

## Pandemics Epidemiology: Societal Impacts and Strategic Response

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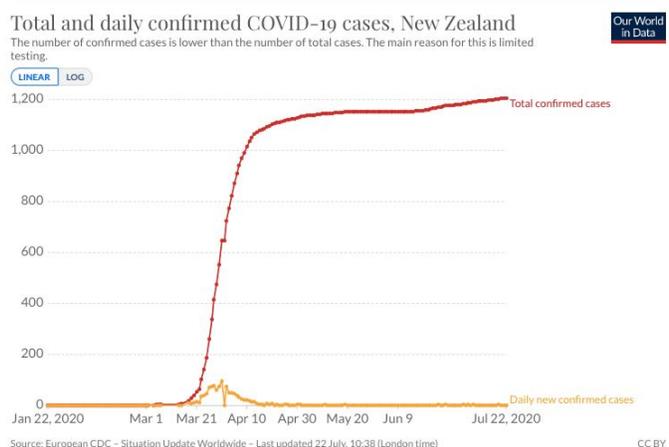
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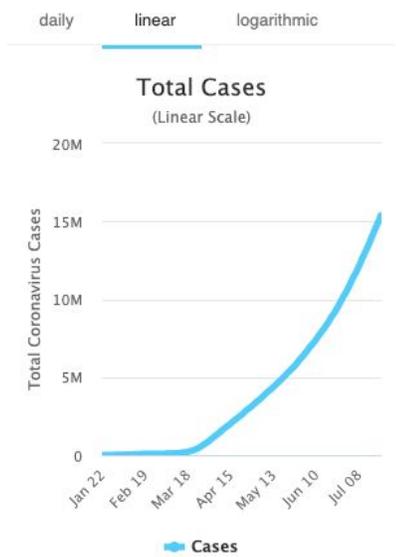
### Introduction

In December of 2019, someone in China contracted a strain of a coronavirus, the family of viruses that are responsible for illnesses such as the common cold and all the way to more fatal diseases such as MERS and SARS. COVID-19 is a respiratory disease, attacking the lungs and other vital organs needed in the process of breathing. COVID-19 is especially deadly to those who lack strong immune systems such as the elderly, the very young, or those whose immune systems are deficient. Over the course of a few months, COVID-19 has spread out of China and into other parts of Asia, Europe, Oceania, and eventually the Americas. New Zealand was one such country that was infected by the virus.

### Infections and fatality rates

Compared to most other countries, New Zealand has relatively low infections and fatality rates. New Zealand has been able to flatten their curve (as shown in the figure). Every day the amount of new cases is almost always less than 10. As of





July 22, 2020 New Zealand has had 1,555 cases of COVID-19 and only 22 deaths. These numbers are relatively low considering the population of New Zealand boasts 4.8 million people (as of July 23, 2020). As a result, New Zealand had an incredibly low infection rate of 0.03% and an even lower fatality rate of .0004% for the entire population and 1.41% for the infected population. When these rates are compared to the worldwide rates, there's a huge difference. The worldwide infection rate is around 0.2% and the fatality rate is around 4.1%. These numbers are humongous compared to those of New Zealand.

### Hospital resource use and future models

As of July 19th, 2020, there is no one in New Zealand receiving hospital-level care for COVID-19. On May 27th, New Zealand discharged its last coronavirus patient from Auckland's Middlemore Hospital. New Zealand was able to flatten the curve efficiently and effectively. The country was able to begin national lockdown efforts early. A month after their first case, the government raised the country's alert to Level 3 restrictions. At this level, schools were closed and mass-gatherings were cancelled. Two days later, the country's alert level was at 4, which issued everyone to stay home and limited travel. The majority of New Zealanders were following these restrictions issued. They closed off foreign flights early on and were able to restrict the people coming from highly infected countries such as China and Iran. As of July 21st, 2020, there have only been 22 deaths related to COVID-19 and with about 1,555 infected in New Zealand. Their cases have been increasing by no more than 3 every day.

According to <https://covid19.healthdata.org/new-zealand>, models show that New Zealand never needed more than what was available and future graphs show that New Zealand will not need more beds, ICU beds, or invasive ventilators than what they have. Since the start of the pandemic, New Zealand's hospital resource use has never exceeded what they have available.

Future models show that New Zealand's daily infections and deaths will be around 0 which in returns means that hospital resource use will be around 0 too.

