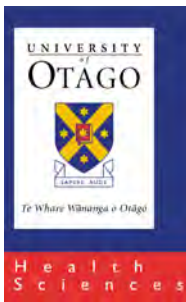# New Zealand's elimination strategy for the Covid-19 pandemic: early success but uncertainties and risks remain

Professor Michael Baker

University of Otago, Wellington, NZ
June 2020

Contributors: Nick Wilson, Amanda Kvalsvig, Andy Anglemyer, Shaun Hendy, Alexei Drummond

Outline

- Strategic choices for countries
- Control, elimination, eradication
- Components of elimination strategy
  - Exclusion
  - Reducing transmission
  - Case and outbreak management
- Pandemic characteristics & effect of lockdown
- Additional actions to maintain elimination
- Uncertainties and Research questions
- Implications and generalisability

Strategic choices by countries

Factors influencing choices of approaches, including:

- Health impact, particularly CFR, IFR
- Transmissibility, notably Ro
- Controllability, ability to exclude, eliminate, manage
- Inequalities
- Certainty of information
- Science capacity
- Awareness of options, counterfactuals, experience, dogma

Mortality rates for Māori vs non-Māori in 3 successive influenza pandemics
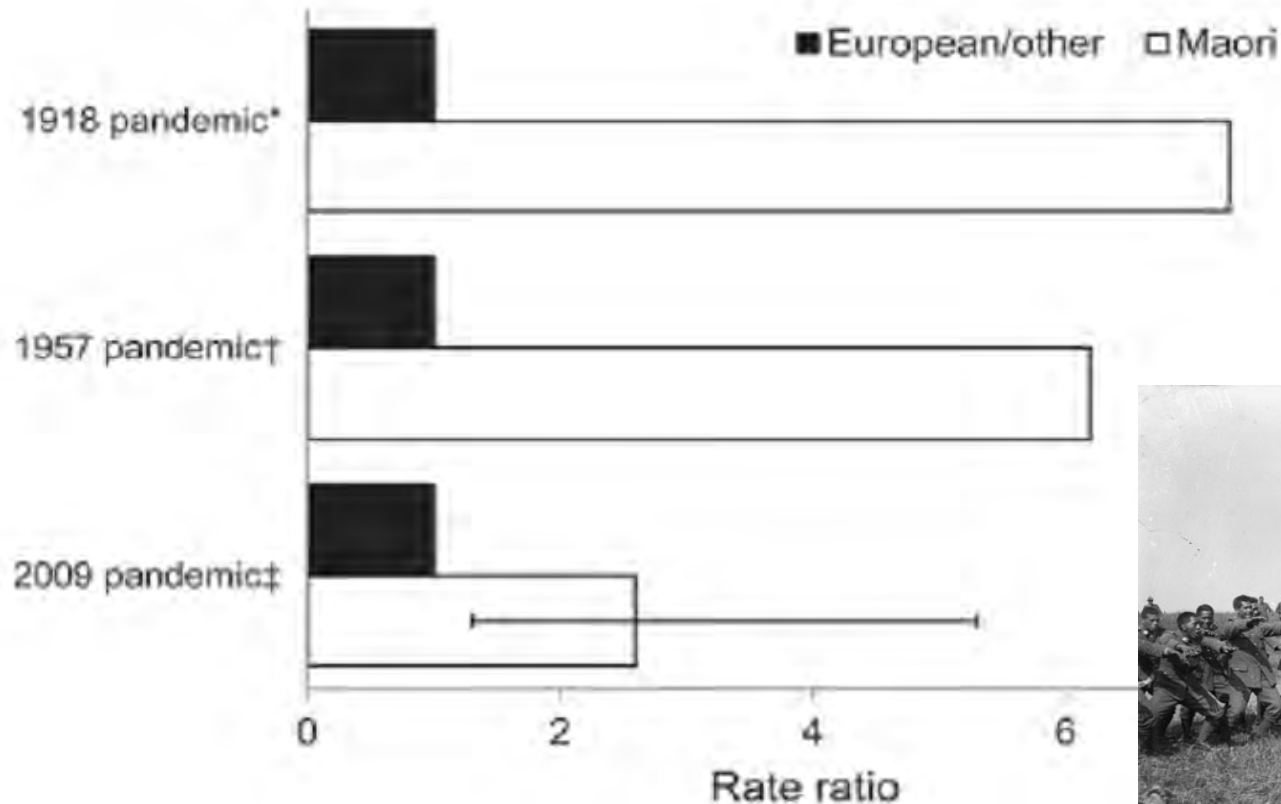
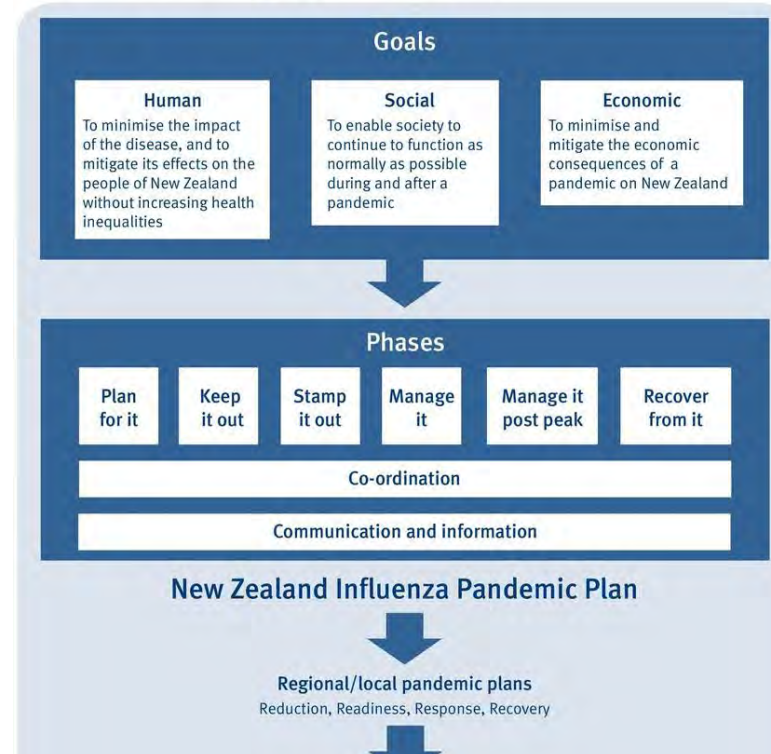Source: Wilson et al 2012, *Emerg Infect Dis*

