distancing & travel restrictions
   - Vaccination (from year 2 of pandemic)
4. **Social safety net**
   - Wage subsidy scheme & other support

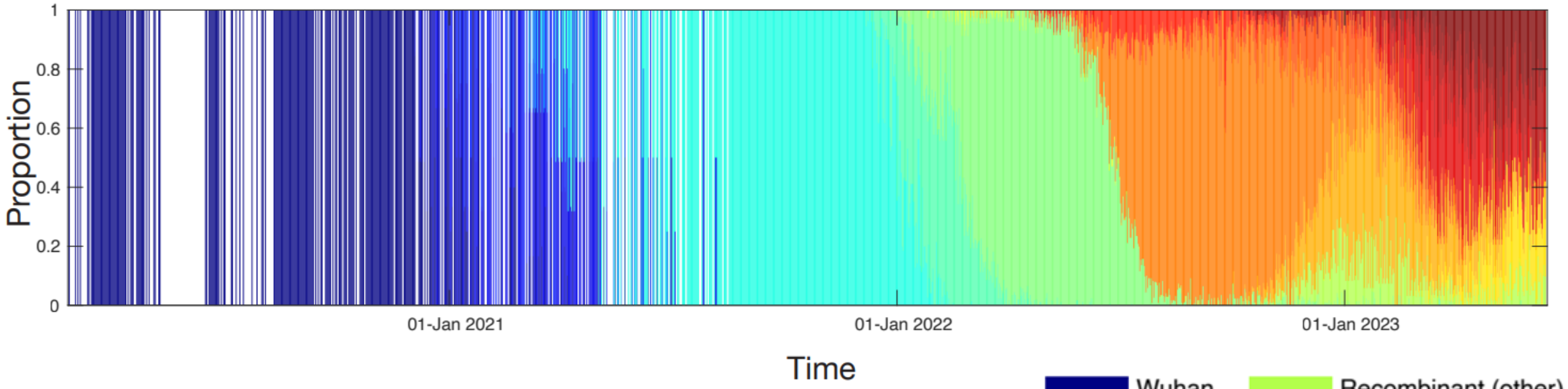
Source: Baker et al 2020, NZ Med J; Baker et al 2020 Med J Australia

NZ Experience with Covid-19 elimination



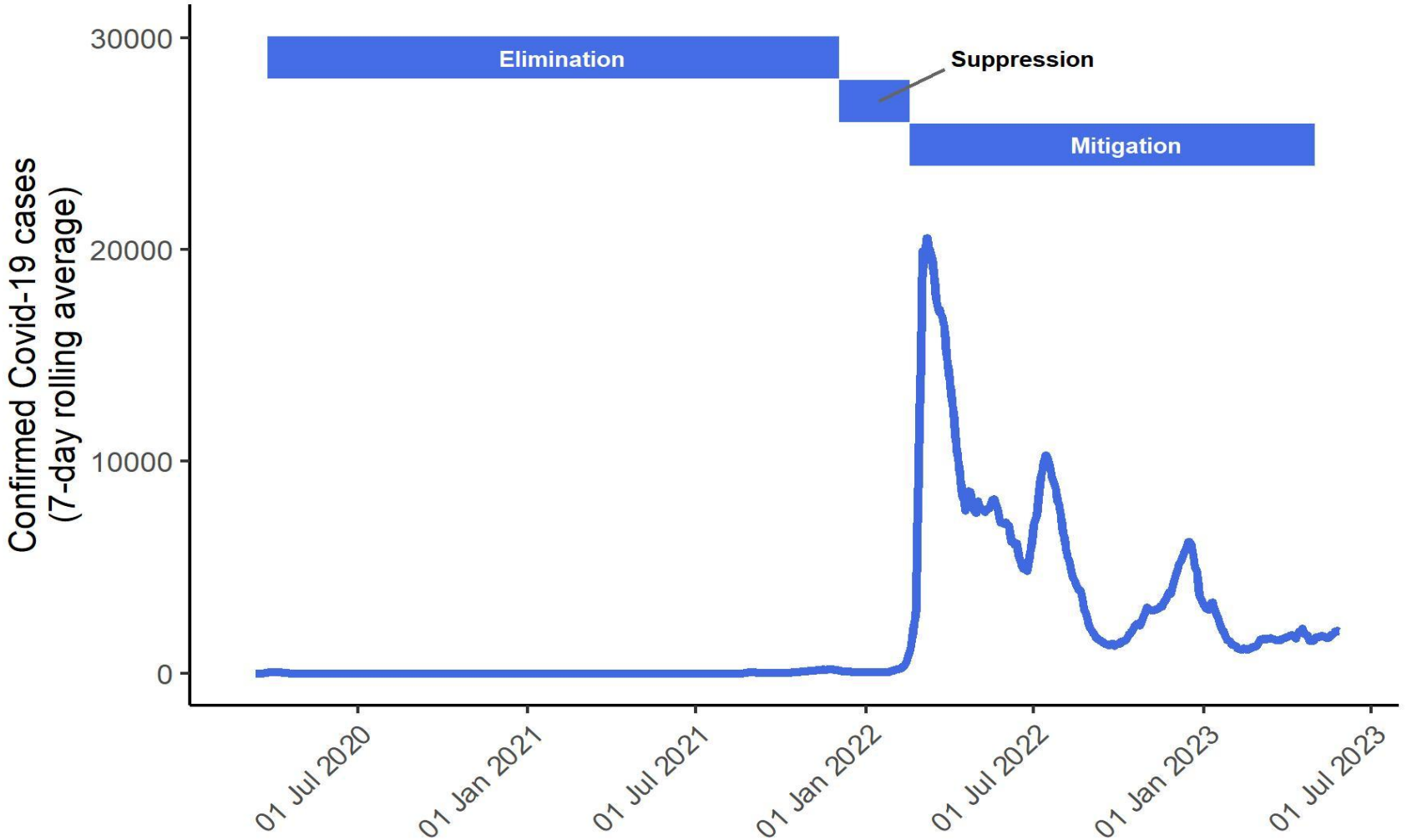
Source: Baker, Wilson, Anglemyer. NEJM 2020: 20 Aug, doi: 10.1056/NEJMc2025203

NZ Experience with Covid-19 elimination
SARS-CoV-2 Evolution → Change pandemic response strategy



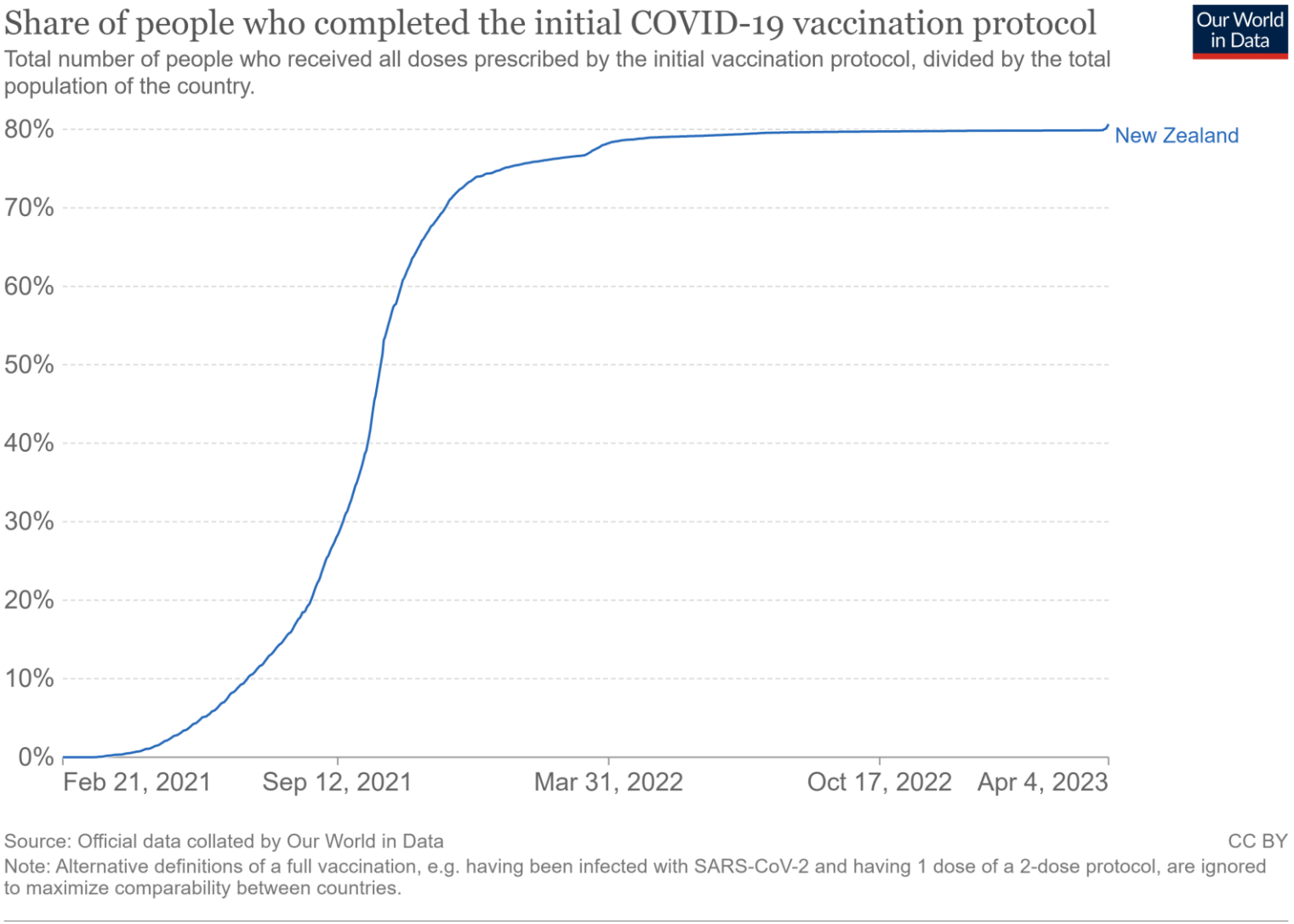
Source: ESR, Covid-19 Genomics Insights (CGI)

