SOCIAL WELLBEING AGENCY | TOI HAU TĀNGATA

Te Atatū – Insights

July 2022

Identifying effective policy responses to the COVID-19 pandemic

At a glance

This report summarises a series of analyses conducted by the Social Wellbeing Agency to determine the effectiveness of several responses aiming to reduce the spread of COVID-19. This involved comparing data on COVID-19 policies to reported case rates in New Zealand and 49 similar countries.

Summary findings

- The most commonly implemented policies across the countries examined related to containment and closure, such as workplace closures and restriction of movement.
- These type of policies significantly reduced COVID-19 case numbers.
- About 40% of the time, countries introduced or strengthened policies in multiple areas at the same time (across the four groupings of containment and closure; economic; health system; and vaccinations).
- The introduction of economic policies such as income support is associated with the largest short-term reduction in COVID-19 cases.
- New Zealand had high adherence to stay-at-home requirements.

Te Kāwanatanga o Aotearoa
New Zealand Government

About this work

Governments around the world have had a shared objective of protecting public health and wellbeing while minimising the economic shock of COVID-19. However, no two governments have taken the same approach when it comes to the management of COVID-19, so there has been a need to understand the effectiveness of different interventions on reducing the impact of COVID-19. This has been an area of significant interest for both researchers and policy makers.

In 2021, the Department of Prime Minister and Cabinet asked the Social Wellbeing Agency to investigate the impact of various government interventions on the spread of COVID-19 and its burden on the health system. This report summarises our findings.

No two governments have taken the same approach when it comes to the management of COVID-19.

The data used for this analysis included:

- **Government policies** from the Oxford University: COVID-19 Government Response Tracker (OxCGRT)
- **COVID-19 cases** from Our World in Data
- **Mobility** data from Google.

We combined data from New Zealand and 49 similar countries to identify general patterns of effectiveness of different interventions around the world, as well as compare New Zealand's experiences to those of other countries. We identified these 50 countries through a statistical clustering exercise, which revealed a group of countries (including New Zealand) with higher GDP per capita, stronger governance (as measured by the World Bank) and higher adherence to COVID-19 policies (as measured by reductions in mobility). This included several countries New Zealand is often compared to such as Australia, the US, the UK, and several that New Zealand is less often compared to including Cambodia, Czech Republic, and Thailand.

Government policies are grouped into four categories:

- **Containment and closure policies** such as workplace closures and restrictions in movement
- **Economic policies** such as income support to individuals, or debt/contract relief
- **Health system policies** such as COVID-19 testing and emergency investments into healthcare
- **Vaccine policies** such as the presence of mandates or prioritisation lists.