Strategic choices by countries

Pandemic influenza plan

- Essentially a mitigation approach

- NZ had its first COVID-19 case on 28 Feb

- Local transmission by early March

- Reached 100 cases on 20 March

Ministry of Health. 2017. New Zealand Influenza Pandemic Plan: A framework for action (2nd edn). Wellington: Ministry of Health.

Figure 1: New Zealand strategic approach to a pandemic

Goals

Human
To minimise the impact of the disease, and to mitigate its effects on the people of New Zealand without increasing health inequalities

Social
To enable society to continue to function as normally as possible during and after a pandemic

Economic
To minimise and mitigate the economic consequences of a pandemic on New Zealand

Phases

| Plan for it | Keep it out | Stamp it out | Manage it | Manage it post peak | Recover from it |

Co-ordination

Communication and information

New Zealand Influenza Pandemic Plan

Regional/local pandemic plans
Reduction, Readiness, Response, Recovery

Control, elimination, eradication

Disease management options:

- Control – Reduce disease incidence to acceptable levels

- Elimination – Disease absence from a country or region

- Eradication – Global absence of infection

What is elimination

Definition of elimination

- Absence of detected cases for a defined period eg, 28 days*

- Presence of a high performing surveillance system

- With defined exclusions eg, cases identified at borders and placed in effective isolation/quarantine

*Usually specified according to statistical likelihood eg 95% probability of elimination. Distinct from active cases.

Source: Wilson et al

Distinguishing features of Elimination

Component of pandemic control system	Feature of elimination vs. 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

Strategic choices for countries

Plan Pandemic Strategy   **Implement Pandemic Strategy**   **Exit path**

Pandemic planning: Assess threat, choose strategy, select interventions* implement ongoing surveillance and evaluation, fine-tune mix of interventions

1. Exclusion strategy: Maximum action to exclude disease Eg. Pacific Island countries and territories

2. Elimination strategy: Maximum action to exclude disease and eliminate chains of transmission. Eg. Mainland China, Taiwan, New Zealand; also as per SARS

Return to carefully managed 'new normal' (3 months in Asian countries). Requires persisting quarantine at borders until vaccine and/or antivirals available

3. Suppression strategy: Action increased in stepwise and targeted manner to suppress case numbers and outbreaks. Eg. Most countries in Europe

Prolonged control measures until vaccine and/or antivirals available: (12-18+ months) or switch strategies

4. Mitigation strategy: Action taken to 'flatten the curve' and protect the most vulnerable. Pandemic wave continues, but lower peak. Eg. Sweden

Pandemic spreads through population until immunity and/or vaccine and/or antivirals available: (12-18+months)

5. No substantive strategy: Largely uncontrolled pandemic wave. Eg. Most low-income states

Control interventions: (1) Border controls to 'keep it out'; (2) Case isolation & contact quarantine to 'stamp it out'; (3) Improved hygiene and use of masks; (4) Physical distancing; (5) Movement restrictions; (6) Combinations including 'lock-down'
NB. There are multiple other interventions to mitigate harm, focussed on health services & protecting vulnerable

New Zealand's COVID-19 Response: Go hard, go early

Border measures

6 Jan: Ministry of Health send border advisory to stakeholders with regard to the WHO risk assessment of COVID-19.

2 Feb: Entry restrictions placed on foreign nationals travelling from, or transiting through, mainland China. Those who can enter the country must self-isolate for 14 days.

28 Feb: Temporary travel restrictions placed on incoming travellers from Iran.

Cabinet confirmed it will not exempt international students from any of the travel restrictions in place.

29 Feb: Health staff begin meeting direct flights landing at New Zealand airports from Hong Kong, Japan, South Korea, Singapore and Thailand.

14 March: Cruise ships banned from coming to New Zealand.

Every person entering New Zealand from anywhere in the world required to self-isolate for 14 days, excluding the Pacific

Strict border exist measures for people travelling to the Pacific.

19 March: NZ borders closed to all travellers except NZ citizens and residents. Gatherings of >100 people cancelled.

New Zealanders advised not to travel overseas.

