

Rationale for Border Control Interventions and Options to Prevent or Delay the Arrival of Covid-19 in New Zealand: Final Commissioned Report for the New Zealand Ministry of Health

Prepared for the Ministry of Health

by

Prof Nick Wilson, Dr Lucy Telfar Barnard, Prof Michael Baker

**COVID-19 Research Group
Health, Environment & Infection Research Unit (HEIRU)
Burden of Disease Epidemiology, Equity and Cost-Effectiveness
Programme (BODE³)
University of Otago Wellington**

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NOTE

Although this report was correct at the time of writing, the information it presents may no longer be current because of continuing evolution of the COVID-19 pandemic and our understanding of it.

Unless otherwise indicated, peer review and full consultation with relevant agencies was not always possible in the timeframe available for producing this report.

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Abstract

In this Report we detail a comprehensive set of reasons for national-level border controls in the face of an emerging pandemic. In the context of the current situation with Covid-19 and New Zealand (NZ), we detail two main options for NZ policy-makers to consider:

- Option 1: Continue with existing border controls but adapt these to all countries with evidence of uncontrolled spread of Covid-19, along with preparing for a full set of major control measures (listed in the Appendix).
- Option 2: Switch from travel restrictions to expanding self-quarantine in NZ for relevant incoming travellers, along with preparing for a full set of major control measures (listed in the Appendix).

For both options the period before any uncontrolled disease spread within NZ is a critical time to maximise system preparedness. Selection of the best of these two options for New Zealand as a whole should not be a health sector decision alone. It should require a full societal perspective (eg, as held by the Prime Minister and Cabinet – potentially with input from all Ministers). Nevertheless, from a public health perspective Option 1 seems preferable given the potential benefits of maximising efforts on the “keep it out” phase of pandemic planning and reducing demand for the “stamp it out” and “manage it” phases.

Purpose of this Report

1. Review the public health rationale for border control measures and their duration – Multiple reasons are given for excluding pandemic diseases at borders. In general, the rationale for these measures decreases after a period of time.
2. Consider options for border control measures – Assuming the rationale for border controls is accepted, at least for a period, then it is important to choose the mix of methods that are most effective and cost-effective from both a health and societal perspective.

Background

As part of a precautionary approach to preventing and delaying the arrival of Covid-19, the NZ Government has imposed travel restrictions for people travelling from China (with special provisions for NZ citizens). The logic for this move comes from the well-established knowledge that air travel can facilitate pandemic spread (see this systematic review on the spread influenza to new areas¹). Another systematic review in the Bulletin of the World Health Organization concluded that “Extensive travel restrictions may delay the dissemination of influenza but cannot prevent it.”² The most recent review identified stated that: “Some studies reported that travel restrictions could delay the start of local transmission and slow international spread, and one study indicated that small Pacific islands were able to prevent importation of pandemic influenza during 1918–19 through complete border closure.”³ While the WHO generally advises against travel restrictions, NZ has technically met its International Health Regulations (IHR) obligations by providing a rationale to WHO within the requisite timeframe. Furthermore, WHO advice on travel restrictions is very general and does not address the needs of islands or consider very severe pandemics.

It is difficult to estimate the impact of such travel restrictions on reducing the risk of Covid-19 arrival in a country. Nevertheless, the introduction of Covid-19 seems likely to have been prevented (or at least slowed) in a number of countries, presumably via a mix of border control measures, and contact tracing and case isolation/quarantine measures. For example, of 76 countries outside China reporting cases on 4 March to WHO,⁴ only 9 had 100+ cumulative cases in total. However, it is still plausible that there is unreported silent transmission occurring in some of these countries, owing to the high proportion of cases who have mild illness (at 81% of symptomatic cases as per Chinese data⁵).

Past modelling work for NZ is only of limited guidance to the travel restriction issue, as it relates to full border closure and what is probably a more severe pandemic, ie, the 1918 influenza pandemic.⁶

Method

Development of options was based on the authors’ general knowledge of pandemic control (based on their research into the 1918 influenza pandemic, SARS, and the 2009 influenza pandemic). They have also had involvement with the WHO in International Health Regulations (IHR) work (MB) and have been in WHO meetings to discuss the role of border controls and the IHR (NW in 2019). Nevertheless, a rapid literature search for systematic reviews around pandemic control was conducted (using PubMed on 27 February 2020). Peer review of this work came from Ministry of Health colleagues – with subsequent amendments.