Countries used many different policies, sometimes at once

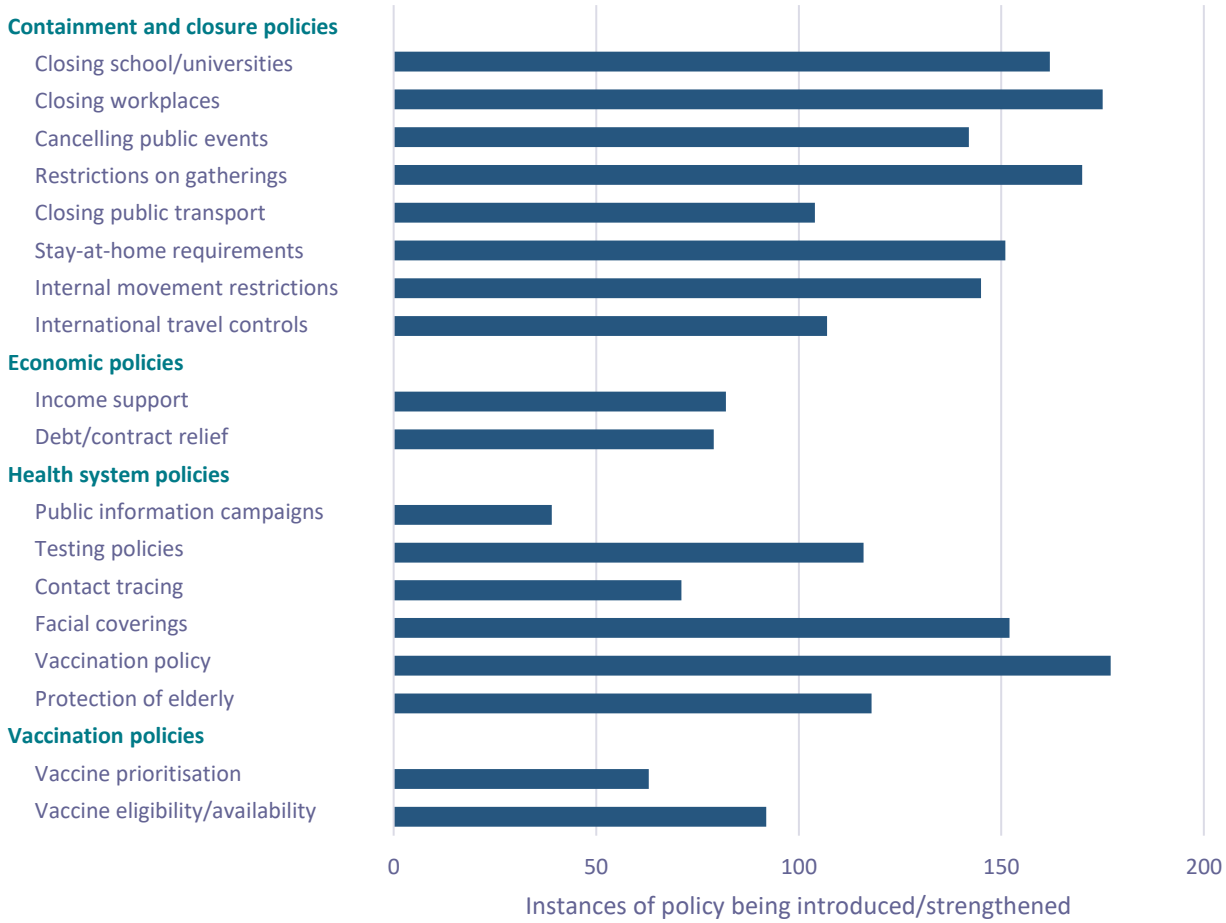
Before examining impact, it is helpful to understand how different governments responded to COVID-19. Of the 18 policies tracked in the OxCGRT dataset, each was implemented by almost every country over the course of 2020 or 2021. Most countries strengthened these policies at least once over this period, for instance by upgrading government recommendations to requirements; making local policies more widespread; or introducing restrictions, withdrawing them, and subsequently reintroducing them.

Figure 1 provides an indication of how common different policies were across the 50 countries. The most commonly introduced or strengthened policies related to vaccine availability, closing workplaces and educational settings, and restrictions on gatherings. The OxCGRT data includes three separate vaccination policies. The most common policy category relates to the existence of policies that prioritise vaccines, as opposed to the actual availability of vaccines, or their coverage.

The least common policies related to public health campaigns, contact tracing, and economic policies such as income support or debt/contract relief. In the OxCGRT definitions, 'income support' relates to the government providing direct cash payments to those who lose their jobs or cannot work. 'Debt/contract relief' relates to a government freezing financial obligations for households, for example stopping loan repayments, preventing services like water from stopping, or banning evictions.

The most commonly introduced policies related to vaccine availability, closing workplaces and educational settings, and restrictions on gatherings.