NZ Experience with Covid-19 elimination: Change in pandemic response strategy



Source: Baker, Kvalsvig, et al. NZMJ, 6 Oct 2023

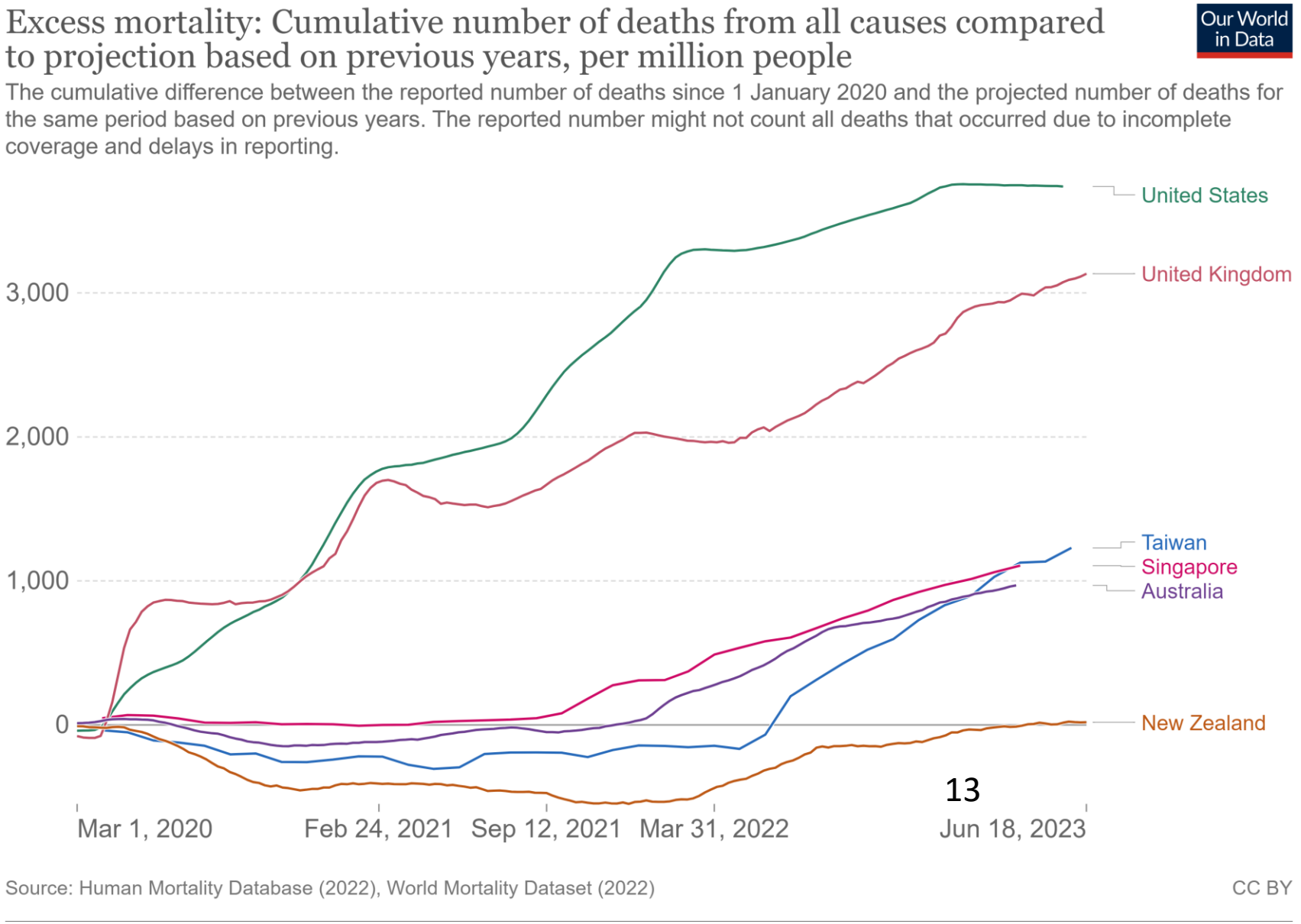
NZ Experience with Elimination: Vaccination



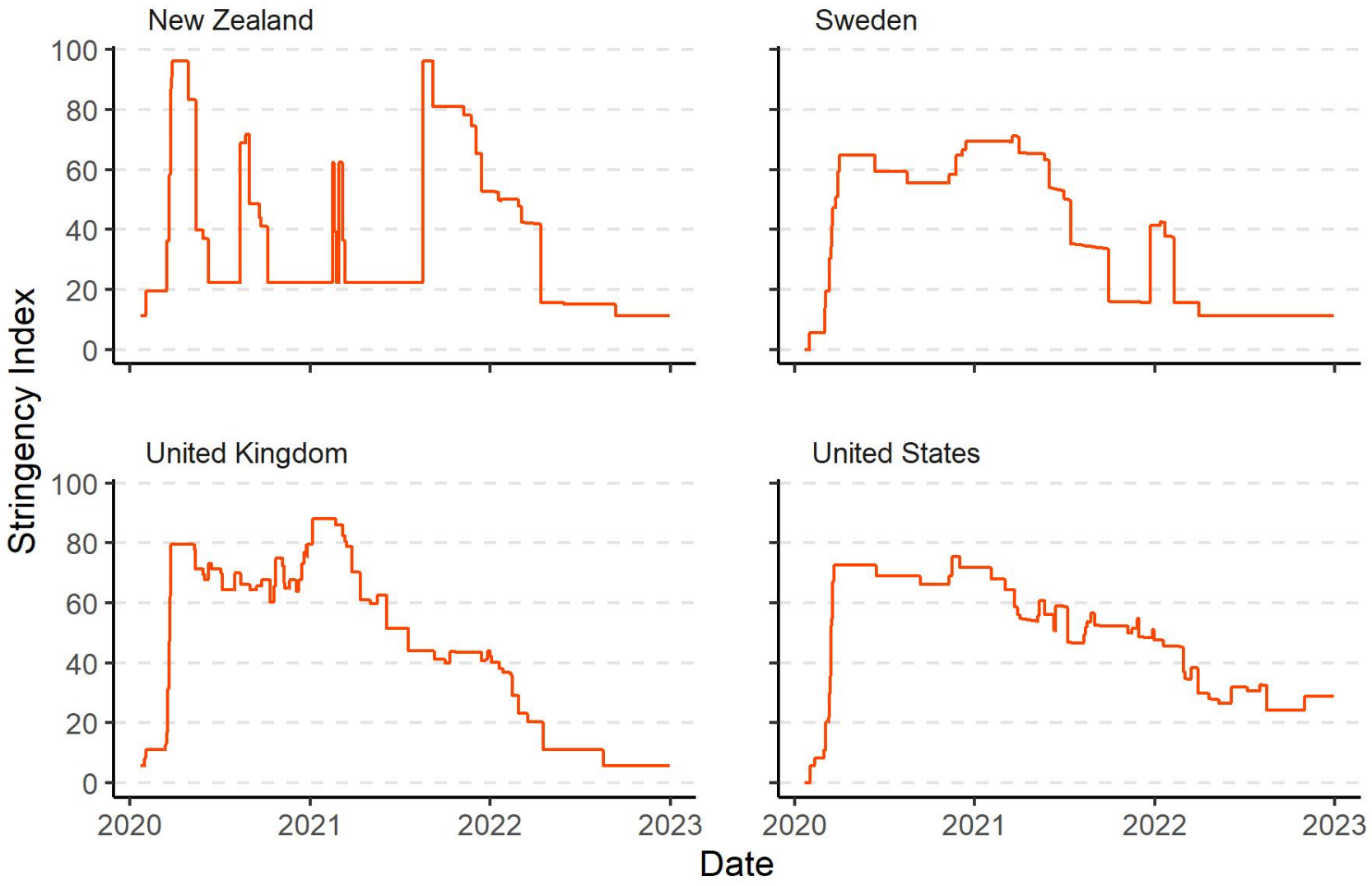
~90% adults had 2 doses of mRNA (Pfizer) vaccine by end of 2021

