600 days of Battle: New Zealand (NZ) performance and practices that saved lives against Covid-19

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Abstract

According to Silva (2020b), among 108 well–evaluated countries, NZ was the eighth-best nation during 180 days of battle against Covid-19, and one year after that publication, on 29th October 2021, about 5,004,0026 lives were officially lost by Covid–19, while NZ only reported 28 deaths (WORLDOMETERS, 2021). To complement Gomes da Silva (2020) and Silva (2020a; 2020b; 2021a; 2021b) research, the main aim of this article is to investigate the NZ performance and management practices used to save lives against Covid-19. It uses an online questionnaire with descriptive, bibliographic, and documentary approaches to identify management practices, including cultural practices and Non-Pharmaceutical Interventions (NPIs), adopted during the pandemic. The main performance is found by using the Fatality Total Index and Resilience Index to compare NZ's performance with 43 countries during 600 days of battle. As a result: 1) among the 44 countries, NZ was the most resilient and the second (FTI600=0.0165) best-best performer, after China (0.0066); 2) among 131 respondents living in NZ, 34.35% don´t believe that cultural practices are decisive for the low rate of Covid–19 death, while 65.65% believe in that. From those that believe, the most decisive cultural practices were washing hands, not hugging in public, and not shaking hands; 3) for 131 respondents, the ten main policy measures adopted by the National Government that saved lives against the virus are international travel control, public event cancellations, restriction on internal movement, public information campaigns, schools closures, support the expansion of the testing system, wage subsidies for workers, workplace closures, increase the medical and personal equipment capacity, and effective public-private collaboration. At the final, lessons are provided from 360 policies, measures, programs, projects, acts/regulations, innovative products/services identified, with the majority led by the Public Sector (66.7%), followed by Corporations (11.4%), Universities (8.9%), Others (8.3%), and Startups (4.7%).

Keywords: Covid–19; FTI; Health; Innovation; Management practices; Policy; Resilience

1. Introduction

On 20th October 2021, NZ completed 600 days (20 months since the first reported case in the country) of intense battle against a virus called by the WHO (2020) Coronavirus disease.

Even though until 20th October 2021, around 6.76 billion doses of Covid–19 vaccines have been administered globally (OUR WORLD IN DATA, 2021), the world surpasses 4,941,538 fatal cases (WORLDOMETERS, 2021) with no signs of pandemic control in several countries, especially in low-income countries, since only 2.9% of people from those countries have received at least one dose of vaccine.

To give an example that we can not rest against the Covid-19, Table 1 shows that until 03rd July 2021, the virus mortality was accelerating globally, since one million deaths are happening in less time, taking 254 days to kill the first 1,002,883 victims, decreasing to 118 days to surpass 2,003,443 deaths, continuing decreasing to 90 days to surpass 3,008,156 fatal cases, and finally decreasing to 88 days when surpassed 4 million fatal cases on July 03, 2021, with USA, Brazil, India, Mexico, and Peru among the most critical countries in terms of total deaths, while NZ officially reported only a total of 26 fatal cases, situated in the 196th position when compared against 223 countries or regions (WORLDOMETERS, 2021), reason by which the main question of this research is "**How NZ is saving lives against the Covid-19?**"

Table 1: World Total Covid-19 Deaths x NZ Total Covid-19 Deaths to each one million

World Total Deaths	Dates	Period between dates (Days)	NZ Total Deaths
1,002,883	D1=September 10, 2020	254 since December 31, 2020	24
2,003,443	D2= January 06, 2021	D2 – D1 = 118	25
3,008,156	D3 = April 06, 2021	D3 – D2 = 90	26
4,003,102	D4 = July 03, 2021	D4 – D3 = 88	26 (196th place)

Source: Worldometers (2021) accessed on September 5th 2021

When is analyzed the total number of fatal cases of Covid–19 overtime, the world surpassed the first one million reported deaths on 10th September 2020, with the USA, Brazil, India, Mexico, UK, and Italy considered the most critical countries. In that time (October 2020), Silva (2020b) developed a holistic methodology to identify the top twenty benchmark nations that were saving lives against Covid–19, and its 15 phases showed that among 108 well–evaluated countries, the top nations were 1)Vietnam, 2) Taiwan, 3) Thailand, 4) China, 5) Malaysia, 6) Singapore, 7) South Korea, 8) NZ, 9) Australia, 10) Japan, 11) Hong Kong, 12) Cyprus, 13) Greece, 14) Latvia, 15) Iceland, 16) UAE, 17) Czech, 18) Lithuania, 19) Norway, and 20) Estonia. That study did not focus on the innovations, measures, policies, projects, or cultural aspects that were adopted by each country overtime, the reason by which it was recommended to identify, and disseminate them (SILVA 2020b p. 568).

On November/20, an article (GOMES DA SILVA, 2020) was published focused on Thailand's performance and the best management practices adopted to save lives against Covid–19, during the first 180 days facing the pandemic. The second (SILVA, 2021a) was published on January/21 to investigate the performance and the best management practices adopted in Taiwan to save lives, during the first 300 days facing the pandemic. And the third (SILVA, 2021b) was published on May/21 to investigate the Vietnam performance and management practices used to save lives against Covid-19, during the first 426 days of combating the virus.

To complement the research package (GOMES DA SILVA, 2020; SILVA, 2020a; 2020b; 2021a; 2021b), this article aims to investigate the NZ performance and management practices used to save lives during 600 days of battle against the Covid-19. The specific goals are a) to present the first measures of NZ National Government and main partners against the Covid-19; b) to compare NZ performance against other countries during the pandemic; c) to propose a way to find the most resilient country overtime; d) identify management practices (including NPIs) adopted in NZ, taking into consideration cultural practices, main policy measures, programs, projects, strategies, and innovative solutions.

For the academy, the research can contribute to the teaching process and development of new research, especially related to NPIs on Covid–19. Although several authors published valuable information related to coronavirus (ASKITAS, TATSIRAMOS, AND VERHEYDEN, 2021; CHAN., YUAN, AND CONVERTINO, 2021; COUSINS, 2020; COWLING et al., 2020; CHUANG et al, 2020;

FLAXMAN et al., 2020; HUANG et al, 2021; GEOGHEGAN et al, 2021; HA et al., 2020; LE, VODDEN, and ATIWESH, 2021; JEFFERIES et al, 2020; JIAN et al 2017; JIAN et al 2020; NGUYEN, 2020; MARANI et al, 2021; SUMMERS et al, 2020; PANG 2003; ROBERT, 2020; SVOBODA et al. 2004; VAN NGUYEN et al, 2020; YEH AND CHENG, 2020; YEN et al 2011; YEN et al 2014; WANG, et al, 2020; WILSON et al, 2021), there are needs to present a more complete study concerned to: a) NZ profi le, specially related to the Central Government Structure, as well as National Health and Disability System; b) update the performance evolution comparison of a benchmark country against other well–evaluated nations, taking into consideration the estimated number of Covid–19 fatal cases by one million population during the first 20 months facing the pandemic; c) the identification of the most resilient nation with ability to avoid fatal cases overtime; d) provide a study related to cultural aspects, policy measures, programs, projects, strategies, and innovative solutions adopted overtime.

The research is important for public authorities since they will know management practices against Covid-19 developed not only by the National Government and Local Authorities of NZ but also by other stakeholders (Corporations, Start-Up, Universities, and others).

Finally, it is useful for benchmark or for the development of strategies to prevent or control similar pandemic episodes in the future, since the yearly probability of occurrence of extreme epidemics can increase up to threefold in the coming decade due to disease emergence from zoonotic reservoirs associated with environmental change (MARANI et al, 2021).

2. NZ Background

2.1 A young country with rich diversity

NZ or Aotearoa is a multicultural country located in the South Pacific Ocean with short history when compared with other countries. The Maori people start to arrive there in the late 13th century and since 1642 the Europeans became aware of the country's existence (ARA, 2019).

Nowadays, NZ has almost five million people with an average life expectancy for men and women respectively being 81 and 84 years old (UNITED NATIONS POPULATION FUND, 2021).

According to the last census published in 2018 (NZ, 2020), around 160 ethnic groups with more than 100 people are living in NZ. There are six major ethnic groups there: European (70.2%), Maori (16.5%), Asian (15.1%), Pacific peoples (8.1%), Middle Eastern/Latin American/African (1.5%), and Other (1.2%).

Finally, according to World Population Review (2021) and Statistics Time (2021), the NZ area is 270,467Km2 with a density of 18.46 people per Km2, ranked in the 202nd position among 235 countries/territories investigated in 2021.

2.2 NZ Central Government and Local Authorities

Every three years, The NZ Government is formed from a democratically elected House of Representatives. NZ is a constitutional monarchy (Queen Elizabeth II) with a parliamentary system of government based on The Legislative (no Senate), The Executive (Ministers of the Crown), and The Judiciary Branches (NEW ZEALAND GOVERNMENT, 2019).

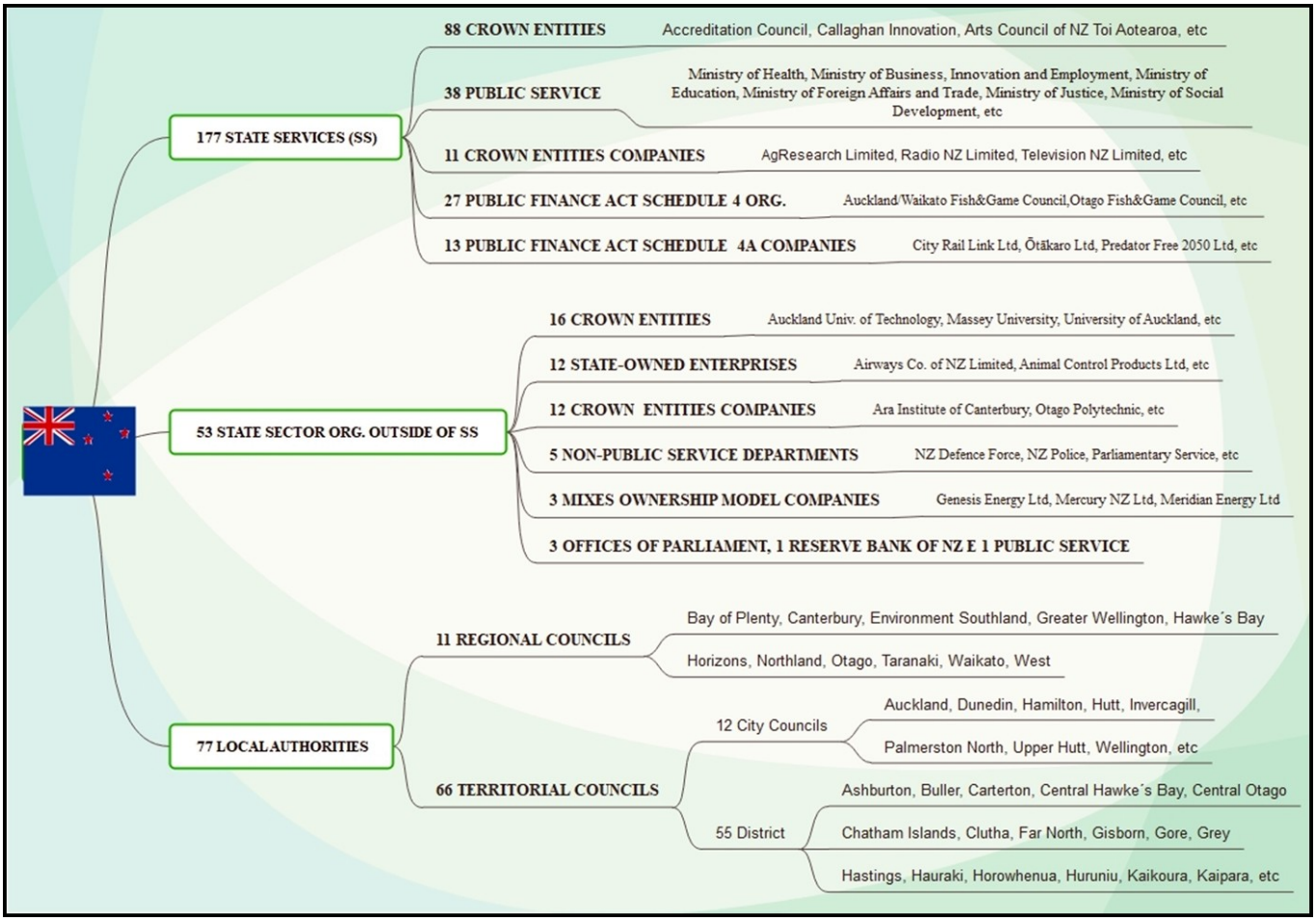
In NZ the Government is formed by appointing Ministers who must first be elected members of the Parliament. Nowadays, The Prime Minister is Hon Jacinda Arden, she works together with 19 Ministers supported by other Branches and Government Agencies (NEW ZEALAND GOVERNMENT, 2019).