Figure 1: Total number of policies introduced

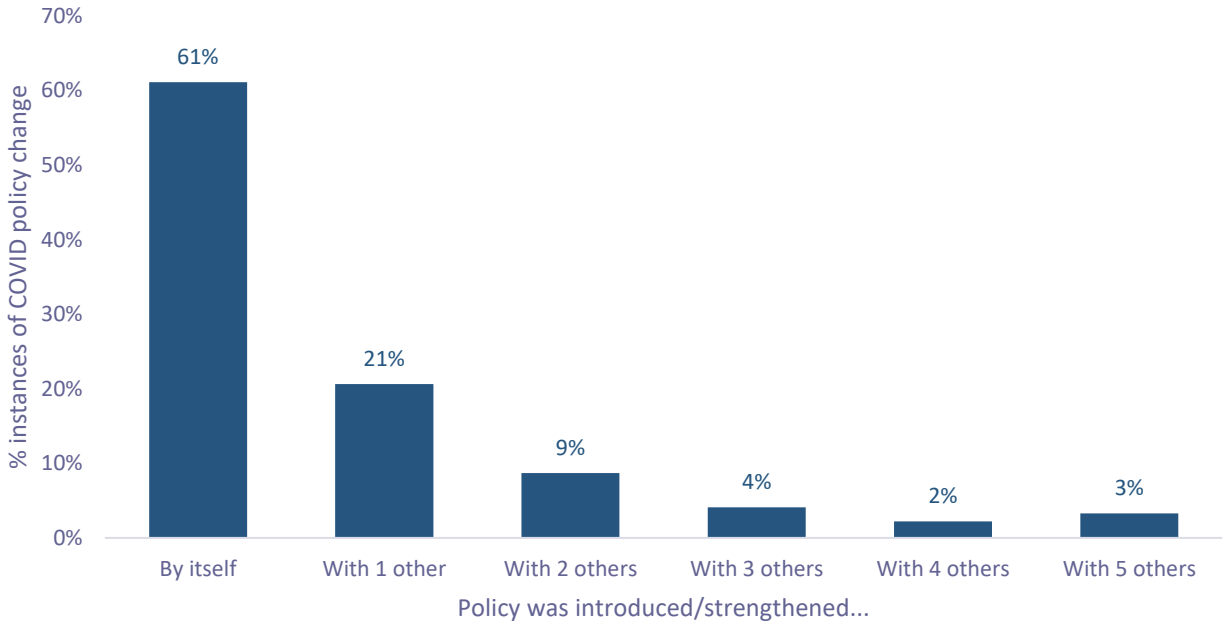


Note: For definitions of each policy category, see OxCGRT: https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/codebook.md.

Figure 2 provides an indication of how often governments introduced or strengthened multiple policies at the same time. Most of the time (61%), policies were introduced by themselves, and 21% of the time, policies were introduced in tandem with one other policy. However, governments sometimes introduced policies aimed at curbing COVID-19 covering five or six separate categories of response at once. An example is the initial response of the New Zealand government in March 2020, which involved simultaneously introducing restrictions on public transport while strengthening previous restrictions on workplaces, gatherings, internal movements and stay-at-home requirements (and the introduction of economic supports in the same week).

Most of the time, policies were introduced by themselves.

Figure 2: How often multiple policies are introduced at once



Some types of policies were more likely to be introduced or strengthened alongside others. Table 1 provides an indication of how commonly each type of policy was introduced with every other type of policy, across the 50 countries. We found certain policies are more commonly used together (shown by the green cells in Table 1):

- Containment and closure responses (C1-C8) were more often rolled out with other containment polices.
- Protection of elderly (H8) policies were commonly paired with general stay-at-home orders (C6).
- Economic policies (E1-E2) were sometimes paired with each other, but were often not implemented with any other type of policy.
- Health responses (H1-H8) were most frequently rolled out individually or alongside one other policy.

Table 1: How often different policies were introduced together

	# times policy introduced or strengthened	Frequency of co-introduction/strengthening																	
		C1	C2	C3	C4	C5	C6	C7	C8	E1	E2	H1	H2	H3	H6	H7	H8	V1	V2
C1	162		32%	22%	27%	13%	25%	25%	11%	7%	9%	2%	4%	6%	7%	4%	11%	2%	1%
C2	175	30%		22%	27%	16%	32%	25%	13%	4%	7%	3%	3%	2%	10%	2%	14%	2%	1%
C3	142	25%	27%		41%	11%	18%	17%	10%	6%	3%	6%	6%	5%	8%	2%	14%	0%	1%
C4	170	25%	28%	34%		14%	23%	18%	11%	6%	7%	2%	5%	4%	9%	4%	14%	0%	1%
C5	104	20%	27%	15%	23%		29%	38%	10%	9%	15%	4%	5%	4%	5%	3%	20%	1%	2%
C6	151	27%	37%	17%	26%	20%		37%	13%	9%	11%	3%	5%	3%	10%	3%	34%	1%	1%
C7	145	28%	30%	17%	21%	27%	39%		12%	8%	10%	3%	3%	3%	7%	3%	19%	1%	2%
C8	107	17%	21%	13%	17%	9%	18%	17%		9%	9%	6%	8%	3%	7%	4%	14%	0%	3%
E1	82	13%	9%	11%	13%	11%	17%	13%	12%		21%	2%	10%	4%	7%	2%	17%	0%	0%
E2	79	19%	15%	5%	15%	20%	22%	18%	13%	22%		1%	6%	4%	4%	1%	16%	0%	0%
H1	39	8%	15%	21%	10%	10%	10%	13%	15%	5%	3%		23%	21%	3%	0%	13%	0%	0%
H2	116	5%	4%	7%	7%	4%	6%	4%	8%	7%	4%	8%		9%	9%	1%	5%	0%	1%
H3	71	14%	6%	10%	10%	6%	6%	7%	4%	4%	4%	11%	15%		8%	3%	4%	1%	1%
H6	152	8%	11%	7%	11%	3%	10%	7%	5%	4%	2%	1%	7%	4%		1%	6%	1%	2%
H7	177	4%	2%	2%	3%	2%	2%	2%	2%	1%	1%	0%	1%	1%	1%		2%	10%	21%
H8	118	15%	21%	17%	20%	18%	44%	24%	13%	12%	11%	4%	5%	3%	8%	3%		2%	1%
V1	63	6%	5%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	2%	2%	29%	3%		56%
V2	92	2%	2%	1%	1%	2%	1%	3%	3%	0%	0%	0%	1%	1%	3%	41%	1%	38%	