Part A. Rationale for border control measures

It is important to assess, and keep reviewing, the rationale for border controls. The following table lists a series of reasons for establishing and sustaining border control measures. In general, the rationale for these measures decreases over time (eg, if epidemic spread is curtailed as per SARS, if improved treatments/vaccines become available, or if the costs of

border controls become unsustainably high).

Table 1: Rationale for the benefits of border control interventions when a country faces an emerging pandemic threat

Rationale by pandemic phase (and ranked in overall importance within each phase – authors’ judgement)	Notes
Mainly during the “keep it out” and “stamp it out” phases	
1) Opportunity to better understand the nature of the pandemic and its health impact to assess a proportionate response. This particularly applies to novel agents where key characteristics are unknown (far more rapid decisions will be possible for well characterised infectious agents)	Depends on high quality studies from areas with active transmission and local modelling studies to assess its expected impact
2) Opportunity to decide whether a combination of border controls may be sufficient to entirely exclude a pandemic from a country or region	Depends on key characteristics of the infectious agent, notably its transmissibility. On occasions the disease might even be eradicated prior to spread to most countries (eg, SARS). More recently border controls protected some Pacific Island jurisdictions from the 2009 influenza pandemic. ⁷
3) Opportunity to push the period of maximum transmission into a season with less respiratory pathogen transmission (eg, summer period in temperate countries like NZ)	Depends on time of arrival of pandemic and seasonality of respiratory pathogen transmission in specific countries
4) Opportunity to improve organisation of healthcare services to maximise effectiveness and ensure infection control	Depends on fine-tuning and rolling out of suitable measures to ensure optimal organisation of healthcare services to maximise effectiveness and ensure infection control. See Appendix.
5) Opportunity to build trust with health authorities and better prepare the population psychologically, including for severe outcomes and potentially for difficult rationing decisions	Depends on developing and delivering suitable messaging. See Appendix.
6) Opportunity for development, production, and distribution of vaccine	Depends on speed of vaccine development, trials, production and distribution. This benefit appears to have been realised in some small Pacific Island jurisdictions after they keep out the 2009 influenza pandemic and could then vaccinate their populations when the new vaccine became available. ⁷
7) Opportunity for evolutionary processes to reduce severity of a novel infectious agent	In general novel agents tend to evolve towards being more transmissible and less severe (with some evidence for the latter with the 1918-1919 influenza pandemic virus strain as per its reduced impact on Australia in 1919).
Mainly during the “manage it” phase (but potentially some relevance to earlier phases)	
1) Opportunity to reduce the intensity of the pandemic with preventive measures (eg, around hygiene, social distancing, protective sequestration etc) (in situations where intensive border control is no longer possible)	Depends on pandemic characteristics. May still be useful to reduce intensity of pandemic from further importing of cases well after it has become established, particularly if the pandemic is more intense outside the country of concern and has relatively low transmissibility. For some smaller islands and isolated regions within a country there may still be

Rationale by pandemic phase (and ranked in overall importance within each phase – authors' judgement)	Notes
	time to protect vulnerable populations, and optimise effectiveness of treatment, and ideally develop options around innovative approaches (eg, protective sequestration). See Appendix.
2) Opportunity to improve case management, notably therapeutics and intensive care	Depends on rapid international observational studies and clinical trials. Some existing medicines can potentially be re-purposed, but usually the development times are quite long and so will typically not be realised until well after the “keep it out” phase.

When considering the 9 rationales in the above table, with regard to Covid-19:

- All of these rationales seem likely to apply. Some of them particularly apply to island nations like NZ, which do not have potentially “leaky” land borders and which have well developed border controls.
- As per early March 2020, Rationale 1 is now partly achieved – though there is still considerable uncertainty around transmissibility and severity (eg, the reproduction number and the case fatality ratio).
- It seems unlikely that Covid-19 can be entirely excluded from NZ in the long term (Rationale 2), but it is conceivable that border controls in combination with warmer summer/autumn weather conditions may be sufficient to prevent sustained transmission for a period of time. Indeed, Rationale 3 is relevant to Covid-19 given the evidence that other coronavirus infections peak in winter.⁸
- Rationales 4 and 5 are underway in NZ.
- Rationale 6 on vaccine development is underway internationally and the last listed rationale (on case management) is also underway internationally, and NZ-based clinicians are very well integrated with these efforts.
- It is important to identify opportunities that will disappear once sustained Covid-19 transmission becomes established in NZ (see Appendix).
- **This pre-arrival time window should be used as effectively as possible to implement all components of NZ’s pandemic plan**, including using international experience to shape local interventions (eg, understanding whether those who have recovered from infection are immune and can therefore take an active role in patient care without fear of reinfection).