Currently, the NZ Central Government has around 230 active organizations (Figure 1), most (177; 77%) considered as State Service and 53 (23%) classified as State Sector Organizations outside of State

Services. For example, in the State Service, there are 88 Crown Entities such as Accreditation Council, Callaghan Innovation; 38 Public Service organizations such as Ministry of Health (MH), Ministry of Business, Innovation and Employment (MoBIE), Ministry of Education (ME), Ministry of Defense (MD), Ministry of Transport (MT), Ministry of Foreign Affair (MoFA), etc...; 11 Crown Entities Companies such as AgResearch, Radio NZ Ltd, etc...

In addition, in terms of local authorities, this country is divided into 16 Regions, eleven managed by Regional Councils, and five managed as Territorial, organized with 12 City Councils and 54 District councils.

Figure 1: Number of organizations of NZ Central Government and Local Authorities



Sources: NZ Government (2021a; 2021b)

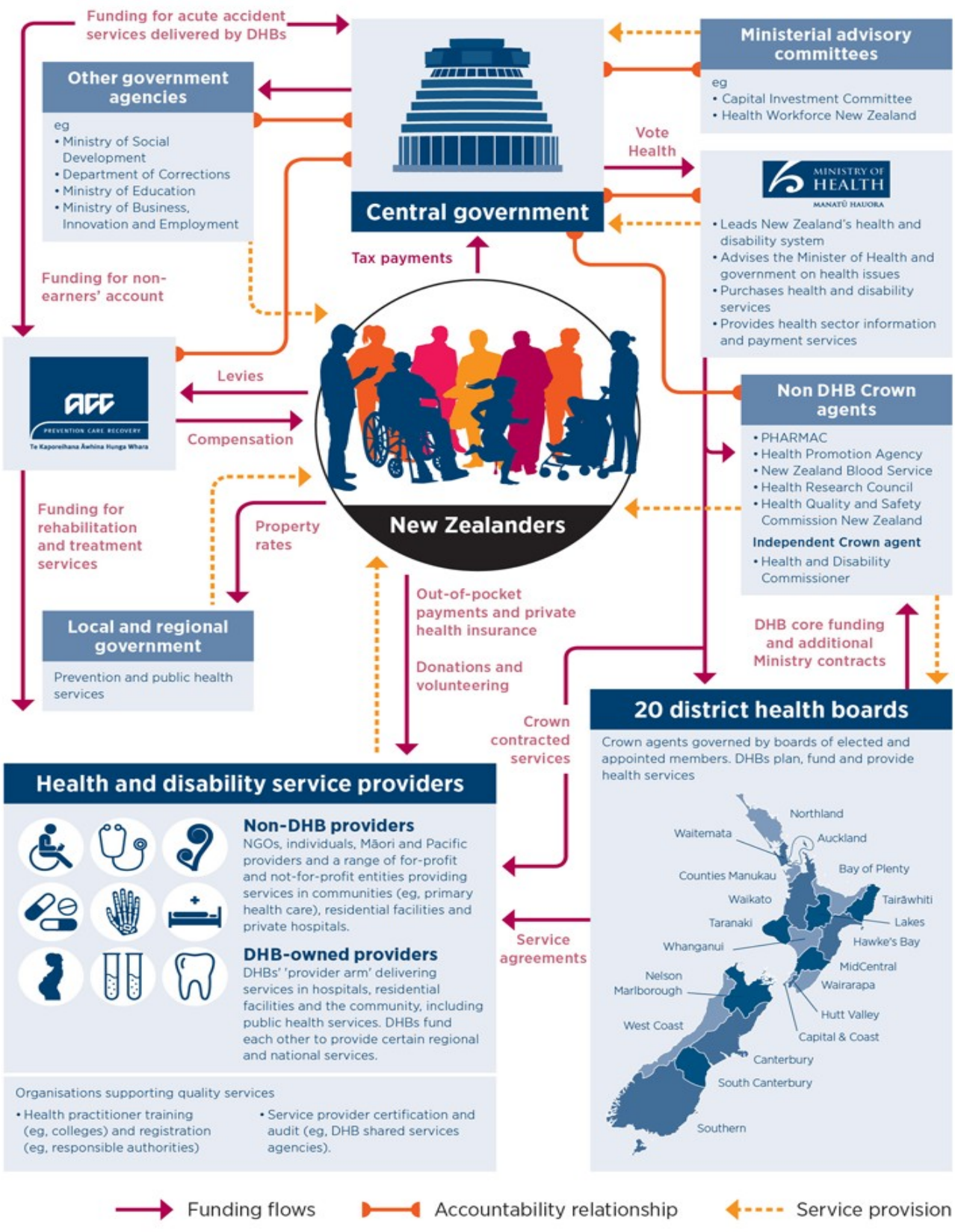
2.3 NZ Health and Disability System

According to Goodyear-Smith, and Ashton (2019) NZ was one of the first nations to establish a universal, tax-funded nation health service with uniqueness related to the Non-fault Accident Compensation, Pharmaceutical Management Agency, and Innovative Maori Services.

The Ministry of Health is responsible for the leadership, management, and development of the NZ Health and Disability System, which vote health <https://bit.ly/3no7D5G> available in $ 19.871 bi in 2019/20 is the main source of funding. This system's statutory framework has over 20 pieces of legislation, such as The Health Act 1956, Accident Compensation Act 2001, The Crown Entities Act 2004, and NZ Public Health and Disability Act 2000.

Figure 2 shows that New Zealanders are in the heart of the NZ Health and Disability System, which is also responsible for services to people with disabilities.

Figure 2: NZ Health and Disability System



Source: NZ Ministry of Health (2020)

The system has several relationships among stakeholders, including NGOs, and Private suppliers, many governments, and Crown agencies, such as:

a) twenty District Health Board (DHB), which are responsible for funding and providing health services in their districts <https://bit.ly/3lfyXjS>; b) at least 31 Crown Entities and Statutory Boards; c) Capital Investment Committees with eleven committee to provide advice to the Ministers of Health and Finance; d) Non-Governmental Organizations (NGOs) that receive Vote Health funding to provide flexible, responsive, and innovative frontline service delivery;

e) Public health units to deliver regional public health services; f) the Pharmaceutical Management Agency (PHARMAC) responsible for the Pharmaceutical Schedule and negotiation of drugs purchase from suppliers; g) the Medicines and Medical Devices Safety Authority (Medsafe) that manages regulations, and legislation concerning to medicines and therapeutic products, including the approval of Covid-19 vaccine; h) the Accident Compensation Corporation (ACC) created in 1974 to manage the compensation programs. Nowadays, it is a comprehensive, government-funded no-fault personal injury scheme that helps to prevent injuries, and funds treatment, rehabilitation and compensation for people who are injured in New Zealand; i) others.

2.4 NZ Health Workforce and Infrastructure

According to NZ Health Workforce Advisory Board (2020), research pointed that the health sector is the second largest employer in NZ with 213,000 professionals, which represents 9% of those employed in the country.

From an interview given to NZ Doctor (2021), the Minister of Health, Hon Andrew Little, informed that the current system is under serious stress and they are working to reform it achieving five outcomes related to Equity to all New Zealanders, Partnership, Excellence, Sustainability, Person and whānau-centered care. According to Hon Andrew, the current system has a significant proportion of the NZ workforce with a) 77000 staff working in the 20 DHBs; b) another 145,000 working in health organizations across the nation, including 30 primary health organizations; c) 17,000 practicing doctors and 60,000 nurses.

From a report published last April, Cumming (2021) informed that: there are 57 medical laboratories located in NZ; 2) until 2019, NZ had 12,667 hospital beds and until May 2020, there were 358 ICU beds in NZ, increasing to 552 ICU until July/20; 3) until the end of April 2020, there were 334 ventilators available; 4) NZ has 10.2 nurses, and 3.3 physicians per 1000 population, when the Covid-19 hit the country, the government called for extra health professionals, with a large response from retired and those on maternity leave, from overseas as well.

2.5 NZ Health Strategy Update: Future Direction and Road Map of Actions 2016

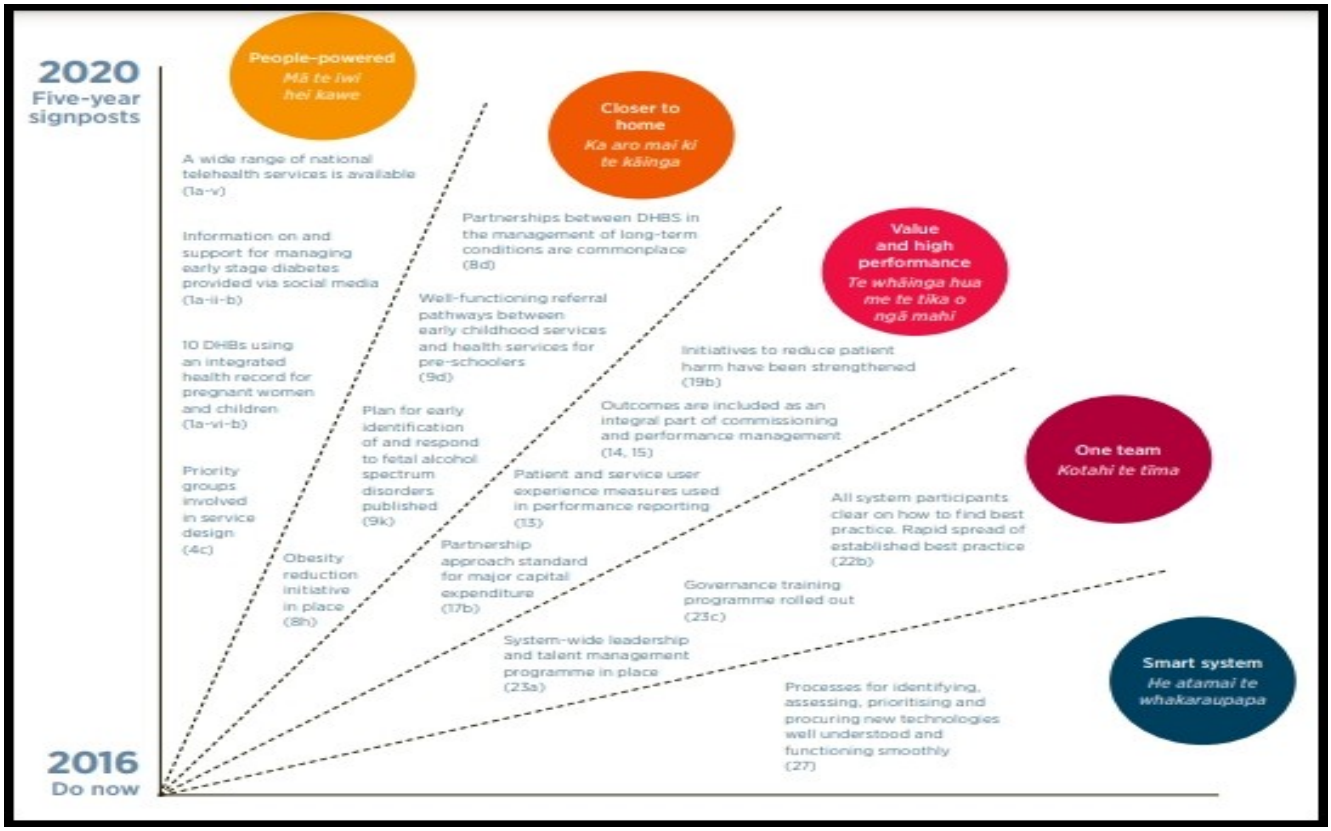
In the last trimester of 2015, the Minister of Health (MH) developed a participatory consultation with 90 meetings and interacted face to face with more than 2,000 people, to find new ways to NZ Health and system support the citizens for the next 10 years, resulting in the 2016 NZ Health Strategy divided into two parts: Future direction and Road map of Actions 2016.