9 April: All new arrivals go into quarantine or managed isolation in an approved facility for a minimum of 14 days.

Support policies

31 Jan: COVID-19 made a notifiable disease under the Health Act.

6 Feb: Government-chartered repatriation flight carrying 193 evacuees from Wuhan, China lands in NZ. Passengers are quarantined for 14 days.

9 March: Covid-19 made a quarantinable disease.

12 March: Bespoke All of Government National Crisis Management Centre activated.

16 March: Gatherings of more than 500 people cancelled.

17 March: Government announces $12.1b Business Continuity Package, which includes tax and business cashflow measures, wage subsidies, increased sick leave and welfare support. The package represents 4% of NZ's GDP.

18 March: "Unite" Public Communications Campaign launched.

24 March: National Close Contact Service created to support Public Health Units to track and trace contacts of confirmed cases as part of a $500m fund to help protect NZers and their health around COVID-19.

15 April: Government announces tax changes to support businesses.

16 April: Case definitions for COVID-19 broadened by removing criteria for history of travel

Alert Level Response

21 March: Prime Minster announces 4 level alert system and places NZ on Level 2. Prime Minister announces that people 70 years and older and those with compromised immune systems should stay home as much as possible. People should work from home if they can, and limit travel.
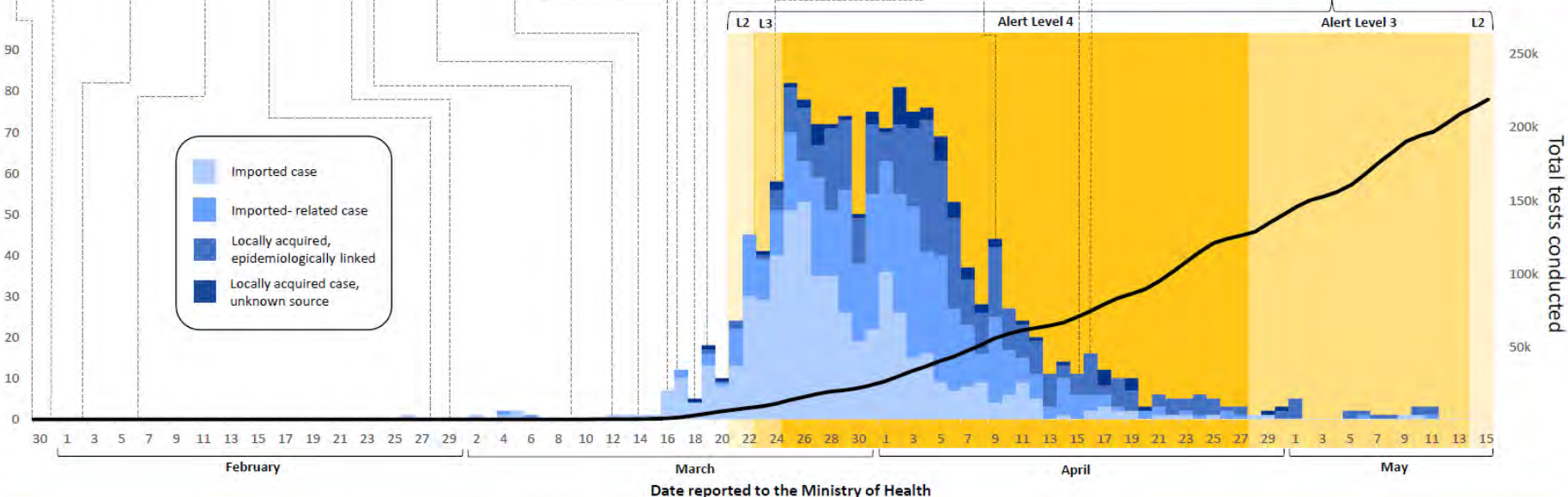
23 March: Prime Minister increases Alert Level to 3 and issues an Epidemic Notice under section 5 of the Epidemic Preparedness Act Act 2006. People are instructed to stay at home from 24 March. Schools and other facilities close.

25 March: Alert Level raised to 4. All non-essential businesses to close and state of emergency declared. The Prime Minister tells NZers to stay home in their household "bubble" - a concept to help people understand who they may have close contact with.

20 April: Prime Minister announces NZ will remain in Level 4 for an additional five days until the end of 27 April.

28 April: NZ moves into Alert Level 3. Bubble extended to close family, caregivers, or to support isolated people. Businesses can open premises but cannot physically interact with customers. People must work from home unless it is not possible.

14 May: NZ moves into Alert Level 2 with restrictions eased over a seven day period in three stages. All workplaces, public venues, and education facilities can open subject to public health and workplace safety requirements.

Chart legend:
- Imported case
- Imported- related case
- Locally acquired, epidemiologically linked
- Locally acquired case, unknown source

Y-axis (left): New confirmed and probable cases — 0, 10, 20, 30, 40, 50, 60, 70, 80, 90

Y-axis (right): Total tests conducted — 50k, 100k, 150k, 200k, 250k

X-axis: Date reported to the Ministry of Health — February, March, April, May

Alert level bands: L2, L3, Alert Level 4, Alert Level 3, L2

Key events

2 Feb: Diagnostic test for COVID-19 available in New Zealand

8 Feb: Two New Zealanders aboard the cruise ship Diamond Princess are confirmed to have the virus.

26 Feb: First COVID-19 case in NZ reported as a traveller returning from Iran. Case confirmed on 28 February.

9-13 March: the World Hereford Conference held in Queenstown, which becomes NZ's first significant cluster.