Part B. Two major options around border control measures

This section details two potential options relating to border controls in the current “keep it out” phase of NZ’s pandemic plan.

Option 1: Continue with existing border controls but adapt these to all countries with evidence of uncontrolled spread of Covid-19, along with preparing for a full set of major control measures (listed in the Appendix).

This option could involve maintaining current border controls but also adapting them to apply to all those countries where there is evidence suggesting likely uncontrolled spread. A simple and highly transparent and operational definition of “likely uncontrolled spread” in a country could be adopted. For example, over 50 new laboratory-confirmed cases in any day in the last 4 weeks or if a country currently has over a set number of cumulative cases (eg, 200 cases). It is possible that a more elaborate multi-criteria decision analysis approach (with weighting of variables) might be more valid than this approach. But it would require more expert staff time and not be as transparent. Furthermore, an elaborate approach seems to be of marginal value when there are likely to be data quality issues with some countries (eg, due to limited health system capacity).

This option also involves preparing for the control measures detailed in the Appendix. The advantages of this approach are:

- As per the list of rationales in Table 1.
- It is one way to enhance the protection of Pacific Island jurisdictions that have strong air links with NZ (eg, all flights into Niue are only from NZ; please see a separate Report we are providing to the NZ Ministry of Health on this topic).
- At present, while Australia takes broadly the same approach as NZ, there is policy coherence across Australasia, which has some advantages.

Downsides of this option are the following:

- Travel restrictions would continue to place economic burdens on the travel/tourism sector, the business sector involved in work-related meetings, and the educational sector (particularly Chinese students wishing to study in NZ). These are real and important burdens, though they are hard to define quantitatively as tourism from countries like China will have declined for other reasons (eg, the Chinese Government banning tour groups leaving China).

Option 2: Switch from travel restrictions to expanding self-quarantine in NZ for relevant incoming travellers and preparing for a full set of major control measures (listed in the Appendix).

This option could see an end to current travel restrictions but with an expansion of self-quarantine in NZ for incoming travellers from countries where uncontrolled spread was deemed to occur. It would also involve preparing for a full set of major control measures as listed in the Appendix.

The advantages of this approach are probably:

- The immediate harm to the NZ economy might be somewhat reduced (ie, for the tourism, business travel and educational sectors which involve overseas students). But this benefit might be constrained if international travel continues to decline globally in coming months due to concerns around Covid-19.
- The policy might be simpler than having to potentially keep adding travel restrictions to countries deemed to have “uncontrolled spread”.

The disadvantages of this approach are probably:

- The short and longer term health benefits potentially arising from the list of rationales in Table 1 may not be realised.
- It would place additional demands on the health system (ie, potentially supporting larger numbers of incoming travellers in home quarantine).

Discussion

Selection of the best of these two options for New Zealand as a whole, should not be entirely a health sector decision. It should require a full societal perspective (eg, as held by the Prime Minister and Cabinet – potentially with input from all Ministers). There is a potential case for involving all the key leaders of all political parties so that there is multi-party support for the final decision. This is an approach NZ has previously taken with war-time cross-party Cabinets (eg, in the First World War). Indeed, this approach may be particularly important for NZ since 2020 is an election year and the need to avoid partisan point-scoring is particularly high.

Nevertheless, from a public health perspective Option 1 is preferable given the potential benefits listed in Table 1 and the potentially severe health impacts of Covid-19 in NZ (see our Covid-19 Modelling Report provided to the Ministry of Health on 5 March 2020).

Appendix: List of a possible “top five” major preparatory actions for reducing Covid-19 health impacts (that can be prepared for in a pre-arrival period)

The list below is based on broad public health principles and should be considered speculative with regard to Covid-19 given continued uncertainty around its epidemiological parameters. This list assumes that a vaccine will not be available for use in NZ for at least six months and so this aspect is not considered further.

1. Prepare for **internal travel restrictions and social distancing interventions**. The effectiveness of these measures against Covid-19 is still uncertain but some research from China is suggestive of benefit.⁹ In particular: “Among individual control measures investigated, the most effective were suspending intra-city public transport, and closing entertainment venues and banning public gatherings.” The recent WHO-China Report also provides indications of markedly successful pandemic control in China,¹⁰ but it is an open question around the generalisability of these approaches to democratic countries.¹¹ Historically there is some evidence for the effectiveness of these interventions from the 1918 pandemic.^{12 13} In particular, internal travel restrictions were effective in 1918 in Iceland.¹⁴ A systematic review provides some evidence for workplace social distancing interventions – at least for influenza.¹⁵ Another review reported that: “Voluntary isolation at home might be a more feasible social distancing measure, and pandemic plans should

consider how to facilitate this measure. More drastic social distancing measures might be reserved for severe pandemics.”¹⁶