According to the NZ Ministry of Health (2016a), the Future Direction outlines directions for the Health System from 2016 to 2026, pointing challenges and opportunities, the future that they want, including culture and values, as well as shows 38 visions for 2026, organized into five strategic themes

(Figure 3): seven visions for people-powered, eight visions for closer to home, nine visions for value and high performance, seven visions for one team, and seven visions for the smart system.

Figure 3: Five strategic themes of the NZ Health Strategy

Figure 4: Possible results of RoadMap of Actions



Source: NZ Ministry of Health (2016a p. 39)

According to the NZ Ministry of Health (2016b), the roadmap of actions 2016 has twenty-seven main areas for action for the first five years, organized in the five themes of the Strategy: five actions for people-powered, seven for closer to home, seven for value and high performance, five for one team, and three for the smart system. Although the strategy update did not consider threat analysis such as the possibility of an epidemic or pandemic overtime, until the end of 2020, it was planned to reach around sixteen results (Figure 4) and the roadmap will be updated over a 10-year lifetime of the Strategy.

3. WHO Covid-19 Strategic Preparedness and Response Plan (SPRP) 2021

Since February 2020 the WHO is providing and improving the SPRP, a document called "Covid-19 Strategic Preparedness and Response Plan", to immediately support United Nations and Government teams against the Covid-19 (SILVA, 2020a).

Since then, the SPRP was updated twice: first) in April 2020 to underline the importance of critical aspects of the public health response, and support countries to safely and sustainably transition out of the severe movement restrictions that had been put in place in some countries; second) in January 2021 called SPRP 2021, to guide the public health response to COVID-19 at national and subnational levels, and to update the global strategic priorities in support of this effort. This last update (Chart 1) takes into consideration the lessons learned in 2020, the emergence of Covid-19 variants, and the gaps in knowledge while anticipating the potential challenges ahead and ensuring a gender-responsive and equitable response based on respect for human rights (WHO, 2021).

Chart 1: WHO SPRP 2021 Goals

Goals	Recommendations
Suppress transmission	Implementing effective and evidence-based public health and social measures, and infection prevention and control measures, including detecting and testing suspected cases; investigating clusters of cases; tracing contacts; supported quarantine of contacts; isolating probable and confirmed cases; measures to protect high-risk groups; and vaccination
Reduce Exposure	Enabling communities to adopt risk-reducing behaviors and practice infection prevention and control, including avoiding crowds and maintaining physical distance from others; practicing proper hand hygiene; using masks; and improving indoor ventilation.
Counter Misinformation and disinformation	Building resilience through managing the infodemic, communicating with, engaging, and empowering communities, enriching the information eco-system online and offline through high-quality health guidance, and by communicating risk and distilling science in a way that is accessible and appropriate to every community
Protect the Vulnerable	Through vaccination, ensuring vaccine deployment readiness in all countries and all populations, by communicating, implementing, and monitoring COVID-19 vaccination campaigns, by engaging health workers, and by building vaccine acceptance and demand based on priority groups, considering gender and equity perspectives to leave no one behind.
Reduce mortality and morbidity from all causes	Ensuring that patients with COVID-19 are diagnosed early and given quality care; that health systems can surge to maintain and meet the increasing demand for both COVID-19 care and other essential health services; that core health systems are strengthened; that demand-side barriers to care are addressed; and by ensuring that all priority groups in every country are vaccinated.
Accelerate equitable access to new COVID-19 tools	Including vaccines, diagnostics, and therapeutics, and support safe and rational allocation and implementation in all countries

Source: WHO (2021 p. 10)

The SPRP 2021 is organized into two parts: part I) focus on a brief overview of the global epidemiological situation, and the most important are the key lessons and challenges for 2021 concerned to Epidemiology, Health Care Systems and Workers, Surveillance Systems, Communities, Public Health and Social Measures, Global, Regional, and National Supply Chains, The Infodemic of misinformation and Disinformation; Comprehensive Preparedness, and Science (WHO, 2021 p.8); part II) sets out the strategic objectives for 2021 to end the Covid-19 pandemic, and build resilience and readiness for the future, which six strategic public health objectives are shown by Chart 1.

4. Methodology

The research applies quantitative and qualitative approaches. It is descriptive, applied, based on bibliographic and documentary research, involving the investigation of articles, guidelines, manuals, official sites, standards, and technical reports, collected from the internet.

The methodology has four main phases:

Phase 1) to present the first measures of NZ National Government and main partners

The investigation focuses on the first measures to prepare, prevent, and control the Covid-19, before 09 April 2020, when the WHO marked 100 days since the first cases of 'pneumonia with unknown cause' were officially reported in China. The NZ Government (Te Kawanatanga o Aotearoa) and Unite against Covid-19 sites, acts, articles, technical reports, transcripts, and other technical sites or documents are the main sources used to collect data (ACAPS, 2020; CUMMING, 2021; GUNN et al, 2021; IMF, 2020; IMF, 2021; NZ GOVERNMENT 2020a, 2020b; NZ DEPARTMENT OF THE PM AND CABINET, 2020; ROBERT, 2020; SUMMERS et al, 2020; NEW ZEALAND LEGISLATION, 2020; RNZ, 2021; THE UNIVERSITY OF AUCKLAND, 2021).

Phase 2) to compare NZ performance against other countries during the pandemic

To reach this goal, the performance was investigated by using the holistic methodology with 15 phases divided by rankings (SILVA, 2020b) published in October 2020, where NZ was considered the eighth-best country to save lives for 180 days facing the pandemic. The reason to develop a new comparative analysis against the 43 semifinalists' nations, is to check the performance evolution of this country overtime when 600 days (20 months) are considered. The period of 600 days was chosen because it is the maximum number of days observed for each country until the conclusion of this article.

For the analysis, it was used the Fatality Total Index (FTI), an indicator that estimates the number of fatal cases by one million population (UNITED NATIONS POPULATION FUND, 2021) during the same period (example 600 days=FTI600) applied to each country facing the pandemic. Worldometers (2021) is the main source used, from December 31, 2019, until October 30, 2021. For each country, it was identified the official date of the first case of Covid–19, and the date when completed 600 days facing the pandemic (DTFC600). After that, The FTI Formula (SILVA 2020b p. 563) was applied for each country, and they are ranked in ascending order by using the FTI600.

It was also observed how the position of each country performed every month, to identify the nation that we're able to continuously keep pace or improve its FTI overtime among the ten top performers. In addition, to propose new research, for each country, another variable also were observed such as the percentage of people over 65 years old (UNITED NATIONS POPULATION FUND, 2021); the population density (STATISTICS TIMES, 2021), Cardiovascular rate deaths per 100,000 people (OUR WORLD IN DATA, 2017), Diabetes Prevalence as the percentage of the population between 20 and 70 years old (OUR WORLD IN DATA, 2019), percentage of male and female smokers from 15 years and older (WHO, 2020d).

Phase 3) to propose a way to find the most resilient country overtime

Finally, to complement this investigation, for every ten top nations (based on FTI600) and for every ten last countries, it was calculated its RESILIENCE INDEX (Equation 1), which represent the country ability to avoid fatal cases overtime, by calculating the percentage of a total number of days without fatal cases compared against the total number of days facing the pandemic, as explained below:

$$\textbf{RESILIENCE INDEX (RI)} = \textbf{TND}_L * 100 / \textbf{NDFP}_N \quad (1)$$

Where:

$\textbf{PFP}_N$ = Period Facing the Pandemic N = from the first day of official reported case of Covid-19 in the country until the N^{th} day analyzed.

$\textbf{NDFP}_N$ = Number of days of PFP_N. For this study, the maximum $\textbf{NDFP}_N$ is equal to 600 days.

$\textbf{Plife}_L$ = Period of Life L, without fatal cases of Covid-19 reported. During all the periods facing the pandemic ($NDFP_{N=600}$), it was selected the five longest periods without deaths. For this study, $Plife_L$ must be equal or higher than the Covid-19 Incubation period (14 days,) used for most quarantine or isolation process (PUBLIC HEALTH ONTARIO, 2020; DHOUIB, et al, 2021). In addition, the period of two weeks related to fatal cases is also used by Imperial College London to develop Short-term forecasts of Covid-19 deaths in multiple countries (BHATIA et al, 2021).

$\textbf{ND}_L$ = Number of Days of $Plife_L$

$\textbf{TND}_L$ = Total Number of Days of $Plife_L$, from the sum of all $\textbf{ND}_L$

Phase 4) to identify management practices (including NPIs) adopted in NZ

An online Survey <https://bit.ly/3nIHjDt> was developed in June 2020, which the main aim, questions, collection methods, pilot test, definitive questionnaire application, management practices, NPIs, and categories definition were described by Silva (2021a; 2021b).

In addition, from June 2020 until the middle of September 2021, parallel to the online questionnaire, several searches on articles, sites of government, universities, journals, startups, associations, and companies located in NZ were realized to identify responses adopted to save lives against the Covid–19.

5. Results

5.1 Around 360 responses identified

According to a report published on 2nd November 2020, by the NZ Department of the PM and Cabinet (2020), the NZ Strategic response against Covid-19 was focused on an agile elimination strategy, with a sustained approach to keep, find and stamp it out, while balancing health, economic and social impacts.

After the data collection made until middle September 2021, 360 responses were found to prevent and/or protect the population against Covid-19 in NZ, as organized by categories in Table 2, and listed in Appendix A, with most of the responses led by Public Sectors (240; 66.7%), followed by Corporations (41;11.39%), Universities (32; 8.89%), Others (30; 8.33%), and Start-Ups (17; 4.72%).

In terms of categories, most (83.33%) is related to Life Adaptation (108; 30%), Economic/Fiscal/Support (71; 19.72%), Health (Prevention, Diagnostic and Treatment=66;18.33%), and Information/Communication categories (55; 15.28%), followed by Infrastructure/Operational (34; 9.44%), Social Distance/Quarantine (15; 4.17%), Movement Restriction (9;2.5%), and Lockdown (2;0.56%).

It is worth noting that 0 response for Social Distance/Quarantine, Movement Restriction, and Lockdown related to Corporations, Universities, Others, and Start-Ups, does not mean that these

organizations do not obey or practice them, but it means that such measures are the primary responsibility of Public Sector (Central Government and Local Authorities) with policies that impact all the population.