Evidence for elimination: Excess Mortality

NZ maintained low cumulative excess mortality throughout the pandemic

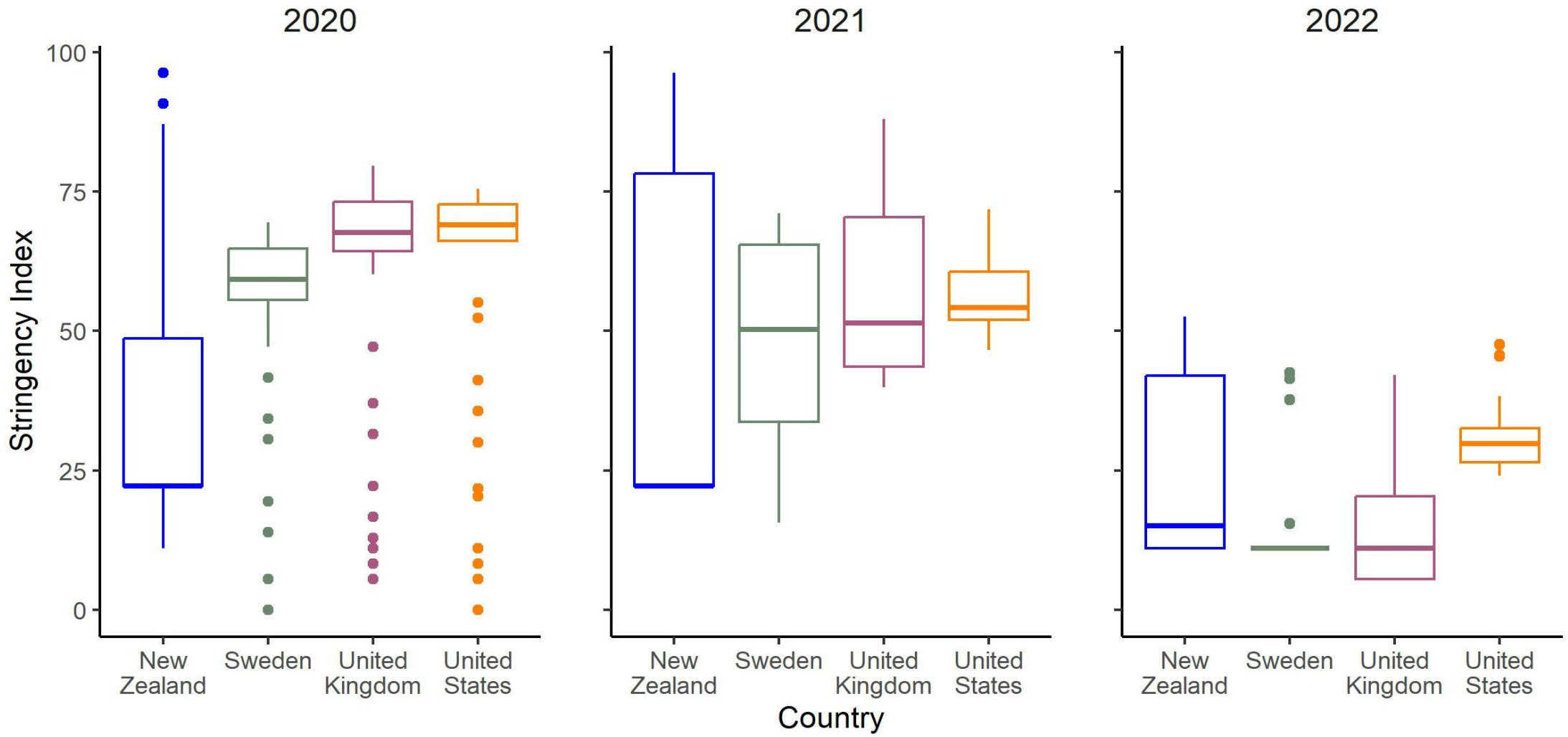


Evidence for elimination: Stringency of controls



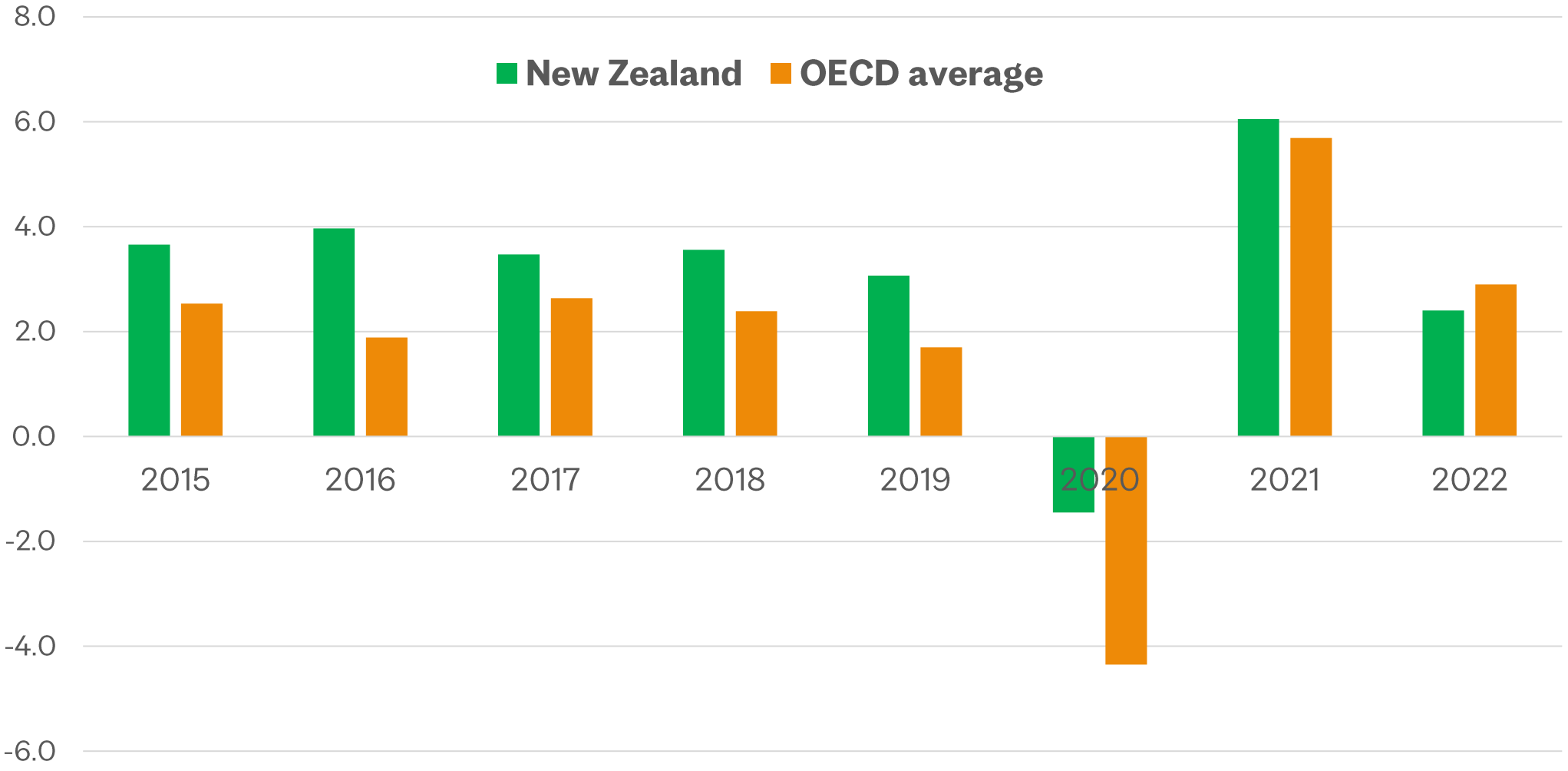
Source: Oxford Stringency Index: https://ourworldindata.org/covid-stringency-index