2. Prepare for **protective sequestration** at the community and institution levels to protect the most vulnerable population groups (eg, those with severe chronic conditions and the elderly). This approach worked in some settings for the 1918 pandemic.¹⁷ (See also a forthcoming Report that we plan to provide to the Ministry of Health on such novel interventions).
3. Prepare to maximise **personal hygiene behaviours** eg, via mass media and social media based campaigns around hand hygiene and respiratory hygiene. There is Cochrane Systematic Review evidence for hand hygiene preventing the spread of respiratory viruses.¹⁸ There is also plenty of NZ evidence around large gaps in hand hygiene,^{19 20} respiratory hygiene,²¹ and soap provision in toilets.^{22 23}
4. Prepare campaigns to **encourage self-isolation and home care** of those with likely Covid-19 symptoms (especially for those not needing hospitalisation). There is some evidence for such home support in reducing the impact of the 1918 pandemic in some NZ settings²⁴ and it may have been a factor in differential mortality between cities, large towns and small towns in NZ in 1918.²⁵
5. Prepare to **optimise health care services** to ensure effectiveness in saving the maximal number of lives (eg, deferring elective surgery, effectively applying triage, enhancing infection control etc).

These type of interventions (specifically combining: case isolation, quarantine, personal hygiene measures, social distancing and travel restrictions) have been reported to work better in combination than when used individually (according to one systematic review²⁶).

All of these interventions have some costs, ranging from reducing individual freedoms, to government expenditure on campaigns and the costs of enforcement (eg, by police and military assisting with any internal travel restrictions). Policy-makers should also consider the ethical dimensions of all pandemic controls,²⁷ and also the literature on the cost-effectiveness and resourcing implications of pandemic control/respiratory virus control measures (eg, as per these two systematic reviews:^{28 29}). For example, for “mild” pandemics (as per the 2009 H1N1 pandemic) one of these systematic reviews states that school closures and social distancing may not qualify as efficient measures (when using a willingness-to-pay threshold of \$45,000 per disability-adjusted life-year).²⁸ But it does note that such interventions “may become cost-effective for severe crises”. The other noted that the relatively low cost of personal protective equipment and its increased usage during epidemics and pandemics, can make its provision “economically attractive”.²⁹

References

1. Browne A, Ahmad SS, Beck CR, Nguyen-Van-Tam JS. The roles of transportation and transportation hubs in the propagation of influenza and coronaviruses: a systematic review. *J Travel Med* 2016;23.

2. Mateus AL, Otete HE, Beck CR, Dolan GP, Nguyen-Van-Tam JS. Effectiveness of travel restrictions in the rapid containment of human influenza: a systematic review. *Bull World Health Organ* 2014;92:868-80D.
3. Ryu S, Gao H, Wong J, Shiu E, Xiao J, Fong M, Cowling B. Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—International Travel-Related Measures. *Emerg Infect Dis* 2020;26 (Early Release).
https://wwwnc.cdc.gov/eid/article/26/5/19-0993_article.
4. World Health Organization. Coronavirus disease 2019 (COVID-19) Situation Report – 44. 2020;(4 March). https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200304-sitrep-44-covid-19.pdf?sfvrsn=783b4c9d_2.
5. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) — China, 2020. *China CDC Weekly* 2020. [cited 2020 Feb 29].
<http://weekly.chinacdc.cn/en/article/id/e53946e2-c6c4-41e9-9a9b-fea8db1a8f51>.
6. Boyd M, Mansoor O, Baker M, Wilson N. Economic evaluation of border closure for a generic severe pandemic threat using New Zealand Treasury methods. *Aust N Z J Public Health* 2018;(8 August).
7. Kool JL, Pavlin BI, Musto J, Dawainavesi A. Influenza surveillance in the Pacific Island countries and territories during the 2009 pandemic: an observational study. *BMC Infect Dis* 2013;13:6.
8. Killerby ME, Biggs HM, Haynes A, Dahl RM, Mustaquim D, Gerber SI, Watson JT. Human coronavirus circulation in the United States 2014-2017. *J Clin Virol* 2018;101:52-56.
9. Tian H, Liu Y, Li Y, Kraemer M, Chen B, Wu C-H, Cai J, Li B, Et al. Early evaluation of transmission control measures in response to the 2019 novel coronavirus outbreak in China. *MedRxiv* 2020013020019844; doi: <https://doi.org/10.1101/2020013020019844>
<https://wwwmedrxiv.org/content/101101/2020013020019844v3>.
10. WHO-China Joint Mission. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). 2020;(16-24 February).
<https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>.
11. Kupferschmidt K, Cohen J. China’s aggressive measures have slowed the coronavirus. They may not work in other countries. *Science* 2020;(2 March).
<https://www.sciencemag.org/news/2020/03/china-s-aggressive-measures-have-slowed-coronavirus-they-may-not-work-other-countries>.
12. Markel H, Lipman HB, Navarro JA, Sloan A, Michalsen JR, Stern AM, Cetron MS. Nonpharmaceutical interventions implemented by US cities during the 1918-1919 influenza pandemic. *JAMA* 2007;298:644-54.
13. Hatchett RJ, Mecher CE, Lipsitch M. Public health interventions and epidemic intensity during the 1918 influenza pandemic. *Proc Natl Acad Sci U S A* 2007;104:7582-7.
14. Summers JA, Wilson N, Baker MG, Gottfredsson M. The influenza pandemic of 1918-1919 in two remote island nations: Iceland and New Zealand. *N Z Med J* 2013;126:74-80.
15. Ahmed F, Zviedrite N, Uzicanin A. Effectiveness of workplace social distancing measures in reducing influenza transmission: a systematic review. *BMC Public Health* 2018;18:518.
16. Fong M, Gao H, Wong J, Xiao J, Shiu E, Ryu S, Cowling B. Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Social Distancing Measures. *Emerg Infect Dis* 2020;26 (Early Release).
https://wwwnc.cdc.gov/eid/article/26/5/19-0995_article.