Table 2: NZ Responses against Covid-19 organized by Categories until 15 September 2021

Categories	FPublic	FCorp.	FUniv.	FOther	FStartup	Total
Life Adaptation	75	6	7	10	10	108
Economic, Fiscal and Support	64	1	2	4	.	71
Health (Prevention, Diagnostic or Treatment)	10	20	20	12	4	66
Information/Communication	45	6	1	2	1	55
Infrastructure/Operational	21	7	2	2	2	34
Social Distance/Quarantine	15	0	0	0	0	15
Movement Restriction	8	1	0	0	0	9
Lockdown	2	0	0	0	0	2
Sub Total	240	41	32	30	17	360
% Sub Total	66.7%	11.39%	8.89%	8.33%	4.72%	100%

5.2 Around 116 responses during the first 100 days

Table 3 shows a total of 116 (32% of 360) responses given in NZ to prevent and protect lives against Covid-19 until 09 April 2020, when WHO marked 100 days since the first cases of "pneumonia with unknown cause". And the main measures taken during the first 100 days in NZ against Covid-19 are shown in Figures 5 and 6, and they will be described in the next sections.

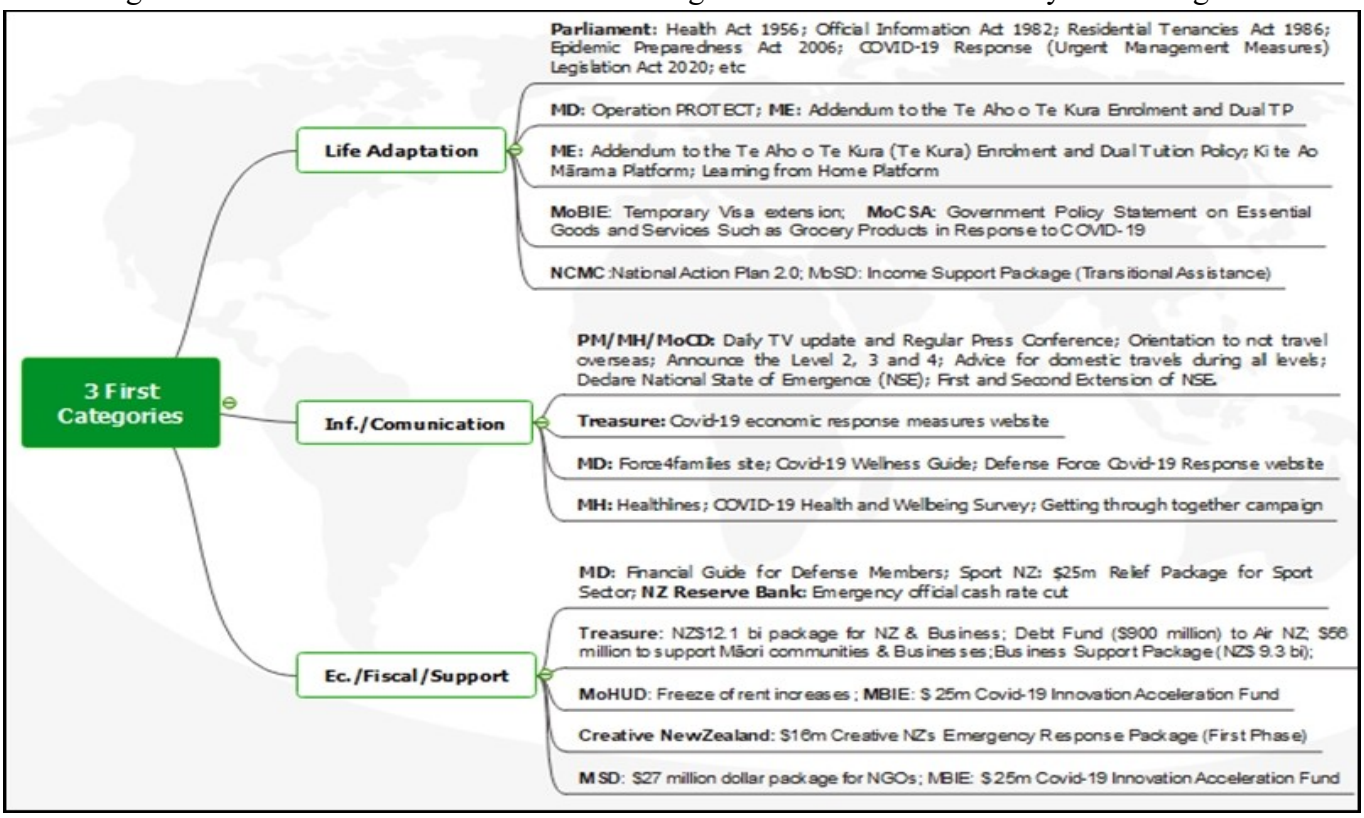
However, when only the public management practices led by NZ Public Sectors were investigated, it was found that 75 measures (64.7% of 116, and 31.25% of 240) were adopted:

Twenty-five (33.33% of 75) for Life Adaptation, sixteen (21.33%) measures concerned to Information/Communication category, ten (13.33%) measures for Economic/Fiscal/Support, nine (12%) for Social Distance/Quarantine, six (8%) related to Movement Restriction, four (5.33%) concerned to Health (Prevention, Diagnostic and Treatment), four (5.33%) for Infrastructure/Operational purposes, and one (1.33%) Lockdown.

Table 3: NZ Responses against Covid-19 organized by Categories until 9 April 2020

Categories	FPublic	FCorp.	FStartup	FOther	FUniv.	Total
Life Adaptation	25	3	9	6	0	43
Information/Communication	16	3	1	0	0	20
Health (Prevention, Diagnostic or Treatment)	4	10	2	1	2	19
Economic, Fiscal and Support	10	0	0	1	1	12
Social Distance/Quarantine	9	0	0	0	0	9
Infrastructure/Operational	4	0	1	1	0	6
Movement Restriction	6	0	0	0	0	6
Lockdown	1	0	0	0	0	1
Sub Total	**75**	16	13	9	3	116
% Sub Total	**64.7%**	13.8%	11.2%	7.8%	2.6%	100%

Figure 5: First Measures of NZ Government against Covid-19 classified by the 3 categories



5.2.1 Measures classified as Life Adaptation until 9 April 2020 (first 100 days) as shown by Figure 5

a) Parliament: it is worth noting that among twenty-five measures of the Life Adaptation category, most (17; 68%) are related to Parliament Acts, Regulations, Notices, Rules, from which, eleven were promulgated before 2020. Chart 2 shows the main Acts, goals, and amendments made between 01 January and 09 April 2020. In addition, a total of 52 legal decisions were found (Appendix A) until 15th September 2021, which represents 14.4% of all 360 responses identified in NZ.

Chart 2: Main legal framework used to prepare, prevent, and/or combat Covid-19 in NZ

Main Acts	Legal actions are taken from 31 December 2019 until 09 April 2020
Health Act 1956	Gives broad powers to the Minister of Health, the Director-General of Health, and medical officers of health (MOHs) to deal with the COVID-19. Amended 30 January and 11 March 2020: https://bit.ly/2XsoVnH
Official Information Act 1982	An Act to make official information more freely available, to provide for proper access by each person to official information relating to that person, to protect official information to the extent consistent with the public interest and the preservation of personal privacy, to establish procedures for the achievement of those purposes, and to repeal the Official Secrets Act 1951. Amended 24 March and 03 April 2020: https://bit.ly/3tILnVj
Residential Tenancies Act 1986	An Act to reform and restate the law relating to residential tenancies, to define the rights and obligations of landlords and tenants of residential properties, to establish a tribunal to determine expeditiously disputes arising between such landlords and tenants, to establish a fund in which bonds payable by such tenants are to be held, and to repeal the Tenancy Act 1955 and the Rent Appeal Act 1973 and their amendments. Amended 26 March and 01 April 2020: https://bit.ly/3nDeNmU

Main Acts (Continue)	Legal actions are taken from 31 December 2019 until 09 April 2020
Education Act 1989	Part 33A contains Directions relating to Covid-19. Amended 01 January, 26 March, and 01 April 2020: https://bit.ly/3tJvWMw
Civil Defense Emergency Management Act 2002	A state of national emergency was declared under section 66 of this Act on 25 March 2020 (ended on 13 May 2020 and was replaced by a National Transition Period which was terminated on 8 June 2020). No Amendment during this period, just use: https://bit.ly/3tLsDVl
Local Government Act 2002	25B Modifications to clause 25A while epidemic notice in force for COVID-19. Amended 17 January and 26 March 2020: https://bit.ly/399FaYS
Epidemic Preparedness Act 2006	Enables any necessary changes to legislation to be made, either by activating dormant legislative provisions or by the Governor-General modifying legislation (by Order in Council). Amended 26 March 2020: https://bit.ly/3kgS4eh
Immigration Act 2009	In force from 2 April 2020. For example, deeming existing temporary visas extended in certain circumstances (deactivated in part from 11.59pm on 24 June 2020 by the Epidemic Preparedness (Epidemic Management – Covid-19) Notice (No. 2) 2020
COVID-19 Response (Taxation and Social Assistance Urgent Measures) Act 2020	The Bill includes targeted measures aimed at providing relief to those that have been economically affected by the COVID-19 outbreak. Enacted 25 March 2020: https://bit.ly/3CfDZDR
Social Security Act 2018	In force since 25 March 2020, for example, allowing the Ministry of Social Development (MSD) to grant emergency benefits to people not otherwise entitled to them. Amended 01 April 2020: https://bit.ly/3tJL7p0
COVID-19 Response (Urgent Management Measures) Legislation Act 2020	An omnibus Act that amends the Education Act 1989, the EPA 2006, the Local Government Act 2002 (LGA 2002), the Local Government Official Information and Meetings Act 1987 (LGOIMA 1987) and the Residential Tenancies Act 1986. Enacted 25 March 2020 and corrections have been made to section 4 on 31 March 2020: https://bit.ly/3Agfxlg
Imprest Supply (Third for 2019/20) Act 2020	To authorize expenses and capital expenditure to be incurred by the Crown and Offices of Parliament during the 2019/20 year in advance of an Appropriation Act; and (b) to authorize capital injections to be made to departments and Offices of Parliament during the 2019/20 year in advance of authorization under an Appropriation Act. Enacted 25 March 2020: https://bit.ly/2XmB7ps . Note: It was repealed 01 July 2020.

Sources: NZ Government (2020b) and Practical Law New Zealand (2021)

b) Ministry of Education (ME):

According to NZ Government Gazette (2020), on 17 February 2020, it was published the Addendum to the Te Aho o Te Kura (Te Kura) Enrolment and Dual Tuition Policy, a document that sets out the criteria for an additional government-funded gateway for accessing dual tuition at Te Aho o Te Kura Pounamu, to ensure that students who have been unable to enter New Zealand due to travel disruptions or restrictions associated with the novel coronavirus outbreak can access education while overseas.

It launched on 23 March 2020 two platforms: c1) the Learning from home and Ki te Ao Mārama website <https://kauwhatareo.govt.nz/> to support teachers, parents, and whānau in helping children to

continue to learn; c2) Learning from Home <https://learningfromhome.govt.nz/>, a distance learning to support education communities during Covid-19 pandemic. It has resources, guidance, and information for parents, whānau, teachers, and leaders from early learning to senior secondary

c) Ministry of Defense (MD): Planning and Start Operation PROTECT, a military operation to support all Covid-19 responses.