The number of daily infections peaked on March 30th with 109 new cases. With these new cases, some required hospitalization and some were in serious conditions which resulted in the peak of the number of beds needed from April 8th to April 21st, number of ICU beds needed from April 10th to April 22nd, and the number of invasive ventilators needed from April 10th to April 22nd. Hospitals needed 15 beds, 6 ICU beds and 6 invasive ventilators during the peak. The number of daily deaths peaked around April 18th, with 1 death a day.

New Zealand's success with the coronavirus also helped by their implementation of widespread testing and contact tracing. On May 20, New Zealand released NZ Covid Tracer app. "If later, they [citizens of New Zealand] test positive for the COVID-19, contact tracers can review where the person has been and decide whether to follow up with the venues to alert them of their potential risk." This app would help significantly to take care of the coronavirus pandemic.

### **Mitigation effort**

Aside from some of the largest nations in the world stands New Zealand, a relatively remote island that lies on the Western side of the South Pacific Ocean. Despite being a small country, New Zealand has earned itself a huge name in the midst of the novel coronavirus, which has made its way all over the world. The difference however between New Zealand and several other large countries, like the U.S. and China, is the effectiveness of its mitigation efforts. This island country, which relies on transportation and trade with other countries, is just as much as a target as other countries are. At first, it took an approach to slow the virus down or "flatten the curve", rather than trying to eliminate it at once, in hopes of alleviating stress on medical facilities. This method was similar to that of the approaches taken by the U.S. and the U.K. Upon realizing the potentially devastating effects of COVID-19 on the population, New Zealand immediately took a different approach. Instead, it took a "go hard, go early" approach to put the country into lockdown. It immediately sought preparations to isolate the country, which essentially was done to prohibit the virus from entering the country in any way. At first, a travel

ban was implemented from people coming from China to New Zealand, but soon restrictions included parts from all over the world. On March 19th, New Zealand closed all of its borders, banning all sorts of travel to the country. In terms of communicating with the public, New Zealand implemented a four-stage system that indicated the severity of the virus at any given moment in time (1 being the least severe and 4 being the most). It started as a two, but soon shot up to a level 4, leading to a nationwide lockdown. This lockdown took place in the end of March, spanning several weeks into April. It only allowed non-essential workers to leave their houses for essential purposes, like grocery shopping, or getting medicine. This heavy and early lockdown set forth by New Zealand stopped any sort of momentum from building up, which can be seen in its staggering low COVID numbers, even from the start. In late March, it had a mere 100 cases without any deaths.

Another major factor in the elimination of the virus was the amount of testing carried out. Because New Zealand was about to carry out large amounts of tests, about 10,000 tests per day to be specific, it was able to track the virus and eliminate it by knowing who should be isolating the most. For COVID-19 especially, knowing who has the virus is extremely important because of its long incubation period. Some people are asymptomatic, which means that they are carriers of the virus, but don't show symptoms. By being able to test at high numbers, people knew if they had to self-isolate because one who tested positive for the coronavirus could contact the people he/she was in contact with in the past few days.

More recently, on June 8th, New Zealand announced that with no new reported cases of the virus for the past 17 days, the country is proud to announce that it has completely eradicated the coronavirus off of its shores. The next question however, is "how will New Zealand be able to sustain its success in keeping its country safe while the coronavirus is still actively present all over the world?"

## Economic Impacts

On February 2nd, 2020, a Phillipino man became the 1st victim to die from Coronavirus outside of China. As a response to the pandemic on the horizon, on February 3rd, 2020, Jacinda Ardern closed down New Zealand from everyone entering the country from or via China, excluding residents returning from China. The ban was extended to Iran on the 28th, the origin of New Zealand's first case of Covid-19 and restrictions were applied to anyone coming from Italy or South Korea. The economic fallout from the travel ban can be felt in the domestic life of New Zealand. Tourism is responsible for the employment of ~8.4% of the working population of New Zealand (229,566). International travel also makes up ~20% of New Zealand's total exports, earning 17.2 billion NZD or about 11.3 billion USD in the fiscal year of 2019. All of this amounts to 5.8% of the GDP being affected directly by decreased levels of tourism through diminished tourist population in tourist destinations and hotels.