15 March: Daily testing for COVID-19 exceeds 100 for the first time.

18 March: Daily testing for COVID-19 exceeds 1,000 for the first time.

21 March: A wedding in Bluff takes place, which becomes NZ's largest cluster with nearly 100 cases.

29 March: First COVID-19 death reported.

3 April: Last significant cluster identified - 50 people at an aged residential care facility in Auckland.

2 May: First day of no new reported cases of COVID-19 since 11 March.

Components of elimination strategy

1. Exclusion of cases

- *Keep it out* – Border Management

2. Reducing transmission

- Reducing transmission per contact – Hygiene measures, Masks

- Reducing contacts – Physical distancing & Travel restrictions

3. Case and outbreak management

- *Stamp it out* – Testing, contact tracing, isolation

Exclusion – Border Management

Key components:

- Entry restrictions (near closure)

- Self-isolation

- Supervised isolation and Managed quarantine

- Practices with aircrew and seaports

Key dates:

- 2 Feb – Entry restrictions & self isolation

- 14 March – Cruise ships banned

- 19 March – NZ borders closed to all except NZ citizens

- 9 April – Quarantine/managed isolation

Wellington Airport, Wikicommons

Reducing transmission

Intervention logic for pandemic response strategies

Types of control measures

Physical distancing, cough etiquette, masks, hand hygiene, infection control in healthcare settings

Case isolation and contact quarantine, working from home, school closures, restricting mass gatherings, border controls

Antiviral treatment for COVID-19 may have a role in reducing the duration of infectivity

How they work

↓**Transmissibility**
Risk of transmission per contact

↓**Contact rate**
Average rate of contact of susceptibles with infected

↓**Duration**
of infectivity

↓R

The logic: Stopping the pandemic means reducing the reproduction number (R) to less than 1. The 3 drivers are **transmission, contact rate, and duration of infectivity.**

Kvalsvig 2020

Reducing transmission – Alert levels

- The Alert Levels are determined by the Government and specify the public health and social measures to be taken in the fight against COVID-19. Further guidance is available on the Covid19.govt.nz website.
- The measures may be updated based on new scientific knowledge about COVID-19, information about the effectiveness of control measures in New Zealand and overseas, or the application of Alert Levels at different times (e.g. the application may be different depending on if New Zealand is moving down or up Alert Levels).

- Different parts of the country may be at different Alert Levels. We can move up and down Alert Levels.
- Essential services including supermarkets, health services, emergency services, utilities and goods transport will continue to operate at any level. Employers in those sectors must continue to meet health and safety obligations.
- Restrictions are cumulative (e.g. at Alert Level 4, all restrictions from Alert Levels 1, 2 and 3 apply).

Published 25 May 2020

ELIMINATION STRATEGY – New Zealand is working together to eliminate COVID-19

Alert Level	Risk Assessment	Range of Measures (can be applied locally or nationally)	
Level 4 – Lockdown Likely the disease is not contained	• Community transmission is occurring. • Widespread outbreaks and new clusters.	• People instructed to stay at home in their bubble other than for essential personal movement. • Safe recreational activity is allowed in local area. • Travel is severely limited. • All gatherings cancelled and all public venues closed.	• Businesses closed except for essential services (e.g. supermarkets, pharmacies, clinics, petrol stations) and lifeline utilities. • Educational facilities closed. • Rationing of supplies and requisitioning of facilities possible. • Reprioritisation of healthcare services.
Level 3 – Restrict High risk the disease is not contained	• Community transmission might be happening. • New clusters may emerge but can be controlled through testing and contact tracing.	• People instructed to stay home in their bubble other than for essential personal movement – including to go to work, school if they have to, or for local recreation. • Physical distancing of two metres outside home (including on public transport), or one metre in controlled environments like schools and workplaces. • People must stay within their immediate household bubble, but can expand this to reconnect with close family / whānau, or bring in caregivers, or support isolated people. This extended bubble should remain exclusive. • Schools (years 1 to 10) and Early Childhood Education centres can safely open, but will have limited capacity. Children should learn at home if possible. • People must work from home unless that is not possible. • Businesses can open premises, but cannot physically interact with customers.	• Low risk local recreation activities are allowed. • Public venues are closed (e.g. libraries, museums, cinemas, food courts, gyms, pools, playgrounds, markets). • Gatherings of up to 10 people are allowed but only for wedding services, funerals and tangihanga. Physical distancing and public health measures must be maintained. • Healthcare services use virtual, non-contact consultations where possible. • Inter-regional travel is highly limited (e.g. for essential workers, with limited exemptions for others). • People at high risk of severe illness (older people and those with existing medical conditions) are encouraged to stay at home where possible, and take additional precautions when leaving home. They may choose to work.
Level 2 – Reduce The disease is contained, but the risk of community transmission remains	• Household transmission could be occurring. • Single or isolated cluster outbreaks.	• People can reconnect with friends and family, and socialise in groups of up to 100, go shopping, or travel domestically, if following public health guidance. • Keep physical distancing of two metres from people you don't know when out in public or in retail stores. Keep one metre physical distancing in controlled environments like workplaces, where practicable. • No more than 100 people at gatherings, including weddings, birthdays and funerals and tangihanga. • Businesses can open to the public if following public health guidance including physical distancing and record keeping. Alternative ways of working are encouraged where possible. • Hospitality businesses must keep groups of customers separated, seated, and served by a single person. Maximum of 100 people at a time.	• Sport and recreation activities are allowed, subject to conditions on gatherings, record keeping, and – where practical – physical distancing. • Public venues such as museums, libraries and pools can open if they comply with public health measures and ensure 1 metre physical distancing and record keeping. • Event facilities, including cinemas, stadiums, concert venues and casinos can have more than 100 people at a time, provided that there are no more than 100 in a defined space, and the groups do not mix. • Health and disability care services operate as normally as possible. • It is safe to send your children to schools, early learning services and tertiary education. There will be appropriate measures in place. • People at higher-risk of severe illness from COVID-19 (e.g. those with underlying medical conditions, especially if not well-controlled, and seniors) are encouraged to take additional precautions when leaving home. They may work, if they agree with their employer that they can do so safely.
Level 1 – Prepare The disease is contained in New Zealand	• COVID-19 is uncontrolled overseas. • Isolated household transmission could be occurring in New Zealand.	• Border entry measures to minimise risk of importing COVID-19 cases. • Intensive testing for COVID-19. • Rapid contact tracing of any positive case. • Self-isolation and quarantine required. • Schools and workplaces open, and must operate safely. • Physical distancing encouraged.	• No restrictions on gatherings. • Stay home if you're sick, report flu-like symptoms. • Wash and dry hands, cough into elbow, don't touch your face. • No restrictions on domestic transport – avoid public transport or travel if sick.