According to NZDF (2021a), from April 2020 until 17 September, around 1210 Defense Force personal are supporting all government response to Covid-19: 332 staff at Managed Isolation and Quarantine Facility (MIQF); 572 in the security of MIQF; 19 in the operations of MIQ (HQ), and one supporting the MH Covid-19 Vaccination Planning, etc...

d) MSD: on 03 March 2020 published the Income Support Package (Transitional Assistance) Amendment - Notice of change 2020. The program extends the grant of temporary financial assistance to people who experience an overall reduction in assistance as a result of the increase to main benefits on 1 April 2020 made by the COVID-19 Recovery Package.

e) MoBIE: Temporary Visa Extension

Immigration New Zealand announced on 24 March 2020 that the government epidemic management notice relating to immigration matters comes into effect on 2 April 2020. This means that any person holding a temporary visa in NZ has an automatic three-month extension granted to their visa but only if their visa expires between 1 April and 9 July 2020.

f) Minister of Commerce and Consumer Affairs (MoCSA): on 24 March 2020, it was published the Government Policy Statement on Essential Goods and Services Such as Grocery Products in Response to COVID-19. It asks the Commerce Commission to have regard to the government's objective of maintaining confidence in the market for essential goods and services by ensuring there is broad and fair access to them by as wide a range of consumers as possible (NZ GOVERNMENT GAZETTE, 2020b).

g) National Crisis Management Centre (NCMC): National Action Plan 2.0

A plan <https://bit.ly/2Z35Dpp> to direct the national response during the current Covid-19 Alert Level 4: Eliminate period and to ensure operational alignment with the strategic intent. The Operational Period is from 25 March 2020 (when was declared the State of Emergence) until 22 April 2020.

5.2.2 Measures classified as Information/Communication until 9th April 2020

An important component of an effective pandemic response is communication, based on science, among governments, health professionals, scientists, the media, and the public (GEOGHEGAN, et al, 2021; THE LANCET RESPIRATORY MEDICINE, 2020; WANG et al, 2020). In addition, the importance of communication can be noted by reading the WHO SERPs, released in February 2020 (WHO, 2020b), and April 2020 (WHO, 2020c), for both documents, it appears in the Risk Communication and Community Engagement, to face infodemic, an over-abundance of information that makes it hard for people to it was hard to find trustworthy sources and reliable guidance when they need.

When is analyzed measures taken by NZ Central Government concerning Information/Communication, during the first 100 days since 31 December 2019, it was found sixteen measures, some of them listed in Figure 5:

a) PM, Ministry of Health, and Government Team Leaders:

Regularly communicate advice to the New Zealanders, via Daily Televised 1 pm Updates, followed by advertising in the print media, TVs, Government, and Media sites, social media such as Facebook and What's App (CUMMING, 2021 p.7).

They are also holding regular Press Conferences with media professionals to update the citizens on the Government´s responses against Covid-19. For instance, from 24th March to 9th April 2020, around 27 Press Conferences happened, it is considered the last date as 14 September 2021, the total

number of Press conferences reaches 108, which transcripts can be accessed here <https://bit.ly/2XGFfkI>.

In addition, they are providing advice for domestic travels during all levels, not travel overseas, announced levels 2, 3, and 4, declared state of emergence, and communicated the first and second extension of the National State of Emergence.

b) Treasure developed a website <https://bit.ly/3C7rZnY> to inform Covid-19 economic response measures adopted overtime;

c) Ministry of Defense (MD):

Developed the Force3families website <https://bit.ly/3CgM7nD> to provide Covid-19 information for military personnel and their families.

Developed the Defense Force Covid-19 Response website <https://bit.ly/2VPyfRS> to provide the latest updates of our involvement in the response to COVID-19 through Operation PROTECT.
Elaborated the Covid-19 Wellness Guide <https://bit.ly/3hBdqBi> to provide guidance for military and their families containing tips for getting prepared against the Covid-19.

d) Ministry of Health (MH):

Provided a free call to Healthline (0800 358 5453) for health advice (nurse 24h a day) and information about Covid19. Also international SIMS (+64 9 358 5453) or two e-mails:

covid-19response@health.gov.nz (queries) and help@covidtracer.min.health.nz (Covid Tracer app).

Develop and carry out the COVID-19 Health and Wellbeing Survey to collect information, to support the NZ government's response. They publish the key findings <https://bit.ly/3EwHJmy> of the respondent's perceptions related to health and wellbeing, worries, understanding of the compliance with the Alert level rules, and household financial struggles.

Support the Public Campaign Awareness "Getting through together" which shares ways to help Kiwis cope with the stress of Covid-19. The campaign has been developed by All Right? who produced the world-leading disaster-recovery program following the Canterbury earthquakes, in partnership with the Mental Health Foundation. It also provides support for parents to talk with their primary-school-aged children about their mental health and wellbeing.

5.2.3 Measures classified as Economic/Fiscal/Support

a) MD: Financial Guide for Defense <https://bit.ly/3hQGpBa> community and their families who may be experiencing financial pressures;

b) NZ Reserve Bank: Emergency official cash rate cut

c) Treasure: on 17 March 2020, the government announced a $12.1 billion package, worth 4 percent of the country's GDP. The package includes a $500m boost for health; $ 5.1b in wage subsidies for affected businesses; $ 2.8b for income support package for vulnerable people; $ 2.8b for business tax changes to free up cash flow, etc… On 20 March 2020, the NZ Government and Air NZ have agreed to a debt funding agreement through commercial 24-month loan facilities of up to $900 million to allow the airline to keep operating and essential routes open. On 23 March 2020, the Finance Minister announced that: $9.3billion for business support package against Covid, also $ 56 million ($40 million from the $12.1 b packages and $16 million from other sources) were reallocated to support Maori communities, businesses to respond to Covid19. It is important to note that overtime the Finance Minister Grant Robertson and other Ministers announced further support for the economy, workers, and businesses;

d) Ministry of House and Urban Development (MoHUD): On 23 March 2020, the NZ Government announced a freeze of rent increases and an extension of no-cause terminations. A rent increase

freeze was in place from 26 March to 25 September 2020. During that time landlords could not increase the rent for their rental properties. This has been applied as law through the COVID-19 Response (Urgent Management Measures) Amendment Act, which came into effect on 26 March 2020;

e) Creative NZ: $16m Creative New Zealand's Emergency Response Package (First Phase), an initial $16 million investment, with funding opening 14 April 2020, distributed to the sector through to 30 June 2020. It includes $4.5 million-plus $11.5 million repurposed from other programs;

f) MSD: on 26 March 2020, it was announced $27 million packages for NGOs, focusing on social sector services and community groups to ensure they can continue to provide essential support to communities as they stay at home to stop the spread of COVID-19;

g) MBIE: $ 25m Covid-19 Innovation Acceleration Fund to speed up the trial and deployment of innovations to help New Zealand's response to COVID-19. The COVID-19 Innovation Acceleration Fund is aimed at the fast development of new products and services that could help to detect, diagnose, treat or prevent COVID-19, by supporting Research & Development, prototyping, and pre-production activities.

5.2.4 Measures classified as Social Distance/Quarantine as shown by Figure 6

It was found nine measures related to Social Distance/Quarantine, described as follow:

a) MH and other Ministries

According to RNZ (2021): on 1st March 2020, they announced that they self-quarantined 14 days for arrivals from Northern Italy and South Korea. On 14 March 2020, it was established self-quarantine of 14 days to all arrivals.

On 19 March 2020, cancellation of public events and limited public gatherings. Gatherings or events where 500 or more people are together in one place outdoors, or 100 people indoors, at one time, should be canceled. And on 21 March 2020, Social distance for the hospitality sector. People going to bars, restaurants, and casinos will be expected to stay at least a meter away from each other, and venues will have to do headcounts to make sure there are not >100 people indoors. A register of guest details will also have to be kept for four weeks, including full name, address, and contact phone and email details.

b) Auckland Council & NZ Gov. MH:

On 13 March 2020, Auckland's Pasifika Festival is canceled due to concerns about the virus spreading.

c) PM & MBIE: Managed Isolation and Quarantine (MIQ) System

On 24 March 2020, Prime Minister Jacinda Ardern informed that gatherings of 500 or more people should be canceled because of fears of Coronavirus. This covered indoor and outdoor events, but not schools or universities, who would get more specific advice from the Ministry of Education.

On 25 March 2020, MoBIE announced that non-essential businesses must close. All bars, restaurants, cafes, gyms, cinemas, pools, museums, libraries, playgrounds, and any other place where the public congregate must close their face-to-face function.

On 9 April 2020, The Prime Minister informed <https://bit.ly/3zzcUcV> that from midnight of that day every person arriving in NZ will have to go into compulsory quarantine as a measure to try and combat Covid-19. Up to 18 hotels were used to implement the new measures and one to two of those were specifically for those set aside under strict quarantine measures, those with symptoms or those who are being tested for the coronavirus.

Figure 6: First Measures of NZ Government against Covid-19 classified by the next four categories