On March 16th, everyone returning from foreign countries were subject to self-isolation upon arrival, excluding people coming from the largely unaffected Pacific islands as well as anyone on air and ship deliveries. The expected GDP drop was 3.8% as tourist numbers are reduced due to the reduced incentive to travel to New Zealand in part by the mandatory 14 day self imposed quarantine (Figure 1).

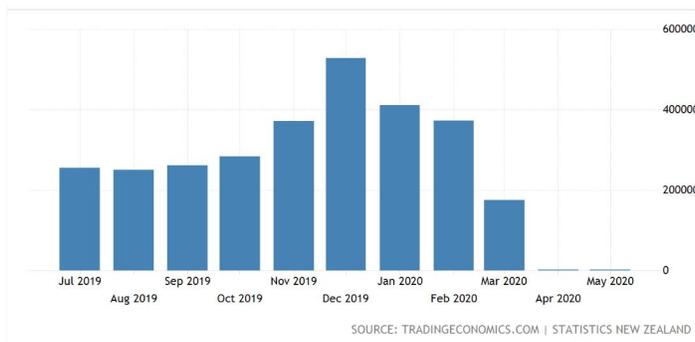


Figure 1: The general decline of tourism as New Zealand goes into lockdown Source: Trading Economics

On March 19th, Jacinda Ardern closed off New Zealand from all foreign travel, including travel from Australia, Germany, Canada, USA, etc. The resulting GDP drop was another 4% due to the complete closure of the border from tourists, effectively placing the tourism industry out of business. Unemployment in New Zealand rose, up to 4.2% in March and is expected to go as far as a little over a double of that number, up to 9.8% in September. As many as 300 businesses are at high risk of closing down and 21,381 are expected to lose their jobs. Among those numbers are the people employed under the tourism

industry, whose jobs are nearly non-existent during the pandemic. In response, the Ministry of Social development began preparing for 300,000 new unemployed benefit applications or about a 13% unemployment rate; a number not seen since the Great Depression of the 1930s.

On March 21st, Jacinda Ardern introduced the Covid-19 alert level system. Initially the level was set to level 2, border closure and the restriction of domestic travel. The resulting drop in GDP was 4.8% due to the reduction of domestic traveling, estimated to be worth 23.7 billion dollars. However, on the 23rd of March, the level would be escalated to level 3. Level 3 meant that on top of the closure of the border, businesses were restricted to working with social distancing in place or had to close down. As a result, New Zealand’s GDP dropped by another 19% as production lines became less efficient and the loss of direct face to face interactions with customers made some jobs impractical. The food services sector was hit especially hard due to these restrictions, falling by 80% from its pre-coronavirus status(Figure 2).

On the 25th of March, New Zealand entered level 4 of lockdown. The lockdown meant that large sections of the economy such as all non essential sectors including education and public services ceased to function. It was estimated that the GDP would fall by another 37% in the absence of all non essential businesses. Areas that were hit the hardest, such as construction

FIGURE 2: GDP BY INDUSTRY DURING LEVELS 3 AND 4 (AS % OF PRE-CORONAVIRUS LEVEL)

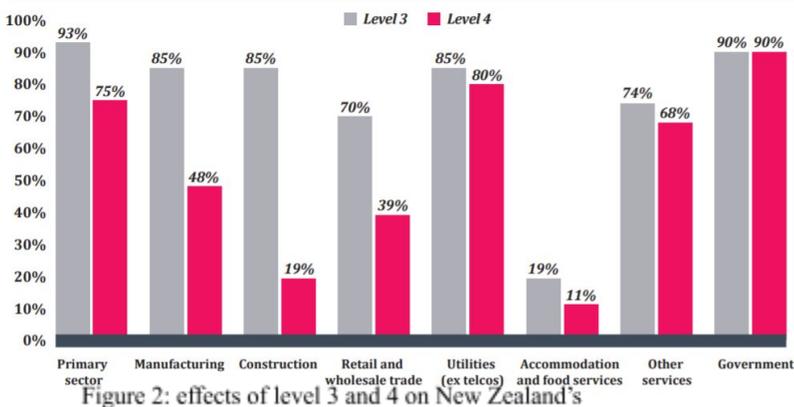


Figure 2: effects of level 3 and 4 on New Zealand's

GDP by industry Source: Reserve Bank of New Zealand

would fall by 70% from their level 3 status (Figure 2) as any kind of movement or action pertaining to construction ceased to exist.