C1 = closing of schools and university; C2 = closing of workplaces; C3 = cancelling of public events; C4 = restrictions on gatherings; C5 = closing public transport; C6 = stay-at-home requirements; C7 = internal movement restrictions; C8 = international travel controls; E1 = income support; E2 = debt/contract relief; H1 = public information campaigns; H2 = testing policies; H3 = contact tracing; H6 = facial coverings; H7 = vaccination policy; H8 = protection of elderly; V1 = Vaccine prioritisation; V2 = vaccine eligibility/availability

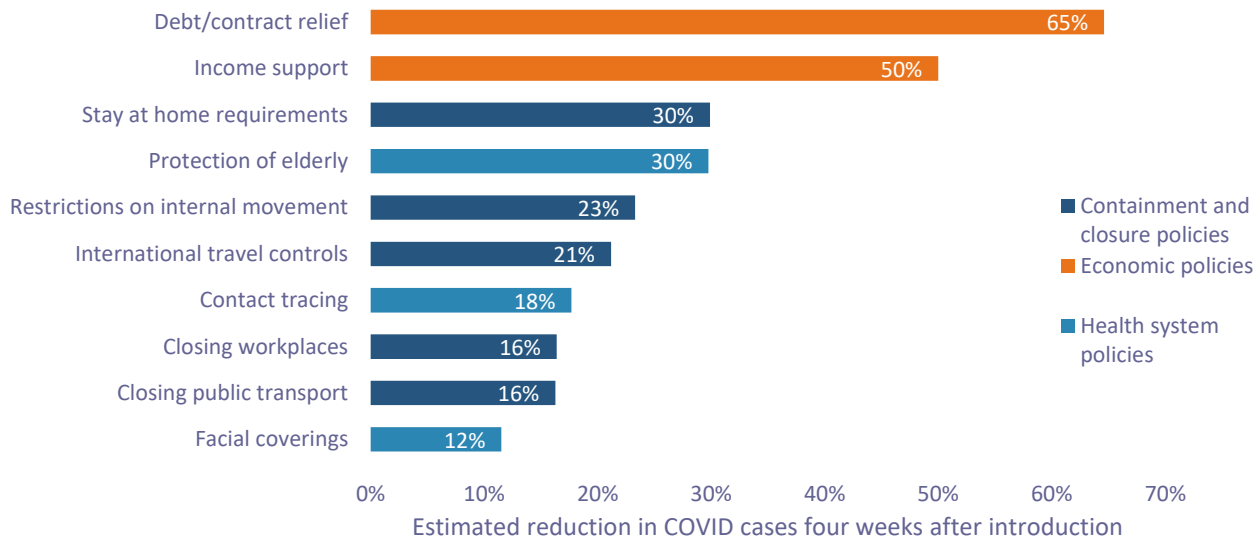
Economic policies show the most evidence of impact

To gauge how effective each policy is, we examined the introduction of every policy across the 50 countries. We used a statistical model to determine the relationship between a country introducing or strengthening a particular policy, and later patterns in reported COVID-19 cases. (We did not examine the impact of countries removing or weakening policies.) The statistical model accounted for the fact that many policies were introduced at the same time, in order to provide estimates for each policy in isolation. See the appendix for more about the statistical model we used.

Of the 18 policies examined, ten were associated with statistically significant reductions in later growth of COVID-19 cases across the 50 countries. Figure 3 shows the implied reduction in cases four weeks after the policy was implemented or strengthened (compared to no policy) for these ten policies. The largest of these were the two economic policies – debt or contract relief, and income support. Relative to our estimated 'do nothing' trajectory of COVID-19 cases, these effects imply a reduction of 50-65% in new cases four weeks after introducing or strengthening the policies. Further analysis indicated that the effectiveness of these policies is because they encouraged adherence to other initiatives (such as workplace closures and stay-at-home orders).

These imply a reduction of 50-65% in new cases four weeks after introducing economic supports.