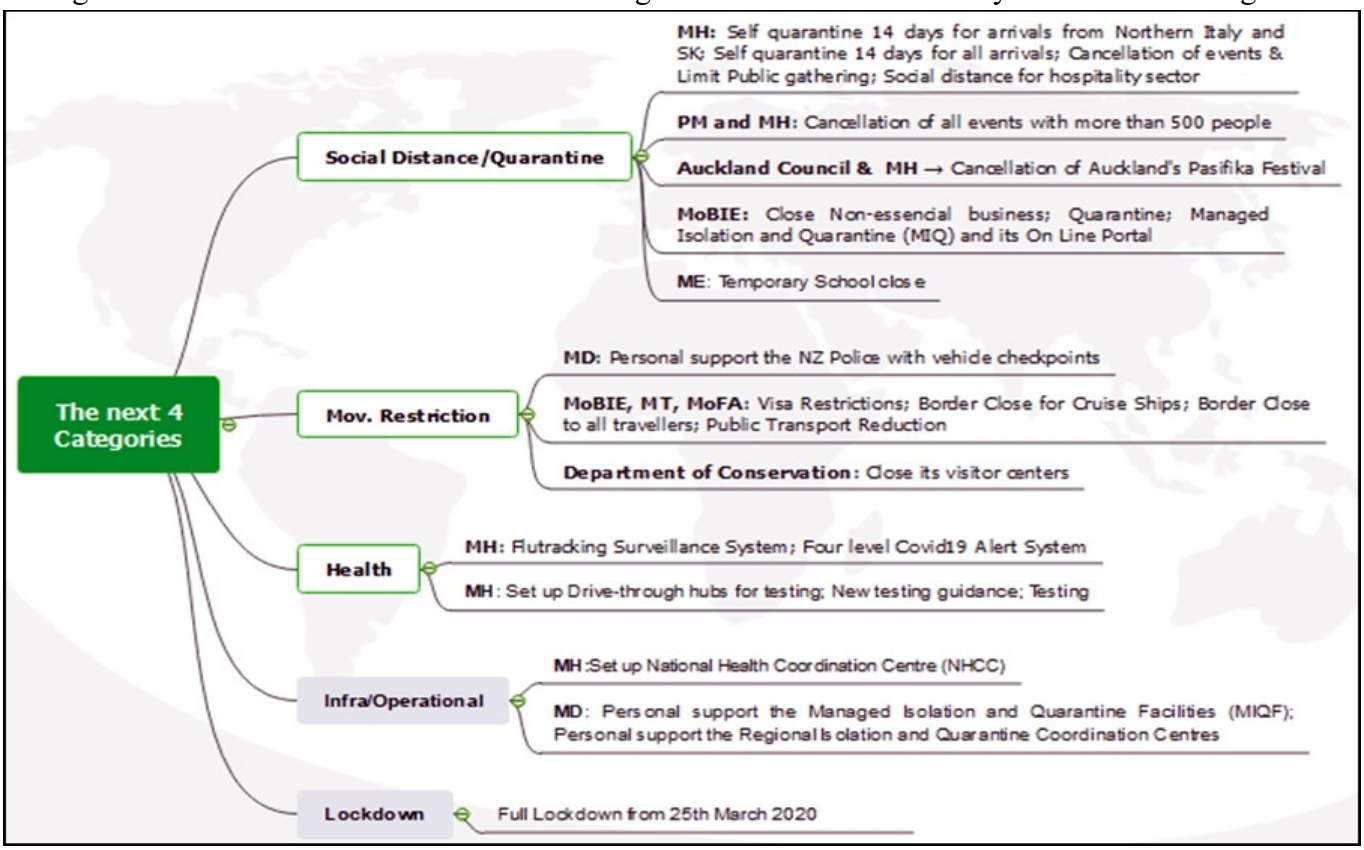
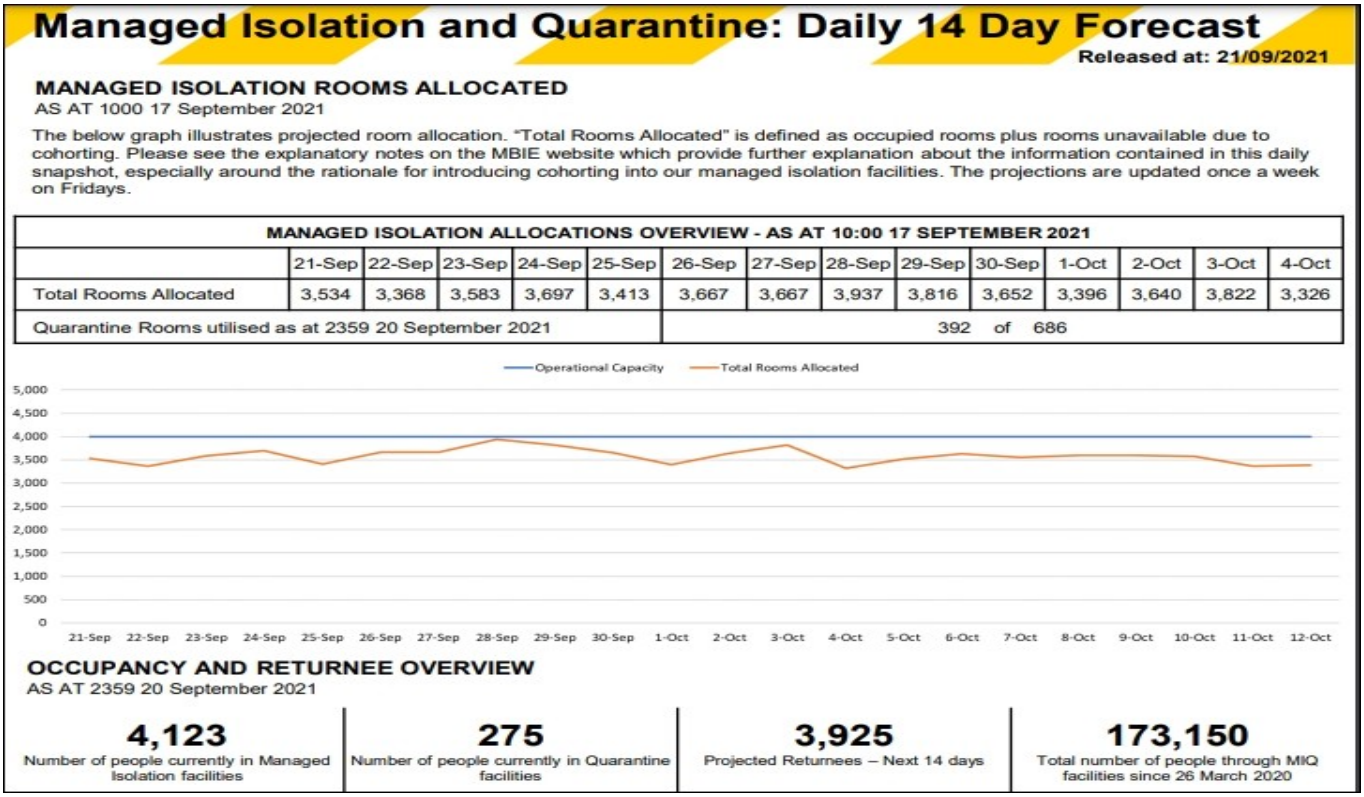


Figure 7: Part of Daily Report of MIQ until 17 September 2021



Managed Isolation and Quarantine: Daily 14 Day Forecast

Released at: 21/09/2021

MANAGED ISOLATION ROOMS ALLOCATED

AS AT 1000 17 September 2021

The below graph illustrates projected room allocation. "Total Rooms Allocated" is defined as occupied rooms plus rooms unavailable due to cohorting. Please see the explanatory notes on the MBIE website which provide further explanation about the information contained in this daily snapshot, especially around the rationale for introducing cohorting into our managed isolation facilities. The projections are updated once a week on Fridays.

MANAGED ISOLATION ALLOCATIONS OVERVIEW - AS AT 10:00 17 SEPTEMBER 2021

	21-Sep	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	1-Oct	2-Oct	3-Oct	4-Oct
Total Rooms Allocated	3,534	3,368	3,583	3,697	3,413	3,667	3,667	3,937	3,816	3,652	3,396	3,640	3,822	3,326
Quarantine Rooms utilised as at 2359 20 September 2021						392 of 686								

OCCUPANCY AND RETURNEE OVERVIEW

AS AT 2359 20 September 2021

4,123	275	3,925	173,150
Number of people currently in Managed Isolation facilities	Number of people currently in Quarantine facilities	Projected Returnees – Next 14 days	Total number of people through MIQ facilities since 26 March 2020

Source: MBIE (2021)

On the same date, MoBIE announced the Online Portal <https://www.miq.govt.nz/> of the Managed Isolation and Quarantine (MIQ) System, an online portal for everyone traveling to NZ be able to secure their place in a managed isolation facility before they board their flight.

It is important to note that since 2 July 2020, they publish a daily update report on Managed Isolation and Quarantine occupancy, projected occupancy, and related information. For example, from 26 March 2020 until 17 September 2021, a total of 31 MIQ facilities in 5 regions already attended a total of 173,150 people (Figure 7), which operational capacity is 4,500 rooms per fortnight before the establishment of Quarantine Free Travel. When quarantine-free travel was announced, 500 rooms per fortnight were set aside as contingency to manage any potential changes to quarantine-free travel (MBIE, 2021).

d) ME: On 25 March 2020, the Minister of Education informed that all schools and early childhood education (ECE) centers will be closed. It was informed that the upcoming school term break will be brought forward to start on Monday, 30 March. For the remainder of that week and through the term break, schools were oriented to establish ways to deliver teaching online and remotely.

5.2.5 Measures classified as Movement Restriction

Seven measures are related to Movement Restriction, as follows:

a) MD: On 14 February 2020, 50 Ministry of Defense personnel supported the NZ Police with vehicle checkpoints established as the Auckland region moved to Alert Level 3.

b) MoBIE:

On 13 March 2020, Visa Restriction. Non-residents of New Zealand who have been to China or Iran in the last 14 days will not be allowed to enter the country.

On 14 March 2020, Border Close for Cruise Ships. Cruise ships cannot enter NZ's territorial waters effective from 23:59 Saturday 14 March 2020. This will remain in place until at least 30 June 2020.

On 19 March 2020, the Border was close to all travelers. It was informed that NZ's borders were closed to almost all travelers from 23:59 on Thursday 19 March 2020.

c) Department of Conservation: on 22 March 2020 closed ts visitor centers were to the public, and from the next day canceled all hut and campsite bookings, says director-general, Lou Sanson.

d) MT: Public Transport Reduction

On 23 March 2020, Public transport was only available for those working in essential services, for medical reasons, and to get to the supermarket.

5.2.6 Measures classified as Health (Prevention, Diagnostic and Treatment) by Ministry of Health

Four measures were identified, the first one already exists in NZ, the Flutracking Surveillance System <https://info.flutracking.net/>, an online health surveillance system used to detect the potential spread of influenza.

The next measures are related to the Four-level Covid19 Alert System, Setting up Drive-through hubs for testing, and New testing guidance and Testing, as explained below.

a) Four-level Covid-19 Alert System launched on 21 March 2020

This is one of the most important Health measures adopted by the NZ Central Government, to standardize and integrate efforts with the society, since it provides scientific information with a popular language, guiding everyone on how should proceed during each level.

The measures are updated based on:

a1) new scientific knowledge on Covid-19;

a2) information on the effectiveness of control measures taken overseas and NZ;

a3) the flexibility to apply Alert Levels at different times in different parts of the country.

Figure 8 shows the main contents of the NZ Alert System, which is composed of Elimination Strategy, and each Alert´s concept, risk assessment, and several measures.

This content was improved overtime and can be viewed on the United Against Covid-19 website provided by the NZ Government (2021a).

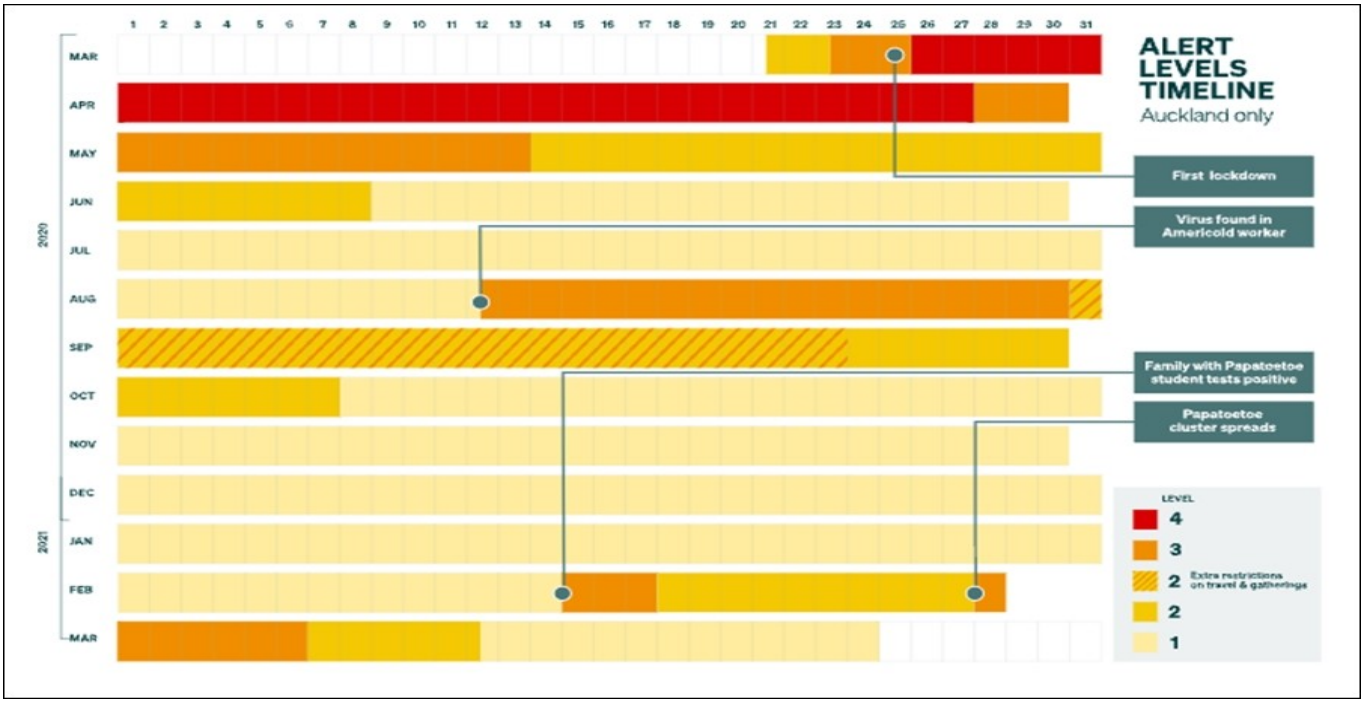
Finally, Figures 9 and 10 show the Covid-19 Alert System Timeline concerning Auckland and the rest of the country from 1st March 2020 until 24 March 2021.