In terms of trade, New Zealand still keeps its ports open for trade. Countries such as Australia are key players in the imports and exports of New Zealand. Australia takes

in 16% of all imports coming from New Zealand and exports 17% of all New Zealand imports in the year of 2019. On May 1st, the Joint Ministerial Statement was signed by 20 countries in order to facilitate the flow of essential goods and services. Alongside Singapore, Korea,

Australia, and Canada, New Zealand signed the Joint Ministerial Statement in order to ensure that the island nation stays connected to other Pacific nations. Under the Joint Ministerial Statement, the participating countries will work together to ensure the trade of essential goods and services flows freely without tariffs and/or prohibitions.

On June 8th, Jacinda Ardern declared that all sources of COVID-19 had been identified and the virus eliminated. The country was placed into level 1 lockdown, easing businesses and lifting restrictions on domestic travel while the border still remains closed. As a result, the GDP is expected to bounce back but the effects of the lockdown can still be felt by many in the working class and those who used to work in the tourism industry.

### **Treatment and vaccine development**

New Zealand invested millions to research treatments for the Coronavirus as well as being prepared to manufacture and develop possible treatments for the coronavirus along with following required clinical protocols. There are many different treatments that could be used to treat the coronavirus before the development of a vaccine enters the market and it includes either using effective antiviral drugs that fight against the coronavirus or utilizing the antibodies of recovered patients that had the Coronavirus by using their blood. The antibody therapies are also known as convalescent sera and it was seen as a treatment plan for people that have a higher risk of exposure from the Coronavirus like healthcare workers as well as the patients infected. Articles had stated that convalescent sera had given positive results during its clinical use and the therapy was commonly utilized in the history of outbreaks, viruses, and diseases but however the reliability of the treatment wasn't evaluated because it wasn't "controlled" and was in smaller studies. The research on the therapy was mostly done overseas but New Zealand was prepared to have it in place as a potential treatment within "matters of months." Other antiviral drugs like the controversial drug hydroxychloroquine are going through clinical trials to test out its efficiency. The side effects of particular antiviral drugs are also considered during its research to find an efficient treatment against COVID19.

Various clinical trials had also begun in New Zealand in efforts to find a treatment for COVID-19 which had involved multiple drugs such as lopinavir/ritonavir, hydroxychloroquine,

azithromycin and steroids and many other treatments. One particular large-scale clinical trial, REMAP-CAP, includes using various possible drug treatments on the patient that was infected with the Coronavirus. The various drugs are tested for its effectiveness so that the proper treatment can be used to treat future patients while ineffective ones are dropped or eliminated. The clinical trials was a global research effort with many other participating countries like the US, Netherlands and countries within the United Kingdom. Other clinical trials in New Zealand like, MRINZ or ASCOT (both are working in collaboration), focuses on the usage and comparing or combining of drugs like hydroxychloroquine and Lopinavir/ritonavir for either treatment or prevention of exposure for frontline Health workers amid the pandemic. It is funded by the Health Research Council of New Zealand. However, there are many factors to considered with the start of the clinical trials which aligns with the status of the pandemic in New Zealand as well as considering the moral ethics and strict regulations

New Zealand participated in the global research effort of developing a vaccine against the Coronavirus. They funded about \$37 million NZD into vaccine development research and an additional \$10 million on domestic “research initiatives” and many more for projects such as the CEPI and the Gavi Vaccine Alliance which focuses on healthcare to poorer countries and vaccine distribution. Meanwhile in their own land, they also began focusing on their own research efforts for development of the vaccines as well as the availability to manufacture the vaccines within their own countries. New Zealand also prioritizes the COVID-19 vaccine strategy which involves the development, the advances in research and the supplying of vaccines.

## **Conclusion**

As of July 22nd, 2020, New Zealand has one of the lowest infection rates and fatality rates. Only 1,555 of the 4.8 million population have been infected with only 22 deaths. New Zealand closed off their borders early with the motto “Go hard and go early”; this approach is what most likely saved the country. A nationwide lockdown was implemented during the end of March and spanned for several weeks which helped eradicate the virus in New Zealand. New Zealand’s responses and efforts to combat the pandemic has served as a role model and has given

the rest of the world a sense of hope in a collaborative attempt to finally end this worldwide catastrophe.

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