Evidence for elimination: Stringency of controls



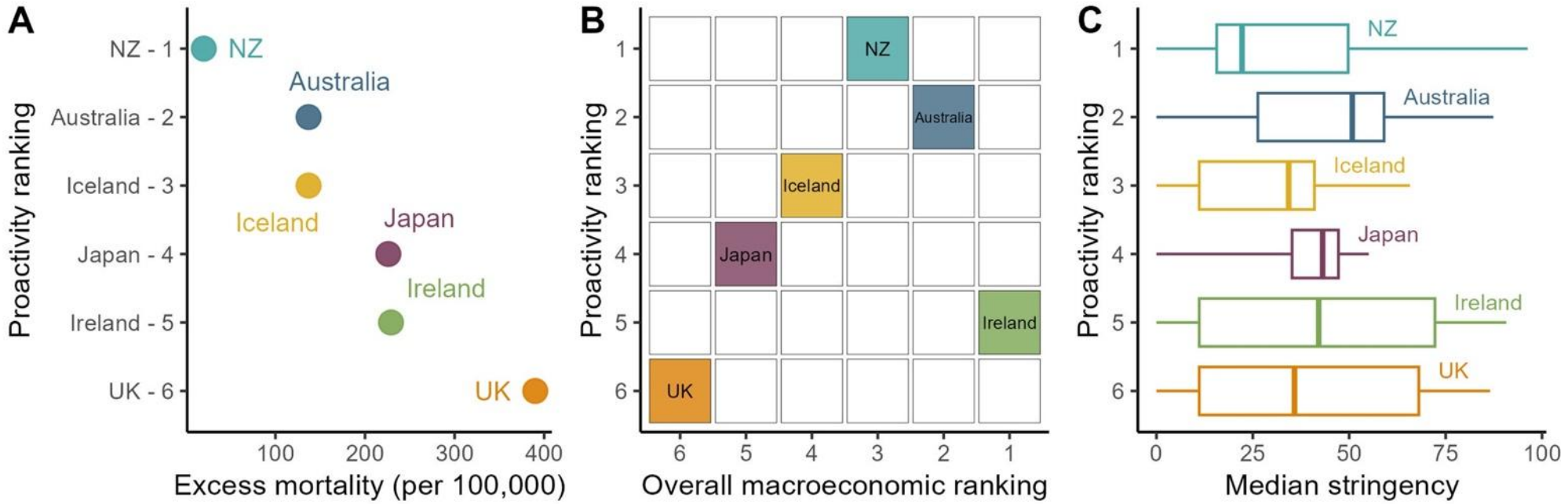
Source: Oxford Stringency Index: https://ourworldindata.org/covid-stringency-index

Evidence for elimination: Economic impacts compared with OECD average for GDP relative to previous period



Evidence for elimination: Comparison of OECD Islands

A proactive Covid-19 response associated with better health and economic outcomes for high-income island countries (n=6 out of 38 OECD countries)



Panel A: Proactivity ranking and cumulative excess mortality (per 100,000)
Panel B: Proactivity ranking and overall macroeconomic rankings
Panel C: Proactivity ranking and median stringency

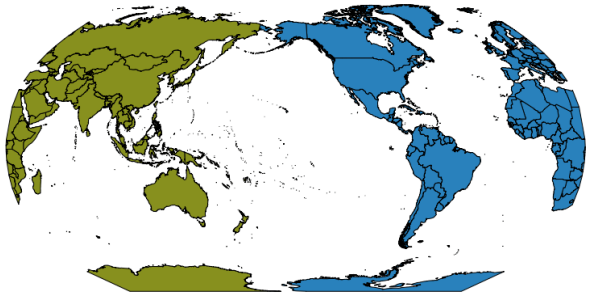
Source: Summers et al 2024, SSM - Population Health, https://doi.org/10.1016/j.ssmph.2025.101827

Evidence for elimination: Global comparison

- Analysis of **193 sovereign jurisdictions** using Global Burden of Disease Study excess mortality data and GDP growth data for 2020-21
- Jurisdictions with **explicit exclusion/elimination** strategies (n=5) showed the **lowest age-standardized excess mortality** (–2.1/100,000) compared to others (166.5/100,000).
- **Duration of border restrictions correlated with reduced excess mortality in islands** (Pearson's r = –0.624, p <0.001)
- No consistent significant relationships emerged between border measures and **GDP growth**, suggesting that stringent border restrictions in a pandemic may not significantly harm economies

Explicit elimination jurisdictions:

- China
- Taiwan
- Singapore
- Australia
- New Zealand



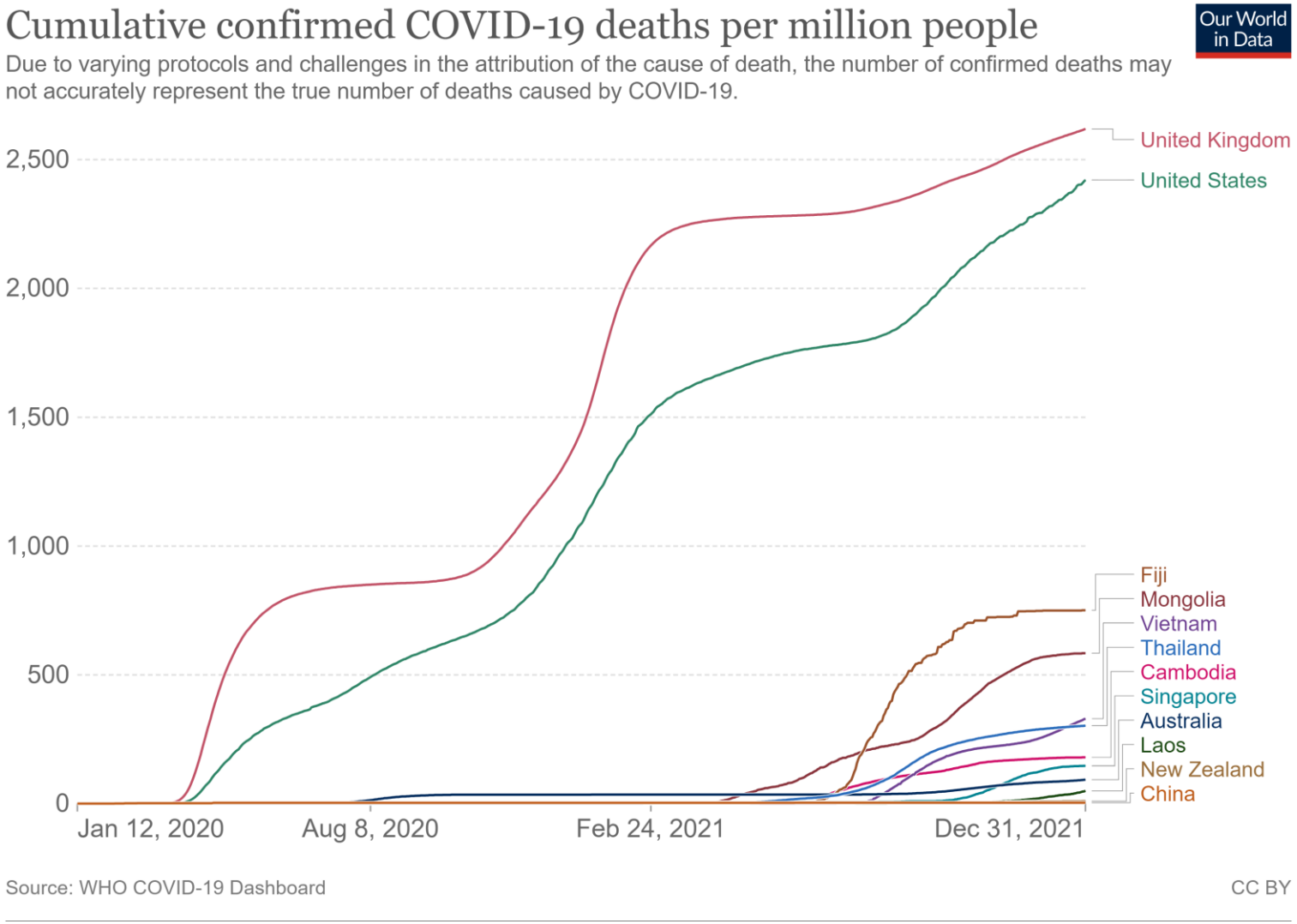
Source: Boyd et al medRxiv 10 April 2025, doi: https://doi.org/10.1101/2025.04.08.25325452