Physical distancing

Key components

- Closure of schools, workplaces
- Stay at home in 'bubble' at level 4
- Physical distancing 2 metres
- Limited travel
- **But**, no promotion of mass masking (=wearing of mainly reusable fabric face masks by public)

Key dates

- Level 4 – 26 March
- Level 3 – 28 April
- Level 2 – 14 May

Social distancing, Alert Level 3, May 2020

Reducing transmission per contact

Key components

- Physical distancing

- Stay at home if sick

- Handwashing

- Cough etiquette

- Infection control in healthcare settings

- **But**, no promotion of mass masking (=wearing of mainly reusable fabric face masks by public)

Source: Pexel

C☀-Search

Case and contact management

Key components:

- Establish & increase testing capacity

- Contact tracing

- Case and contact isolation

- **But**, limited digital assistance with contact tracing

Key dates

- 2 Feb Diagnostic test for COVID-19 available

- 18 March 1,000+ tests per day

- 24 March National Close Contact Service created

Swabbing for Covid-19, Wellington, May 2020

Pandemic: Source of cases

Source: EpiSurv 0900 18/05/2020
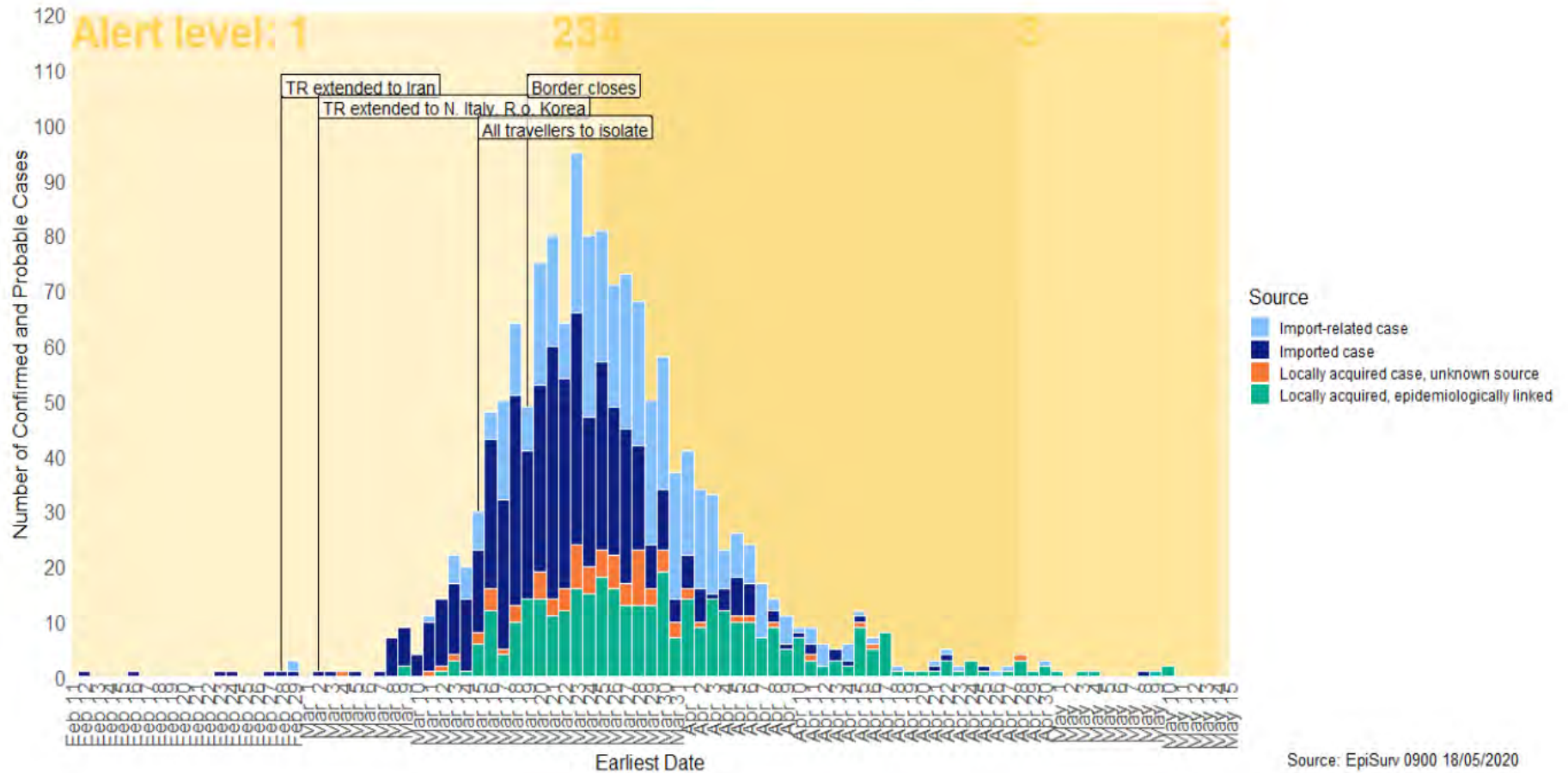
Geographic distribution of COVID-19 cases