Figure 3: Estimated effects of COVID-19 policies on COVID-19 cases



Note: See appendix for details. These estimates of reductions in cases should not be added together between different policies.

Most of the containment and closure policies are linked to statistically significant reductions in cases, with the largest effects for stay-at-home policies, and restrictions on internal and international travel. Closing public transport and workplaces also have significant effects – implying a drop of about 16% in new cases after four weeks.

Of the health system policies examined, protection of elderly people was associated with the largest reduction in subsequent cases, implying about a 30% reduction in new cases after four weeks. This category refers to recommendations or restrictions relating to visiting older people, or restrictions on older people leaving home (in residential care or in the community).

Policies relating to contact tracing and facial coverings were also associated with statistically significant reductions in future cases. Though the estimated impact of these policies was smaller, these also impose much lower costs than restrictions on movement or closure of business and services. This makes them an efficient and effective tool to reduce COVID-19.

The fact that other policies did not have detectable effects in this sample is not necessarily an indication that they are not effective in reducing the spread of COVID-19. The uncertainty associated with many of our estimates are quite large. This is because of factors like:

- A small number of countries used in our analysis (if we expanded the country list, we would end up estimating the impact in contexts very different to New Zealand).
- Many policies are introduced together or in close succession. This makes it harder for statistical models to tease out the impacts of any one policy in isolation.
- Our analysis tracked COVID-19 cases for only a few weeks after each policy was implemented. This is very relevant when interpreting the estimates for vaccination policies – the overwhelming evidence from scientific research is that vaccination is highly effective over the medium and long-term, rather than reducing cases in a matter of weeks.
- The data points available. We used data from the first recorded cases of COVID-19 in early 2020 to late 2021. However, we summarised case numbers to a per-week level, to remove day-to-day variation in reported cases. This meant we are trying to extract information from a relatively small number of data points for each country.

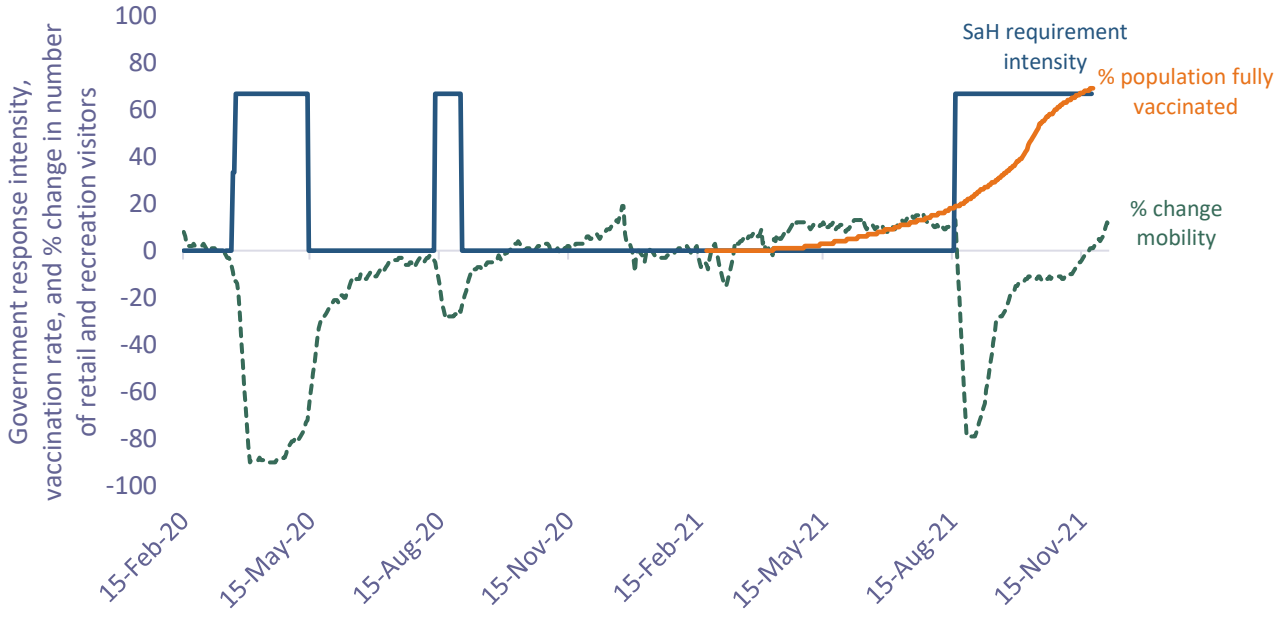
The overwhelming evidence is that vaccination is highly effective over the medium and long-term, rather than reducing cases in a matter of weeks.