Evidence for elimination: Low-Middle income countries

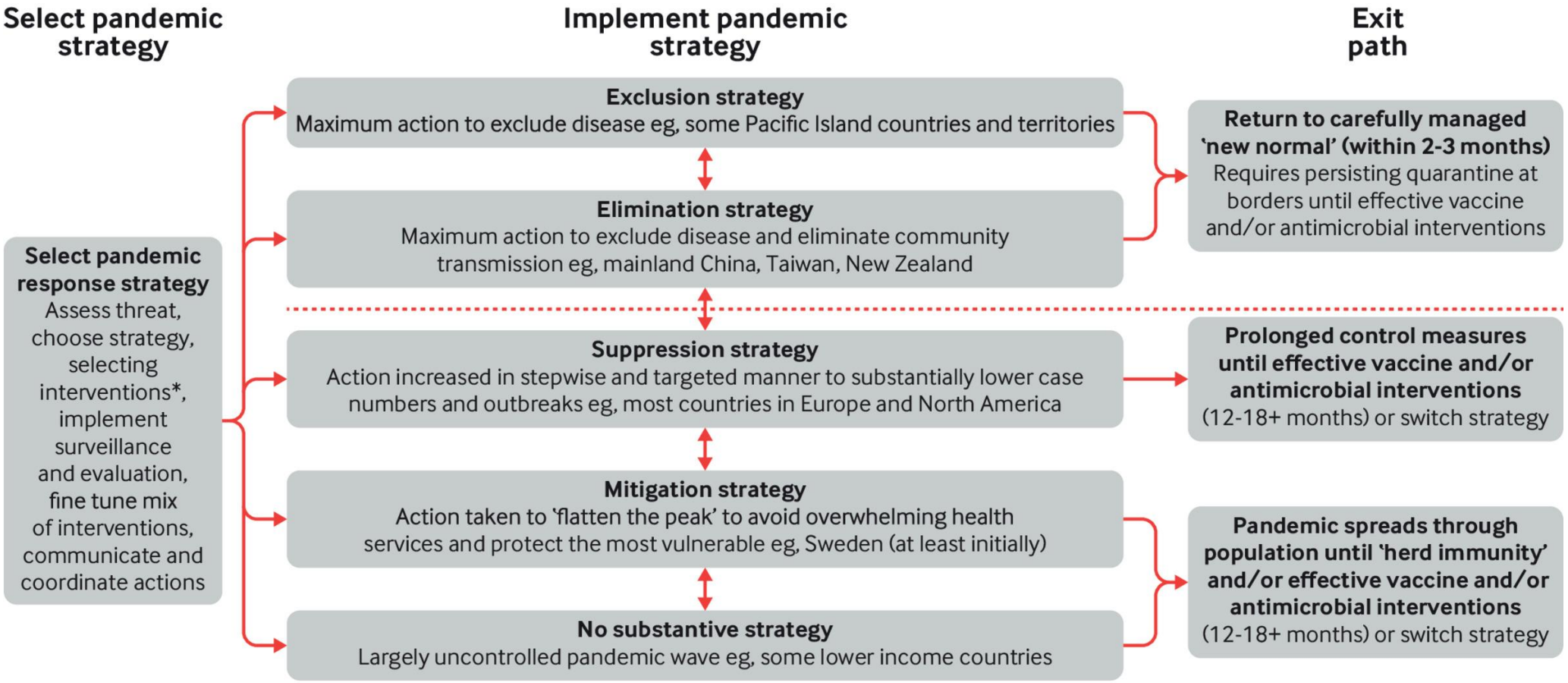
Elimination to delay spread can work in low and middle-income countries and those with extensive land borders

eg Covid-19 for >1 year

- Thailand
- Vietnam
- Cambodia
- Laos
- Mongolia



When exclusion/elimination may be justified



*** Pandemic interventions:** Border controls to "keep it out"; testing, contact tracing, case isolation and contact quarantine to "stamp it out"; improved hygiene behaviours and use of masks; physical distancing; movement restrictions; combinations including "lockdown"; vaccines; antimicrobials

NB. There are multiple other interventions to reduce harm, including protecting vulnerable populations, reorienting health services, social and economic support

Source: Baker, Wilson, Blakely. BMJ 2020 371; Dec 22

When exclusion/elimination may be justified

	Relatively low transmissibility	Relatively high transmissibility
Relatively high case fatality risk	• Middle East Respiratory Syndrome (MERS) • Ebola virus disease (EVD) • Severe Acute Respiratory Syndrome (SARS) • Avian Influenza A(H5N1)	• **Severe non-seasonal influenza*** • **Smallpox** • **Emerging Disease X (e.g. emerging zoonotic disease)** • **Novel synthetic Disease X (e.g. a bioweapon)**
Relatively low case fatality risk	• Influenza A(H1N1) – 2009 pandemic • Poliomyelitis	• Chickenpox • Measles

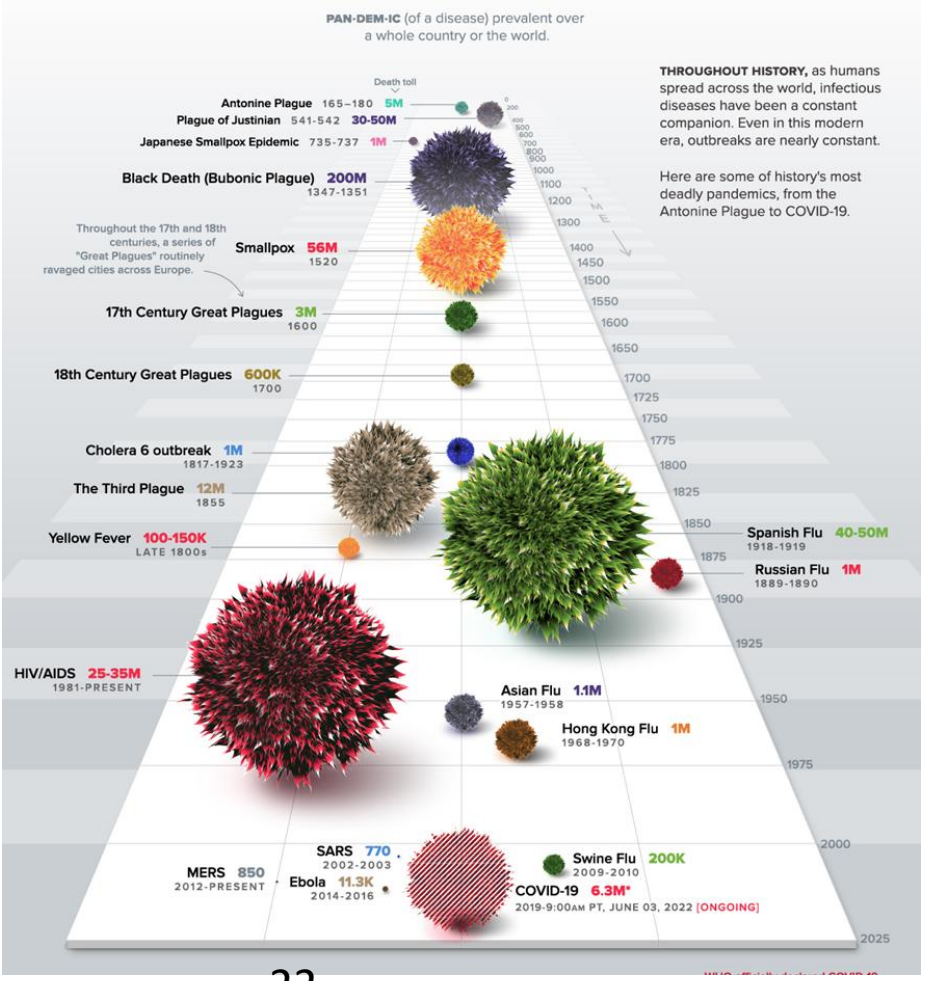
***Approaching the severity potential of the 1918 influenza pandemic**

Source: Boyd, Baker, Wilson. Aust N Z J Public Health. 2020 Apr; 44(2): 89–91.