Age distribution of COVID-19 cases
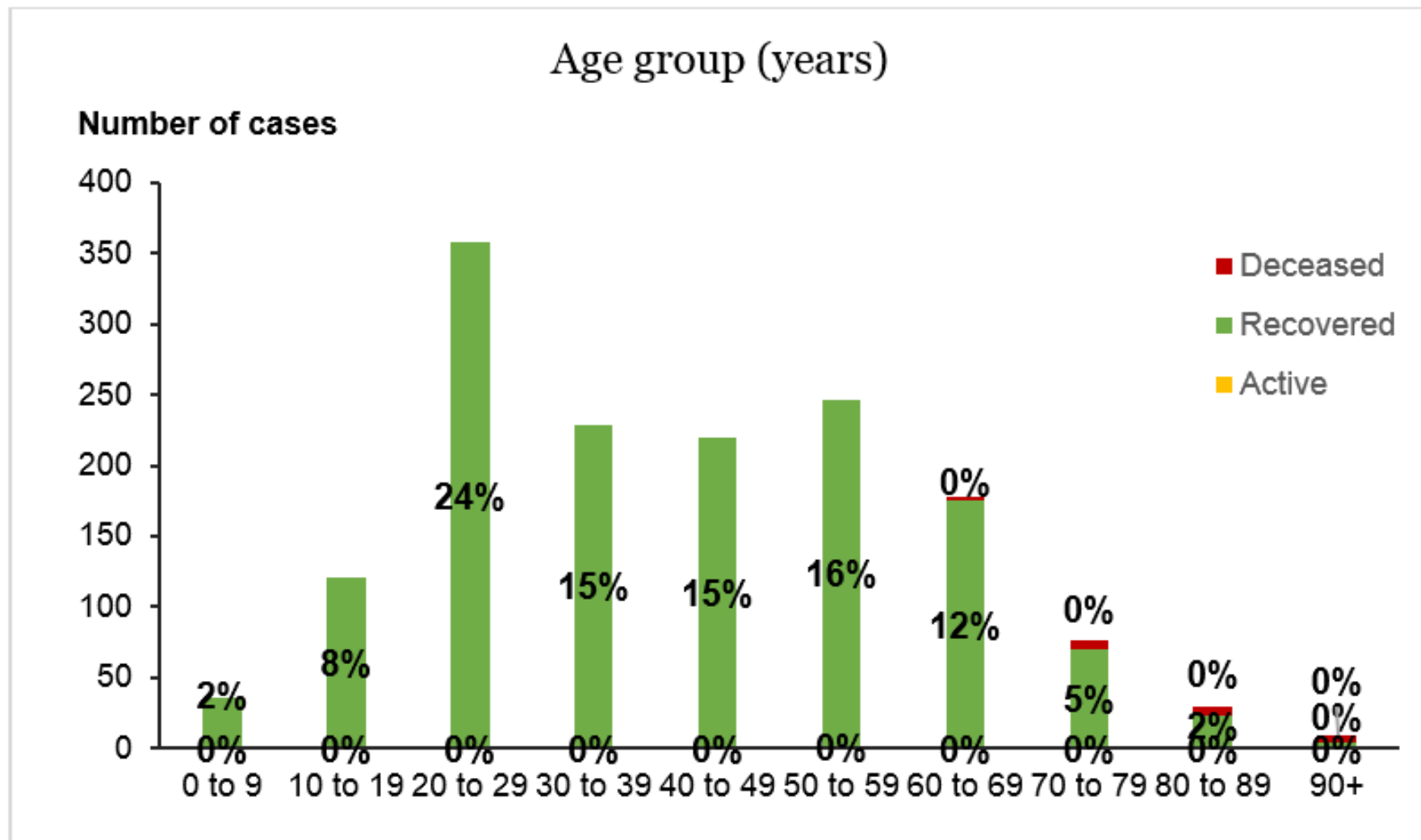
Transmission type of COVID-19 cases