- Fewer countries introduced or strengthened COVID-19 reduction policies more recently, compared to early in the pandemic. We experimented with statistical models that were broken up by time period or used more recent data from periods where the Omicron variant was spreading. These models ended up not being informative because of the low frequency of different policies being implemented over these periods. Partially this is due to the success of vaccination in reducing infection and hospitalisation rates over time.

New Zealand has had high compliance with policies

Containment policies such as restrictions on regional travel or closure of workplaces are only effective if there is high compliance with them. We examined compliance with stay-at-home orders by aligning the intensity of orders with Google mobility data (measuring movement trends, relative to a period of 'normality' before the pandemic). Figure 4 shows a comparison of intensity of stay-at-home restrictions (as measured by OxCGRT, in dark blue) with mobility data (in dotted green) for New Zealand over 2020 and 2021.

Figure 4: Relationship between stay-at-home requirements and mobility, New Zealand



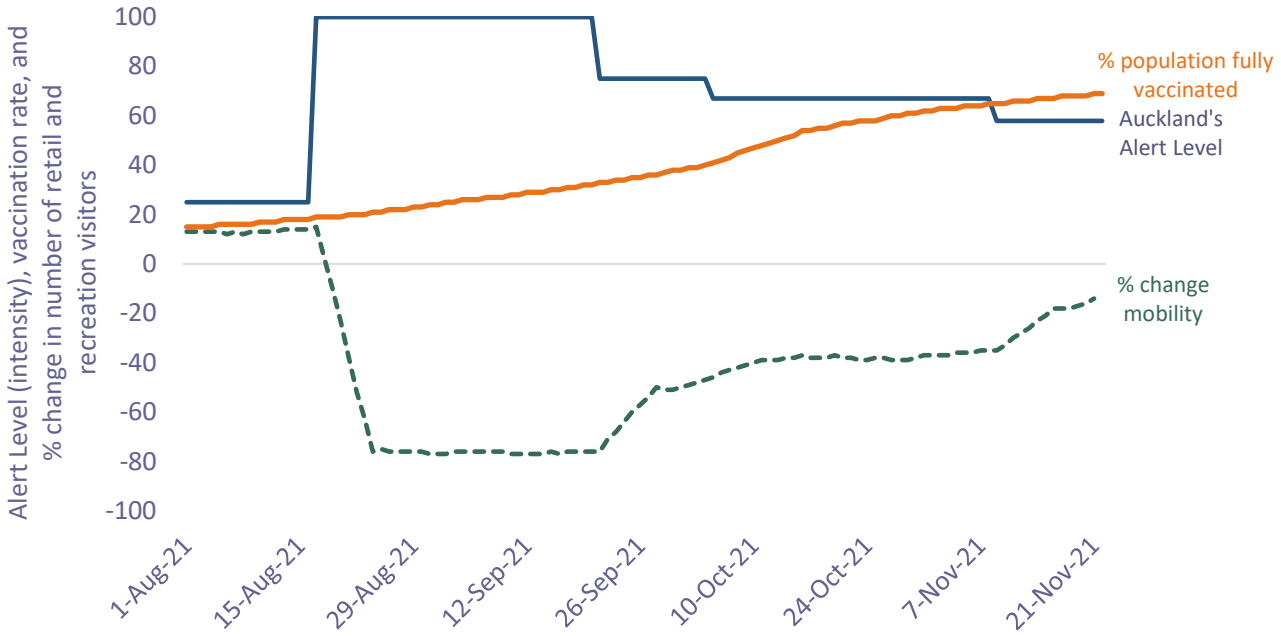
Note: The mobility measure is the seven-day moving average of the number of visits to retail and recreation locations.

A similar measure constructed using visits to workplaces displays the same pattern.

The more recent stay-at-home requirement (in late 2021, corresponding to the spread of the Delta variant) appears to show changes in compliance over time, but this is a misleading artefact of how New Zealand's COVID Alert Levels are represented in the OxCGRT data. Figure 5 looks more closely at this period for Auckland only (the region most affected by the most recent stay-at-home requirement), replacing the OxCGRT measure with Auckland's COVID-19 Alert Level. There is a clear relationship between Alert Levels and mobility within Auckland, again lasting the full length of each Alert Level. Taken together, these graphs are strong indications that New Zealanders responded to government policies by sharply reducing their mobility, and therefore exposure to risk. There appears to be very little indication that this public response changed over the course of the pandemic.