When exclusion/elimination may be justified

Modelling suggests we can expect a ‘Covid-19 magnitude’ pandemic with an 18–26% chance over the next decade,
> 2% likelihood per annum

Risk assessment uses multiple factors for assessing severity and controllability



Sources: Madhav et al 2023. Center for Global Development

Source: The Visual Capitalist: https://www.visualcapitalist.com/history-of-pandemics-deadliest/

When exclusion/elimination may be justified

- **Novel synthetic disease X** - eg, bioweapon or smallpox (**IFR ~30%**)
- **Severe non-seasonal influenza** – eg, 1918 Influenza H1N1 (**IFR ~1-2%**)
- **Emerging disease X -** likely spillover zoonotic disease, eg moderately severe novel coronavirus like SARS-CoV-2 (**IFR ~0.5-1.0%**)

---------- **Exclusion Justified ↑** ----------

Most emerging ID threats are **unlikely to require an exclusion strategy, Eg**

- Most Public Health Emergencies of International Concern (PHEIC): polio (2014), Ebola (2014, 2019), Zika (2016), Mpox (2022, 2024)
- Pandemic influenza H1N1 (2009) after shown to have a low IFR

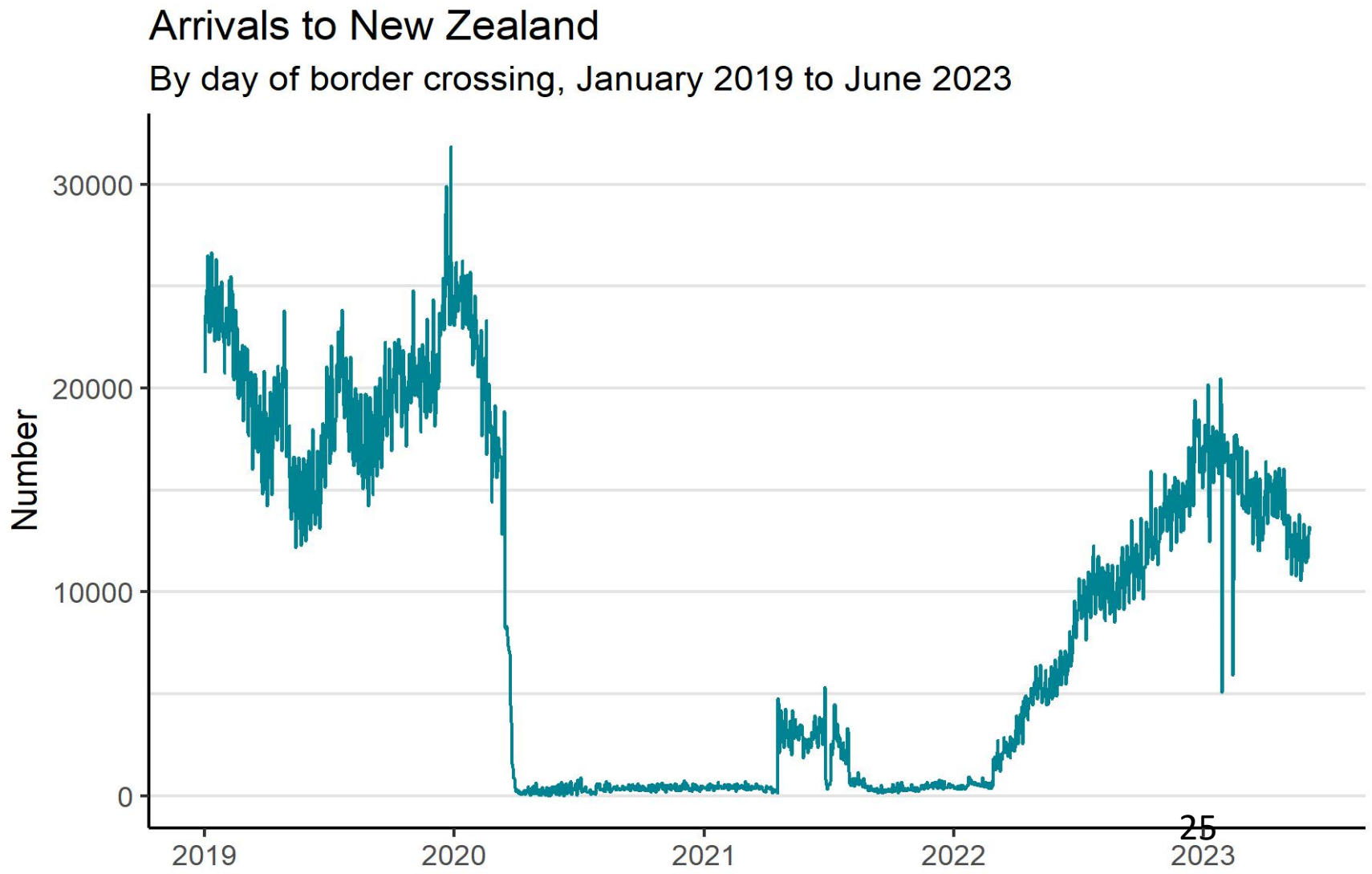
***IFR = Infection Fatality Risk**

Challenges of Elimination: NZ Experience

- High logistic demands to establish and sustain
- Maintaining border controls and quarantine system
- Using Public Health and Social Measures (PHSM) to manage outbreaks, notably ‘stay at home’ order (‘lockdown’)
- Identifying an optimal transition strategy
- Ensuring equity at all stages
- Maintaining public trust and social license
- BUT, many of these challenges also with other pandemic response options

Wellington protest, 2 March 2022

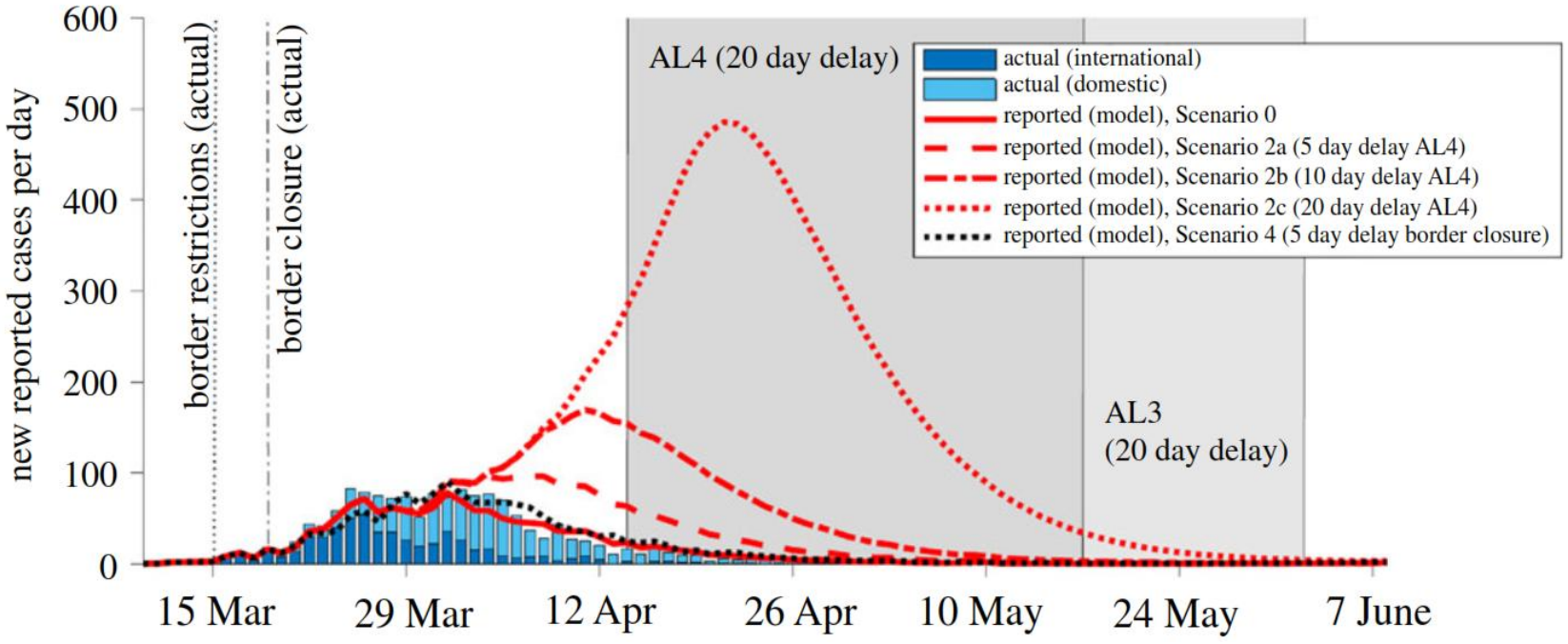
Challenges of elimination: Effective border controls