Transmission type	% of cases
Imported cases	38%
Imported related cases	31%
Locally acquired cases, epidemiologically linked	25%
Locally acquired cases, unknown source	6%
Source under investigation	0%

Source: ESR EpiSurv extract as at 09:00 11 June 2020

Co-Search
COVID-19 RESEARCH COLLABORATIVE I AOTEAROA NEW ZEALAND

Impact of Alert Levels / Lockdowns

Simulated and actual daily numbers of new local and imported cases (confirmed and probable) . Effective reproduction number Reff

- Prior to lockdown: Reff = 1.8 (best-fit to case data) prior to lockdown

- Level 4 Reff = 0.35 (best-fit)

- Level 3 Reff = 0.95 (assumed)

- Level 2 Reff = 1.7 (assumed)
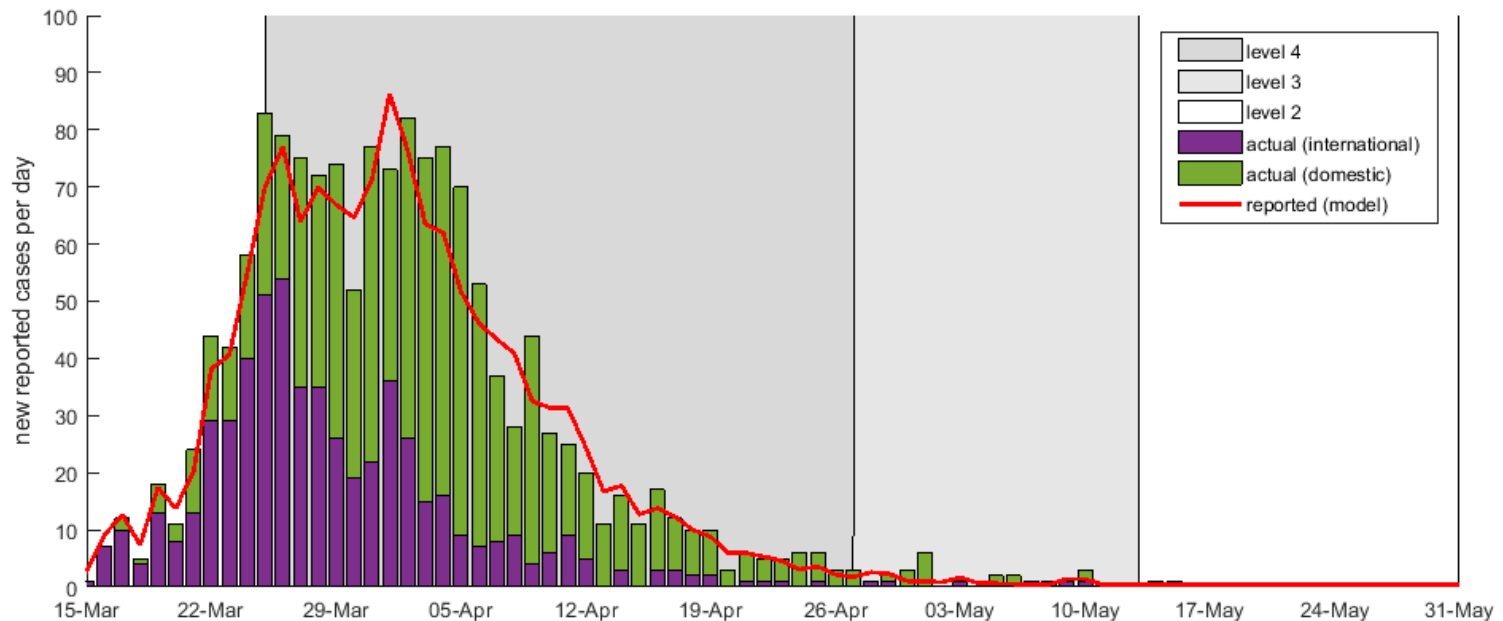
Source: Shaun Hendy et al