These graphs are strong indications that New Zealanders responded to government policies by sharply reducing their mobility, and therefore exposure to risk.

Figure 5: Alert Levels and mobility during Delta, Auckland



Note: The mobility measure is the seven-day moving average of the number of visits to retail and recreation locations.

A similar measure constructed using visits to workplaces displays the same pattern.

What does this tell us?

This paper has summarised the key findings from the work the Social Wellbeing Agency did throughout 2021, examining COVID-19 response policies and their relationships to reported cases in New Zealand and 49 other similar countries. This analysis was undertaken over a short period using the best available data at the time, and so is necessarily limited. Responses to COVID-19 will undoubtedly be closely examined by researchers in the coming years, using datasets that are more detailed and more able to delve into the causal impact of specific policies. However, the evidence summarised in this report can provide a start.

The New Zealand response to COVID-19 can be characterised as involving relatively aggressive policies, swiftly implemented, across a range of containment, economic and health areas. Experience throughout 2020 and 2021 indicates that this approach was highly successful. We believe this analysis gives us clues about some of the most successful ingredients.

In particular, economic policies such as income support and debt or contract relief may have been a key factor. These were some of the least commonly implemented across the 50 countries. Yet we found the implementation of these policies were followed by very large reductions in COVID-19 cases, relative to what might have been expected without any policies.

Another key success factor is the commitment and willingness of the New Zealand population. Policies can only be effective if they are supported and followed by society. In contrast to the experience of other countries, we find strong evidence for immediate and sustained behaviour change in response to stay-at-home requirements in New Zealand, and this response appears to have waned little over the course of the pandemic. This might also explain the success of economic policies, where providing increased economic support can make it easier for people to stay home. Nevertheless, it is clear that responding to COVID-19 required large sacrifices from many, in terms of economic, social, and mental wellbeing. We should not forget these sacrifices, but the evidence clearly indicates they were not in vain.

Another key success factor to COVID-19 policies was the commitment and willingness of the New Zealand population.

Authors and acknowledgements

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Te Atatū – Insights

Ka pō, ka ao, ka awatea is a well-known tauparapara (traditional incantation) within te ao Māori, which refers to the separation of Ranginui (the sky-father) and Papatūānuku (the earth-mother) which brought light in to this world. It talks about 'coming from darkness to light' or 'transiting from a place of not knowing to knowledge'. Te Atatū, indicates the morning light and acknowledges this series of events, and the importance of light representing knowledge in te ao Māori.

Technical appendix

About the model

For measuring changes in week-to-week case numbers, we used the ratio between cases in two consecutive weeks. A ratio of more than one indicates that case numbers are increasing week-to-week, and a ratio of less than one indicates case numbers are decreasing week-to-week. This is a similar, but less sophisticated, idea to measuring the reproductive rate of the virus. The estimates from our statistical model indicate by how much this week-to-week ratio of cases shrank in the two weeks after a particular policy was introduced or strengthened.

Our statistical model was based on every instance across the New Zealand and 49 similar countries where, over a six-week period, a policy was present at a higher level of intensity in weeks three and four than in weeks one and two. The outcome in the model was the difference in case ratios between weeks five and six and weeks one and two. This six-week period was defined individually for each policy, and so a data for a single period might have been used multiple times in the model.