Source: Stats NZ international travel daily movements

Challenges of elimination: Rapid ‘stay at home’ order

Elimination (or exclusion) easier and less disruptive if measures started early in a pandemic, so good to identify scenarios in advance



Source: Binny et al. Royal Soc Open Sc. 2021 17 Nov, doi: org/10.1098/rsos.210488

Advantages of elimination strategy

- Eliminates at source → prevents global pandemic
- Delays transmission → time for interventions to reduce harm
- Reduces deaths and disabilities, protects healthcare system
- Reduces restrictions and economic disruption if successful
- Prevents a diverse range of pandemic scenarios → increases health security
- Provides a globally/regionally coordinated approach → increases chance of success, eg green zones
- Supports strategic investment in pandemic recognition and control globally, especially in Low- Middle- Income Countries

World Health Organization

Disadvantages of elimination strategy

- Potential for harms to exceed benefits if elimination response is inappropriate or poorly delivered, eg may draw resources into elimination of IDs with low impact
- Economic and social costs of some measure may be high and inequitably distributed
- Can erode social cohesion, particularly if sustained
- Can be a focus for disinformation
- Potential unintended consequences from elimination measures
- Border restrictions may increase global inequities

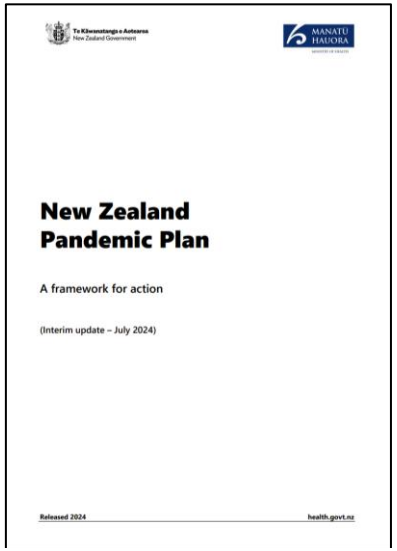
Implementing elimination/exclusion as part of pandemic prevention, preparedness, and response (PPPR)

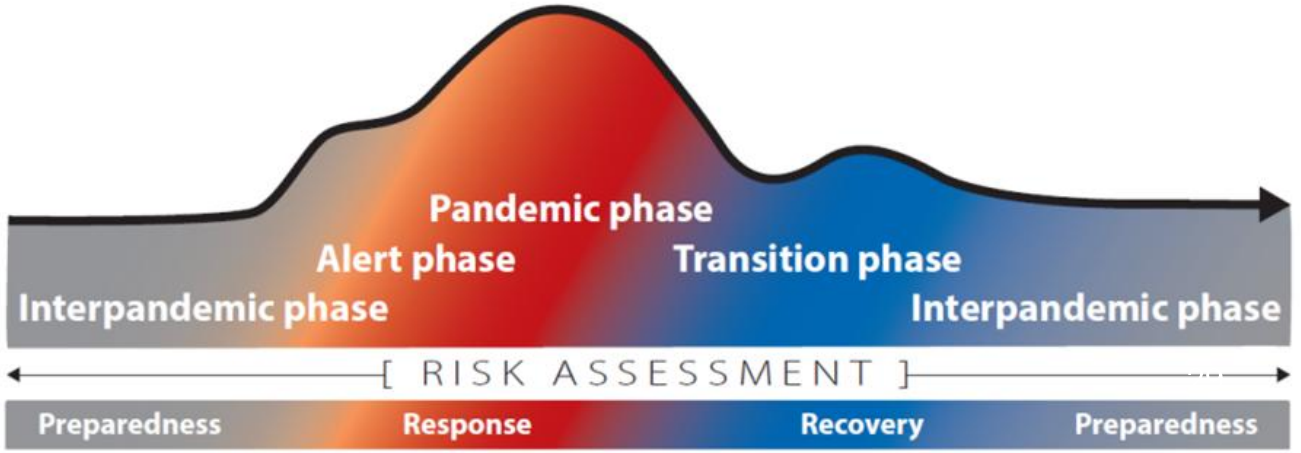
Pandemic planning

1. **Strategy** – to ensure an optimal response

2. **Infrastructure** – to support effective delivery of pandemic response

3. **Engagement** – to support coordinated delivery of response and social licence



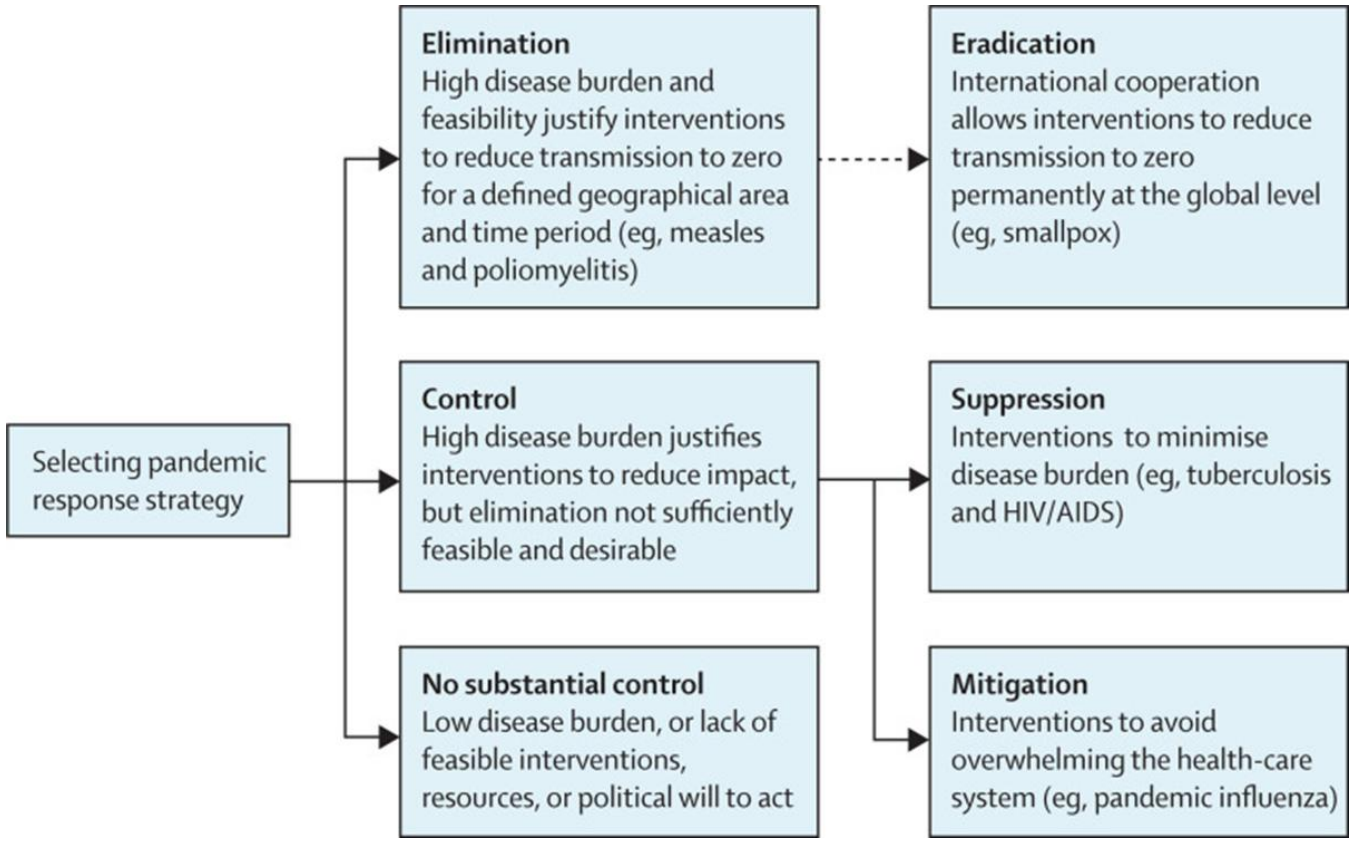


*This continuum is according to a "global average" of cases, over time, based on continued risk assessment and consistent with the broader emergency risk management continuum.