Impact of Alert Levels / Lockdowns
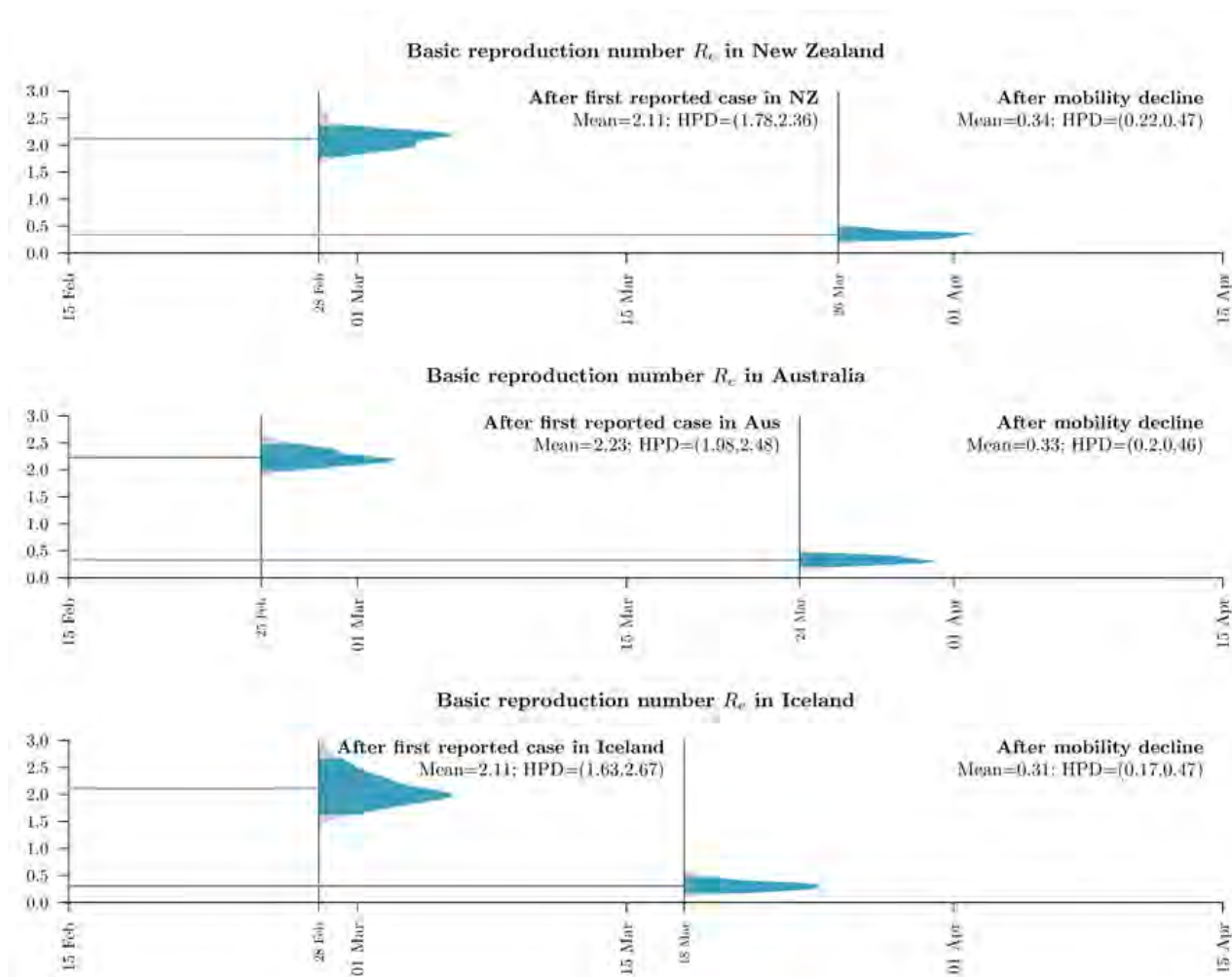
Source: Alexei Drummond , Jordan Douglas, et al. Centre for Computational Evolution, University of Auckland, New Zealand

Flyer delivered to all NZ households, March 2020

Future threats for NZ

Pandemic threats

- Border management

- Increased coronavirus transmission in winter

- Resuming large indoor social gatherings

Effects of pandemic response

- Economic hardship

- Increased inequalities – socioeconomic and ethnic

- Multiple global health threats

Additional actions to maintain elimination

- Continue careful border management

- Establish a culture of face mask use as part of multi-barrier approach to risk management

- Enhance contact tracing with digital tools eg, Bluetooth enabled card/device

- Rapid review of NZ response & establishment of dedicated national public health agency, plus thorough commission of inquiry

Uncertainties and Research questions

- Global pandemic control – vaccines +/- antivirals

- Effectiveness and duration of immunity

- Optimal mix of strategies for managing outbreaks and achieving elimination – face masks, contact tracing

- Managing risk of travel

Strengths and weaknesses of NZ response

Strengths

- Good science, good leadership, decisive action
- Chief science advisors, accessible decision-makers
- Effective strategic advice from epidemiologists
- High public trust and engagement

Weaknesses

- Eroded, fragmented and underfunded public health infrastructure
- Resistance to change eg, face mask policy

Net effects on disease burden

High-income jurisdiction	Death Numbers	Deaths per million population from COVID-19 (22 May))
Elimination / containment		
Australia (lowest in OECD with NZ)	103	4
New Zealand (lowest in OECD with Australia)	21	4
Singapore	23	4
Hong Kong (China)	4	0.5
Taiwan	7	0.4
Fiji (18 cases)	0	0
Samoa, Tonga	0	0
Selected jurisdictions in the OECD		
Belgium (highest in OECD)	9,364	808
United Kingdom (highest Anglophone nation in OECD)	37,048	536
New York		1,500
United States – 100,000 deaths **But NY rate applied to US pop of 328 million -> 0.5 million**	100,000	304
Mitigation – herd immunity		
Sweden	3,412	409
Denmark	563	97
Norway	235	43
Finland	312	56
Other countries		
Brazil	24,593	116
Iran	7,508	90

Summary/Main points

- Risk assessment and effective strategic decision making is important in public health crises

- Requires effective science and leadership

- Need to strengthen public health infrastructure for this and future crises

- Need to strengthen and reform global health agencies like WHO

- Benefits of sharing approaches such as elimination/containment internationally

- Opportunity for broad 'reset' and an increased focus on managing major global health threats