17. Markel H, Stern AM, Navarro JA, Michalsen JR, Monto AS, DiGiovanni C. Nonpharmaceutical influenza mitigation strategies, US communities, 1918-1920 pandemic. *Emerg Infect Dis* 2006;12:1961-4.
18. Jefferson T, Del Mar CB, Dooley L, Ferroni E, Al-Ansary LA, Bawazeer GA, van Driel ML, Nair S, Jones MA, Thorning S, Conly JM. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews* 2011:CD006207.
19. Murray R, Chandler C, Clarkson Y, Wilson N, Baker M, Cunningham R. Sub-optimal hand sanitiser usage in a hospital entrance during an influenza pandemic, New Zealand, August 2009. *Euro Surveill* 2009;14(37)pii:19331.
20. Manning S, Barry T, Baker MG, Wilson N. Hand hygiene practices at a hospital entrance after the 2009 influenza pandemic: observational study over 1 year. *N Z Med J* 2011;124(1334):111-4.
21. Barry T, Manning S, Lee MS, Eggleton R, Hampton S, Kaur J, Baker MG, Wilson N. Respiratory hygiene practices by the public during the 2009 influenza pandemic: an observational study. *Influenza Other Respi Viruses* 2011;5:317-20.
22. Wilson N, Thomson G. Neglecting the basics? Survey of water and soap availability in council-operated public toilets in New Zealand. *N Z Med J* 2013;126(1376):110-4.
23. Reeves LM, Priest PC, Poore MR. School toilets: facilitating hand hygiene? A review of primary school hygiene facilities in a developed country. *J Public Health (Oxf)* 2012;34:483-8.
24. Rice G. Why did Wellington suffer nearly double the death rate of Christchurch in the 1918 influenza pandemic? The 2018 Jim Gardner Memorial Lecture. Canterbury History Foundation: Christchurch, New Zealand, 2018.
25. McSweeney K, Colman A, Fancourt N, Parnell M, Stantiall S, Rice G, Baker M, Wilson N. Was rurality protective in the 1918 influenza pandemic in New Zealand? *N Z Med J* 2007;120:U2579.
26. Lee VJ, Lye DC, Wilder-Smith A. Combination strategies for pandemic influenza response - a systematic review of mathematical modeling studies. *BMC Med* 2009;7:76.
27. National Ethics Advisory Committee. Getting Through Together: Ethical values for a pandemic. Wellington: Ministry of Health, 2007.
<https://www.health.govt.nz/publication/getting-through-together-ethical-values-pandemic>.
28. Pasquini-Descomps H, Brender N, Maradan D. Value for Money in H1N1 Influenza: A Systematic Review of the Cost-Effectiveness of Pandemic Interventions. *Value Health* 2017;20:819-27.
29. Lee K, Shukla V, Clark M, Mierzwinski-Urban M, Pessoa-Silva C, Conly J. Physical interventions to interrupt or reduce the spread of respiratory viruses - resource use implications: a systematic review. *CADTH Technol Overv* 2012;2:e2302.