Figure 8: Part of NZ Alert System

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

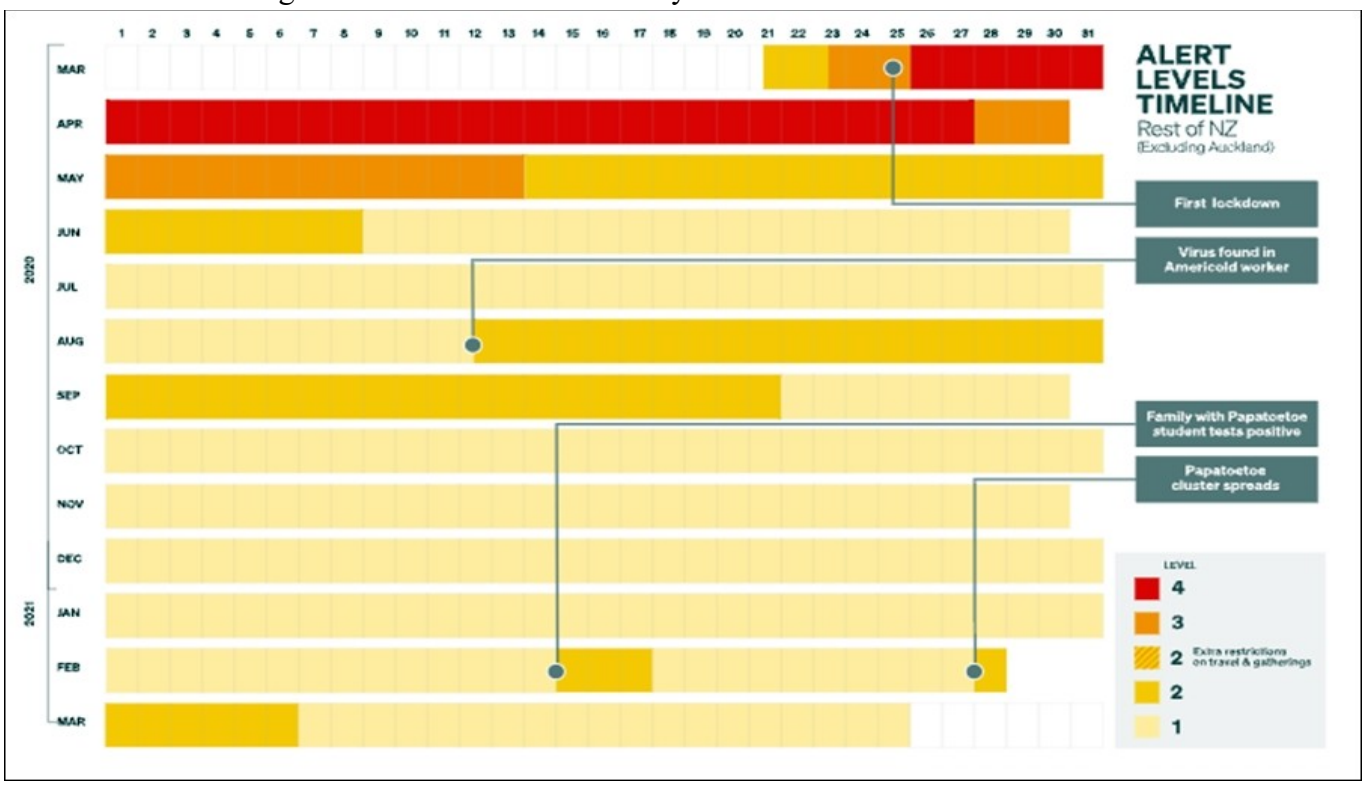
Alert Level	Risk Assessment	Range of Measures (can be applied locally or nationally)	
Level 4 – Lockdown Likely the disease is not contained	• Sustained and intensive community transmission is occurring. • Widespread outbreaks.	• People instructed to stay at home in their bubble other than for essential 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	• Multiple cases of community transmission occurring. • Multiple active clusters in multiple regions.	• 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 , 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 cannot offer services that involve close personal contact, unless it is a supermarket, pharmacy, petrol station or hardware store providing goods to trade customers, or it is an emergency or critical situation.	• Other 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 critical 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	• Limited community transmission could be occurring. • Active clusters in more than one region.	• 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 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. • Face coverings required on public transport and aircraft (but not inter-island ferries) – school buses and children under 12 are exempt along with passengers in taxis or ride share services and people with disabilities or mental health conditions.
Level 1 – Prepare The disease is contained in New Zealand	• COVID-19 is uncontrolled overseas. • Sporadic imported cases. • Isolated local 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. • No restrictions on personal movement but people are encouraged to maintain a record of where they have been. • No restrictions on gatherings but organisers encouraged to maintain records to enable contact tracing.	• 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. • No restrictions on workplaces or services but they are encouraged to maintain records to enable contact tracing. • QR codes issued by the NZ Government must be displayed in workplaces and on public transport to enable use of the NZ COVID Tracer App for contact tracing.

Figure 9: NZ Covid-19 Alert System Timeline for Auckland



Source: RNZ (2021) with graphic credits to Vinay Ranchhod

Figure 10: NZ Covid-19 Alert System Timeline for the Rest of NZ



Source: RNZ (2021) with graphic credits to Vinay Ranchhod

b) Set up Drive-through hubs for testing

On 21 March 2020, Shorecare Northcross, on Auckland's North Shore, was selected to become an assessment center, swabbing. They installed a Drive-through hub, especially for testing coronavirus.

c) new testing guidance and Testing

On 1st April 2020, a new case definition was created by Technical Advisory Group, as a guide for health professionals on testing. From that date, anyone with respiratory symptoms consistent with Covid-19 should be considered for testing regardless of travel history or contact with a confirmed case.

The first test in NZ was made on 22 January 2020 and until 1st April 2020, NZ testing capacity was 3,700 tests daily provided by 8 laboratories. And according to the International Accreditation New Zealand (IANZ, 2021), until 23rd September 2021, there were 32 organizations with accredited medical testing laboratories for SARS-Cov-2.

And according to the NZ Ministry of Health (2021), from 22 January 2020 to 21 October 2021, a total of 3,842,993 tests were realized with 180,921 test kits in stock, and Table 4 shows that most were negative.

Table 4: Testing from 22 January 2020 until 21 October 2021 in NZ

Test Results	In managed facilities	Within NZ communities	Total
Positive for Covid-19	1713	4912	6625
Negative	377171	3458003	3835174
Inconclusive	19	1075	1194
Total	378903	3464090	3842993

Finally, according to Worldometer (2021), on 21 October 2021, NZ realized 768,276 tests per 1M population, ranking 83rd among 223 countries/regions.

5.2.7 Measures classified as Infrastructure/Operational

a) MH: The Ministry of Health set up the National Health Coordination Centre (NHCC) on 28 January 2020, to respond to the global COVID-19 pandemic.

b) MD: Since 1st April 2020 provide personal to support the Managed Isolation and Quarantine Facilities (MIQF) and Regional Isolation and Quarantine Coordination Centres.

c) National Emergency Management Agency (NEMA): Since 9 April 2020, guides the use of key powers that are available to Civil Defence Emergency Management (CDEM) Groups, Group Controllers, Local Controllers, and those acting under their authority to respond to COVID-19.

5.2.8 Measures classified as Full Lockdown (Alert 4)

According to RNZ (2021) and The University of Auckland (2021)., at 11.59 p.m. on 25 March 2020, NZ entered the first Nationwide Lockdown designed to prevent the spread of the deadly COVID-19 virus around the country. On 27 April 2020, Level 4 was changed to Level 3 for two weeks. In addition, from 13h59 of 17 August 2021, after the first case of the Delta variant, another National Lockdown was established and NZ entered Alert Level 4, for the Coromandel Peninsula and Auckland, locations of transmissions, the Lockdown was for an initial 7 days, while the rest of the country, for at least 3 days. It is worth noting that from 25 March 2020 until 24 March 2021, several partial Lockdown happened as described below:

On 7 July 2020: A cluster of new cases in Melbourne was found, 191 new cases reported there, and the Victorian Premier announced that the entirety of metropolitan Melbourne and Mitchell Shire would re-enter lockdown for a minimum of 6 weeks from 9 July.

On 12 August 2020: The greater Auckland moved back into lockdown alert level 3 at noon. The other parts of the country moved into alert level 2.

On 14 February 2021: Auckland went into a level 3 lockdown, after three new community cases in a single South Auckland household. One of the cases is a student at Papatoetoe High School, which was closed in response, and the rest of NZ moved to level 2.

5.3 NZ performance versus 43 semifinalist countries performance

5.3.1 Each country performance during 600 days (FTI600)

When is analyzed each country estimated number of Covid–19 fatal cases by one million population during the first 600 days (20 months) facing the pandemic, the results of Tables 5 and 6 revealed that:

a) China is the best country (Table 5), with FTI600 (last column) equal to 0.0066, followed by NZ (0.0165), Singapore (0.0176), Hong Kong (0.0934), Australia (0.0988), South Korea (0.1031), Taiwan (0.1172), Iceland (0.2098), Norway (0.3636), and UAE (0.3667), all considered the top ten benchmark nations, 60% from Asia, 20% from Oceania, and 20% from Europe;

b) 40% of the ten top countries (China, Singapore, Hong Kong, Taiwan) reported fatal cases (TD=Total Deaths) of SARS2003, while 60% (NZ, Australia, SK, Iceland, Norway, and UAE) did not report deaths in that pandemic, with 30% (Iceland, Norway, and UAE) of nations without SARS2003, which indicates that countries without fatal cases or any cases of SAS2003 can learn from the lessons of the past, to build robust strategies to prevent and control Covid-19 overtime;

c) On the other hand (Table 6), Spain (FTI600=28.0146), Hungary (21.7223), Italy (14.3199), UK (12.9803), Slovenia (9.7730), Lithuania (7.9185), Belgium (7.0711), Czech (7.0441), USA (6.7665), and Poland (6.7115), were the ten last countries (critical) with the highest value of FTI600. In this critical group, most (90%) is from Europe and only the USA (10%) is from North America.

Besides, all critical countries did not report any fatal case of SARS2003, with 60% without any case of that pandemic, indicating that they do not have experience in dealing with a high number of Coronavirus disease cases, and were not able to prepare effective strategies to face the Covid-19 overtime, especially the most critical countries with the highest: c1) population; c2) the percentage of vulnerable people with age equal or over 65 years old; c3) the number of cardiovascular death rate per 100000 individuals; c4) percentage of smokers, especially female smokers rate, since Table 7 shows highest differences when their median is compared with the median of the ten top countries.