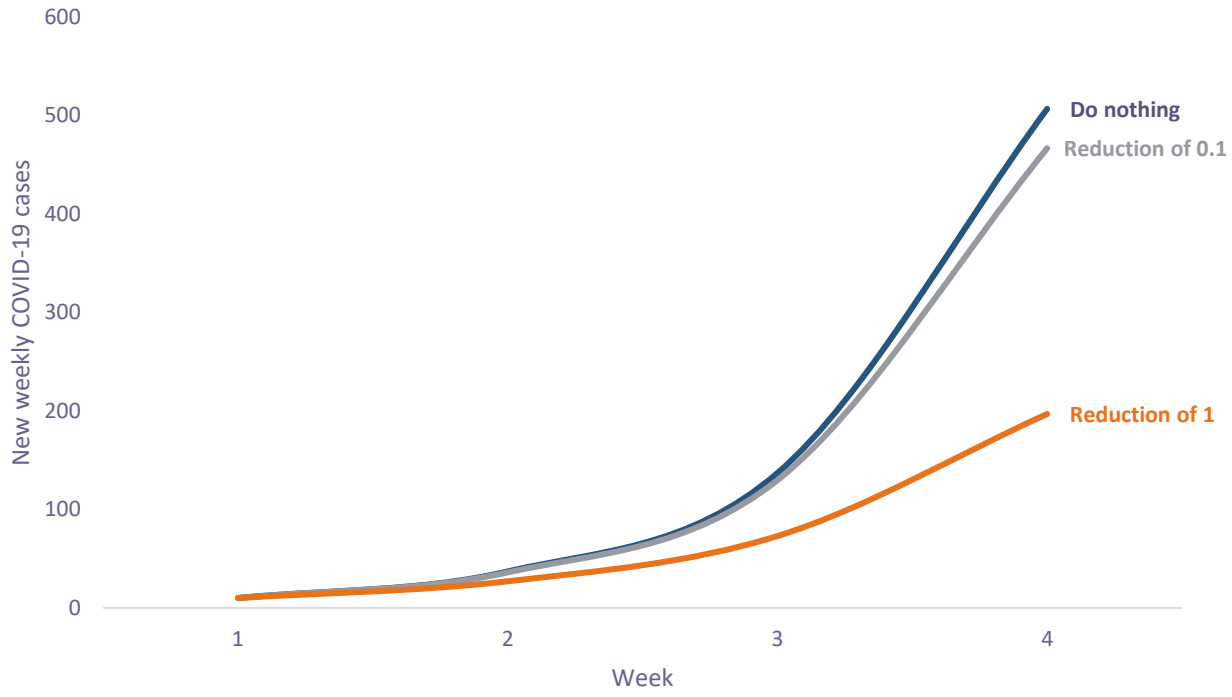
The model was an ordinary least squares regression model that included variables corresponding to each of the 18 COVID-19 reduction policies; country population; log of new cases per million; and country fixed effects. These models use data on COVID-19 cases and policies up until 30 November 2021.

The results of the model (including the estimated effects of all 18 policies) are reported in Table A1.

How we derived the case reduction estimates

To give a sense of the size of our estimates, we converted the case ratios in our statistical model into reductions in COVID-19 cases. Figure A1 shows a representative trajectory of new COVID-19 cases over a four-week period, starting with 10 cases in week 1. The dark blue line represents growth in the number of new weekly cases when COVID-19 cases reproduce (R_0) by a factor of 2.5 every five days. We chose this value from R_0 based on estimates from international literature that mainly range between 2 and 3. Larger values for R_0 will result in smaller implied effects of the policies we examine.

Figure A1: New weekly cases for multiple indicative trajectories



After four weeks, the initial 10 cases are producing about 500 new weekly cases. The light grey line represents the trajectory with a reduction in the week-to-week case ratio of 0.1. By four weeks in this trajectory, there are about 470 new cases per week – an 8% reduction. The orange line represents the trajectory with a reduction in the week-to-week case ratio of 1. At four weeks, there are only about 200 new cases, representing a reduction of about 60%, relative to the baseline 'do nothing' trajectory.

Table A1: Results of statistical model

Policy	Estimated reduction in weekly case ratio		Standard error	Implied reduction in new cases after six weeks
Containment and closure policies				
Closing school/universities	0.14	*	0.08	
Closing workplaces	0.21	***	0.08	16%
Cancelling public events	-0.03		0.09	
Restrictions on gatherings	0.13	*	0.08	
Closing public transport	0.21	**	0.10	16%
Stay-at-home requirements	0.41	***	0.09	30%
Restrictions on internal movement	0.31	***	0.09	23%
International travel controls	0.28	***	0.10	21%
Economic policies				
Income support	0.76	***	0.10	50%
Debt/contract relief	1.08	***	0.11	65%
Health system policies				
Public information campaigns	0.19		0.21	
Testing policies	0.13		0.09	
Contact tracing	0.23	**	0.11	18%
Facial coverings	0.15	**	0.07	12%
Vaccination policy	-0.03		0.06	
Protection of elderly	0.41	***	0.10	30%
Vaccination policies				
Vaccine prioritisation	0.00		0.11	
Vaccine eligibility/availability	-0.11		0.10	

Note: *, **, *** denote statistical significance at 90%, 95%, and 99% confidence levels, respectively. Estimated effects derived from a statistical (ordinary least squares regression) model that also adjusted for country population, log of new cases per million, and country fixed effects. Reduction in new cases is an indicative estimate relative to no intervention and R_0 of 2.5 (see Figure A1). This is only reported for policies that were statistically significant at 95% confidence. These estimates of reductions in cases should not be added together between different policies.