Implementing elimination/exclusion as part of PPPR

Recommendations

- **WHO assigns response strategy** for new Public Health Emergencies (PHEIC)
- **Elimination/exclusion is default strategy** for IDs with high burden and where this goal is feasible



Major strategic choices for managing an emerging infectious disease with pandemic and public health emergency of international concern potential

Source: Baker et al. The Lancet, 13 Jan 2023

Implementing elimination/exclusion as part of PPPR

Pandemic Prevention

Spill-over infection from animal reservoir, likely for Covid-19, potentially via wet market

Laboratory-escape, unlikely for Covid-19, but labs have been source of previous ID outbreaks

Multiple measures, including:

- Supporting global agencies: WHO, WOAH, FAO, UNEP
- International law and active collaborations, eg IHR 2005, Pandemic Agreement
- Improve laboratory safety & regulate dual use research of concern (DURC)

Implementing elimination/exclusion as part of PPPR

Communication to build policy support and social licence for PPPR

Public Health Communication Centre is an independently funded organisation based at the University of Otago, Wellington

- Increases the reach and impact of public health research and evidence by making it more accessible to the public and decision-makers
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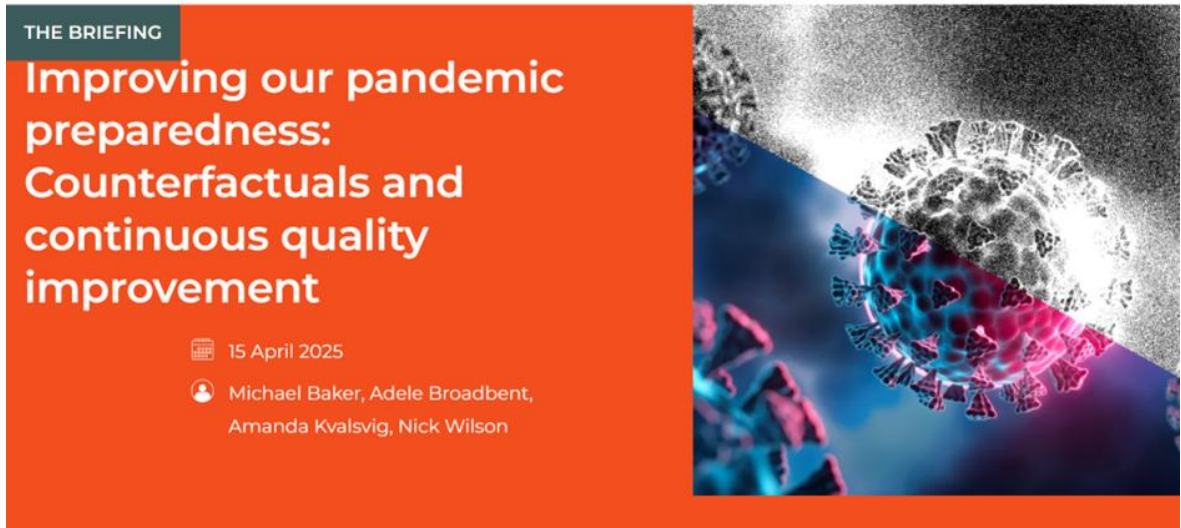


Conclusion:
An effective pandemic response

The conversation
Coronavirus outbreak

This article is more than 2 months old

Five ways New Zealand can keep Covid-19 cases at zero

Michael Baker and Nick Wilson

Mon 8 Jun 2020
04.02 BST

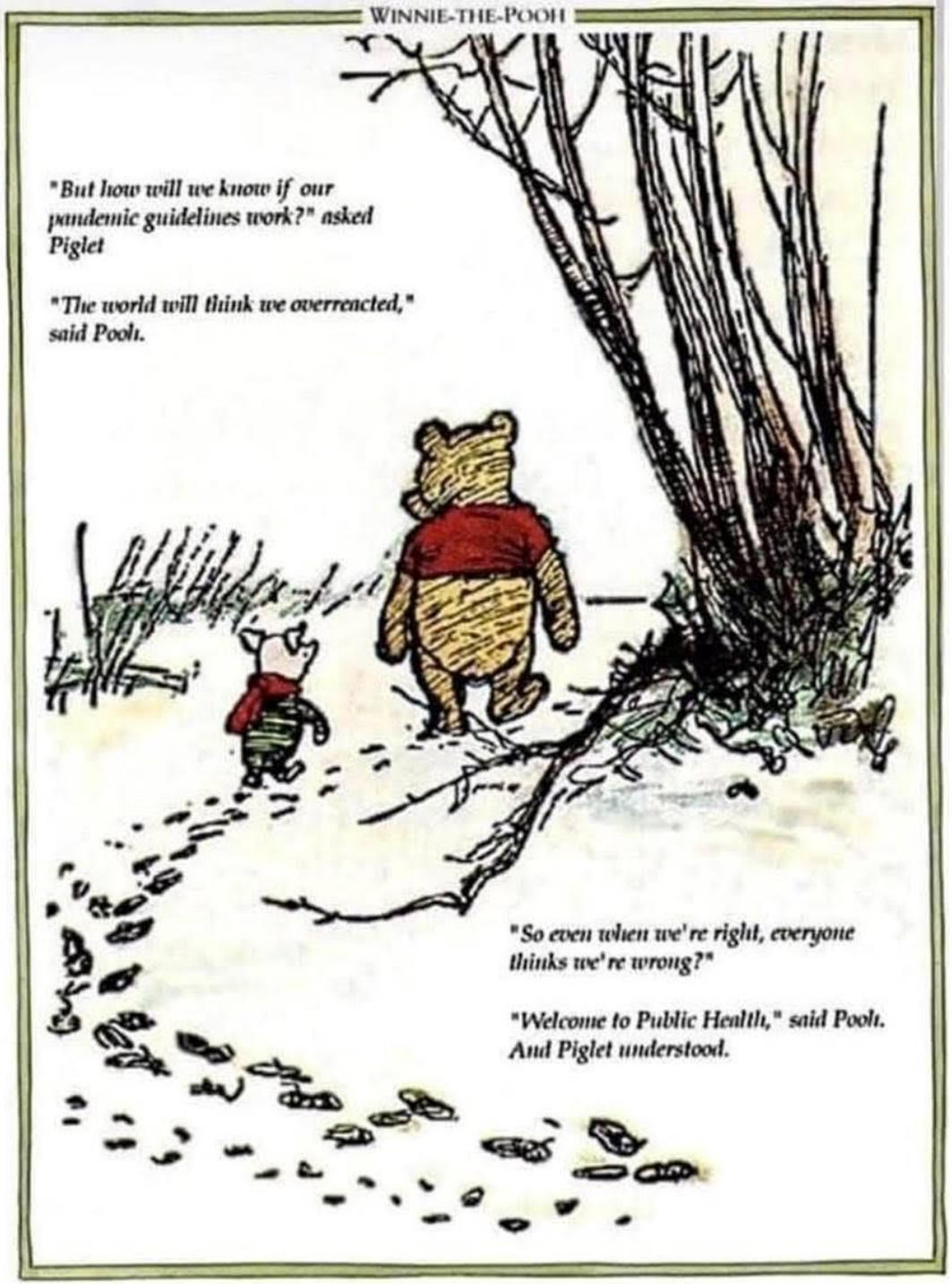
308 205

Modelling shows it is very likely New Zealand has eliminated coronavirus. Keeping it that way is the next big challenge

- Coronavirus - latest updates
- See all our coronavirus coverage

Critical importance of evidence-informed strategy

Based on Effective Science + Good Political Leadership



Conclusion:
An effective pandemic response

A public health triumph: nothing happened

Acknowledge Contributors to HEIRU / Co-Search











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