Table 5: Twenty-two best countries profile & performance in ascending order of FTI600

R	COUNTRY	CONT.	SARS2003TD/TC	START	P2021 (Mil)	PD21	%AGE>=65	CARDVD/100K	%DIAB_PREV	%FEM_SMO	%MALE_SMO	HBED/1K	FTI600
1	China	Asia	349/5327=6.5%	31/12/19	1.444	154	12	262	9	2	48	4	0,0066
2	NZ	Oceania	0 / 1 = 0%	28/02/20	5	18	17	129	6	14	16	3	0,0165
3	Singapore	Asia	33/238=13.9%	23/01/20	6	8424	14	92	6	5	28	2	0,0176
4	HK	Asia	299/1755=17%	23/02/20	8	7193	19	.	5	.	.	.	0,0934
5	Australia	Oceania	0 / 6 = 0%	25/01/20	26	3	17	108	6	14	19	4	0,0988
6	SK	Asia	0 / 3 = 0%	20/01/20	51	528	17	86	7	6	38	12	0,1031
7	Taiwan	Asia	37/346=10.7%	21/01/20	24	674	14	104	.	.	.	7	0,1172
8	Iceland	Europe	No case	28/02/20	0	3	16	118	6	14	14	3	0,2098
9	Norway	Europe	No case	26/02/20	6	15	18	114	5	18	19	4	0,3636
10	UAE	Asia	No case	27/01/20	10	120	1	318	16	1	36	1	0,3667
11	Japan	Asia	No case	16/01/20	126	346	29	79	6	11	33	13	0,3822
12	Thailand	Asia	2 / 9 = 22.2%	13/01/20	70	137	14	110	7	3	43	2	0,3850
13	Finland	Europe	No case	29/01/20	6	18	23	154	6	18	21	3	0,4586
14	Qatar	Asia	No case	27/02/20	3	252	2	177	16	1	27	1	0,4658
15	Vietnam	Asia	5 / 63 = 7.93%	23/01/20	98	317	8	245	6	1	46	3	0,7955
16	Cyprus	Asia	No case	09/03/20	1	132	15	141	9	23	50	3	0,9972
17	Denmark	Europe	No case	27/02/20	6	137	20	115	8	19	18	3	1,0926
18	Malaysia	Asia	2 / 5 = 40%	25/01/20	33	100	7	261	17	1	43	2	1,2513
19	Israel	Asia	No case	21/02/20	9	406	13	93	10	16	35	3	1,8186
20	Canada	N. Am.	43/251=17.1%	27/01/20	38	4	19	106	8	12	23	3	2,5548
21	Germany	Europe	0 / 9 = 0%	27/01/20	84	241	22	156	10	26	30	8	2,9457
22	Netherlands	Europe	No case	27/02/20	17	509	21	109	5	21	26	3	3,1390

Table 6: 22 countries profile & performance in ascending order of FTI600 (Continuation of Table 5)

R	COUNTRY	CONT.	SARS2003TD/TC	START	P2021 (Mil)	PD21	%AGE>=65	CARDVD/100K	%DIAB_PREV	%FEM_SMO	%MALE_SMO	HBED/1K	FTI600
23	Austria	Europe	No case	25/02/20	9	110	20	145	7	28	30	7	3,1492
24	Luxembourg	Europe	No case	29/02/20	1	242	15	128	5	20	24	5	3,3573
25	Estonia	Europe	No case	27/02/20	1	31	21	256	4	24	37	5	3,4932
26	Switzerland	Europe	0 / 1 = 0%	25/02/20	9	221	19	100	6	23	28	5	3,6547
27	Malta	Europe	No case	07/03/20	0	1384	22	169	8	23	28	4	3,8333
28	Portugal	Europe	No case	02/03/20	10	111	23	128	10	22	33	3	4,5732
29	Chile	S. Am.	No case	03/03/20	19	25	13	128	9	40	49	2	4,5839
30	Sweden	Europe	0 / 5 = 0%	31/01/20	10	25	21	134	5	29	28	2	5,1755
31	Ireland	Europe	0 / 1 = 0%	29/02/20	5	72	15	126	3	21	26	3	5,3001
32	Latvia	Europe	No case	02/03/20	2	30	21	350	5	24	50	6	5,3663
33	Greece	Europe	No case	26/02/20	10	80	23	176	5	33	45	4	5,5180
34	France	Europe	1/7=14.3%	24/01/20	65	120	21	86	5	33	36	6	6,4938
35	Poland	Europe	No case	04/03/20	38	123	19	227	6	22	30	7	6,7115
36	USA	N. Am.	0 / 27 = 0%	21/01/20	333	36	17	151	11	19	31	3	6,7665
37	Czech	Europe	No case	01/03/20	11	139	20	227	7	27	36	7	7,0441
38	Belgium	Europe	No case	04/02/20	12	384	20	115	5	23	27	6	7,0711
39	Lithuania	Europe	No case	28/02/20	3	43	21	343	4	19	35	7	7,9185
40	Slovenia	Europe	No case	04/03/20	2	103	21	153	6	20	25	5	9,7751
41	UK	Europe	0 / 4 = 0%	31/01/20	68	282	19	122	4	17	21	3	12,9803
42	Italy	Europe	0 / 4 = 0%	31/01/20	60	205	24	113	5	20	27	3	14,3199
43	Hungary	Europe	No case	04/03/20	10	106	21	278	7	26	35	7	21,7293
44	Spain	Europe	0 / 1 = 0%	31/01/20	47	94	20	99	7	27	29	3	28,0146

Table 7: Comparative variables performance among Ten top countries versus Ten critical countries

AVERAGE, SD, AND MEDIAN	P2021 (Mil)	PD21	%AGE>=65	CARDVD/100K	%DIAB_PREV	%FEM_SMO	%MALE_SMO	HBED/1K
X 10 TOP COUNTRIES	158	1713	14	148	7	9	27	4
S 10 TOP COUNTRIES	452	3234	5	83	4	6	12	3
MEDIAN OF 10 TOP	9	137	16	114	6	10	23	4
X 10 CRITICAL	58	152	20	183	6	22	30	5
S 10 CRITICAL	100	109	2	82	2	4	5	2
MEDIAN 10 CRITICAL	25	115	20	152	6	21	30	5
DIF MED10CRIT – MED10TOP	16	-22	4	38	0	11	6	1

5.3.2 NZ performance per month and Resilience

For each country, it was calculated the FTI per month from the FTI60 until FTI600. Also, the average, standard deviation, and median were calculated for each FTI by month, to identify each country group FTI performance overtime.

It was also observed how the position of each country performed overtime, to identify the most resilient country that we're able to continuously keep pace or improve its FTI overtime among the ten top performers. Finally, to complement this investigation, for the ten best countries (based on FTI600), from the first day of the reported case of Covid-19 until the day 600th, it was analyzed the period by which there were no reported fatal cases, to identify the total number of days without fatal cases (TNWFC) and divide it by 600 days.

As a result, Figures 11 and 12 show that:

a) In general, when the performance of all 44 countries is analyzed (X 44 countries and Median 44 countries) since the first reported case of Covid-19 in each country, it was noted that the period with the highest FTI is the third month and fourteenth month. In addition, from the ninth month (FTI274; X43=2.880; Med43=1.447) the number of fatal cases of Covid19 rises continuously, reaching its peak in the fourteenth month (FTI426; X43=5.313; Med43=3.973) and since then reducing due vaccination process;

b) When is analyzed the FTI performance overtime only from the group with the ten most critical countries (X last 10 countries; Median last 10 Countries), it was observed that in terms of median, the most critical period of fatal cases is the twelfth month (FTI366; Medlast10countries=11.437); while in terms of average the most critical period of fatal cases is the fourteenth month (FTI426; Xlast10countries=15.190), from which the FTI continuously decreases, due to the advance of vaccination;

c) When is analyzed the FTI performance overtime (Figure 12), considering only the group of the ten top countries (which NZ is included), it was noted that its FTI average is very low, representing between 0.948% and 3.004% of the FTI average value of the 10 last countries. In this group, Norway, Iceland, Australia, HK, and SK have the highest FTI overtime, while China, Singapore, Taiwan, Thailand, Vietnam, and NZ the lowest;

d) When the position of every country is organized based on FTI ascending order (Chart 3) overtime, it was noted that only China and NZ were able to keep pace without losing position, with special emphasis on NZ since it was the unique country (Table 8) to reduce its FTI overtime, ascending continuously from FTI60 = 0.1121 (seventeenth place) to FTI600 = 0.0165 (second place). In addition, it is necessary to act with caution concerning China numbers since 1) at times, WHO and other authors have complained about the Chinese Government slowness and lack of transparency to provide data (AP NEWS, 2020; ROMANIUK, and BURGERS, 2020; SCMP, 2021; TIEZZI, 2021); 2) China was

considered the 78th nation in terms of Corruption Perception Index 2020 (E.V., 2020), while NZ was considered in the first position, meaning that people living in NZ trust much more in the transparency of public sector than people living in China.

Figure 11: Average and Median of 44 Countries FTI from FTI60 (2 Months) to FTI600 (20 Months)

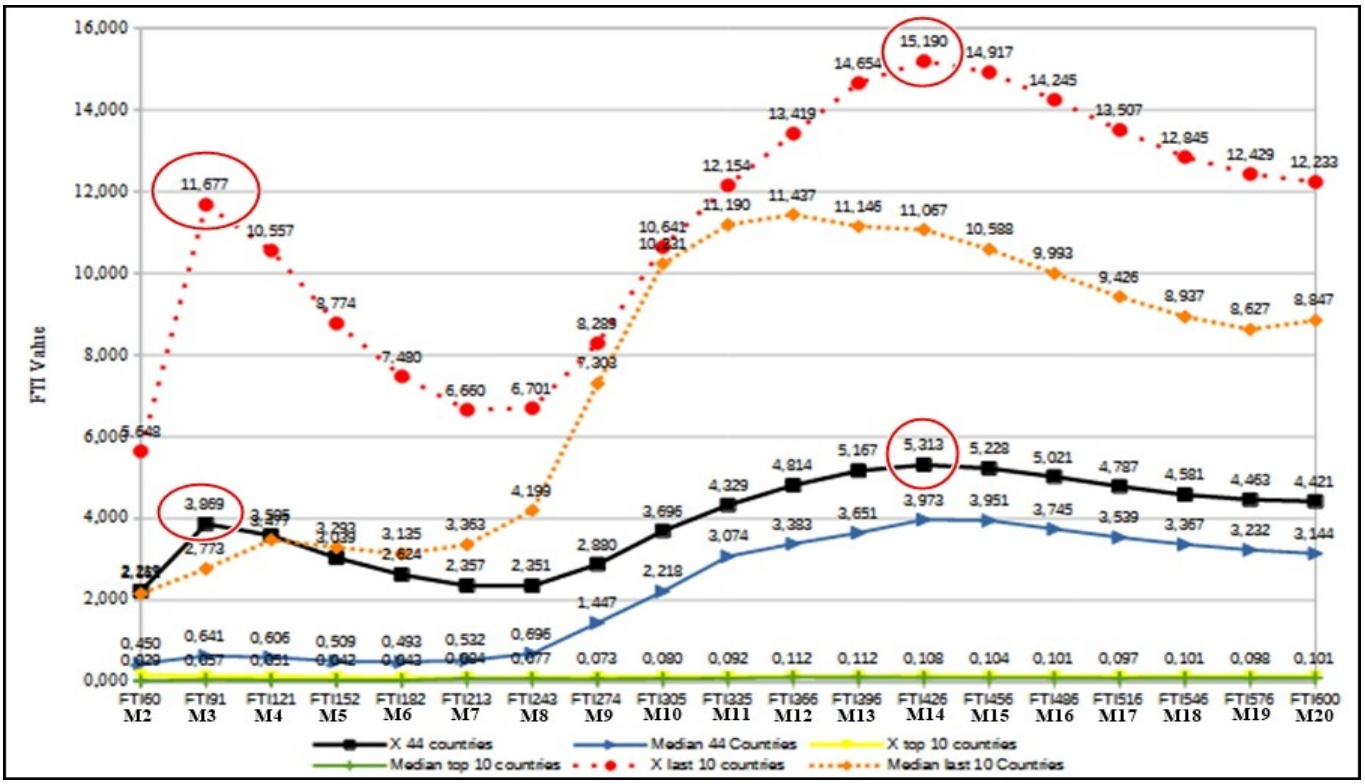


Figure 12: Top ten countries FTI performance from FTI60 (2 Months) to FTI600 (20 Months)

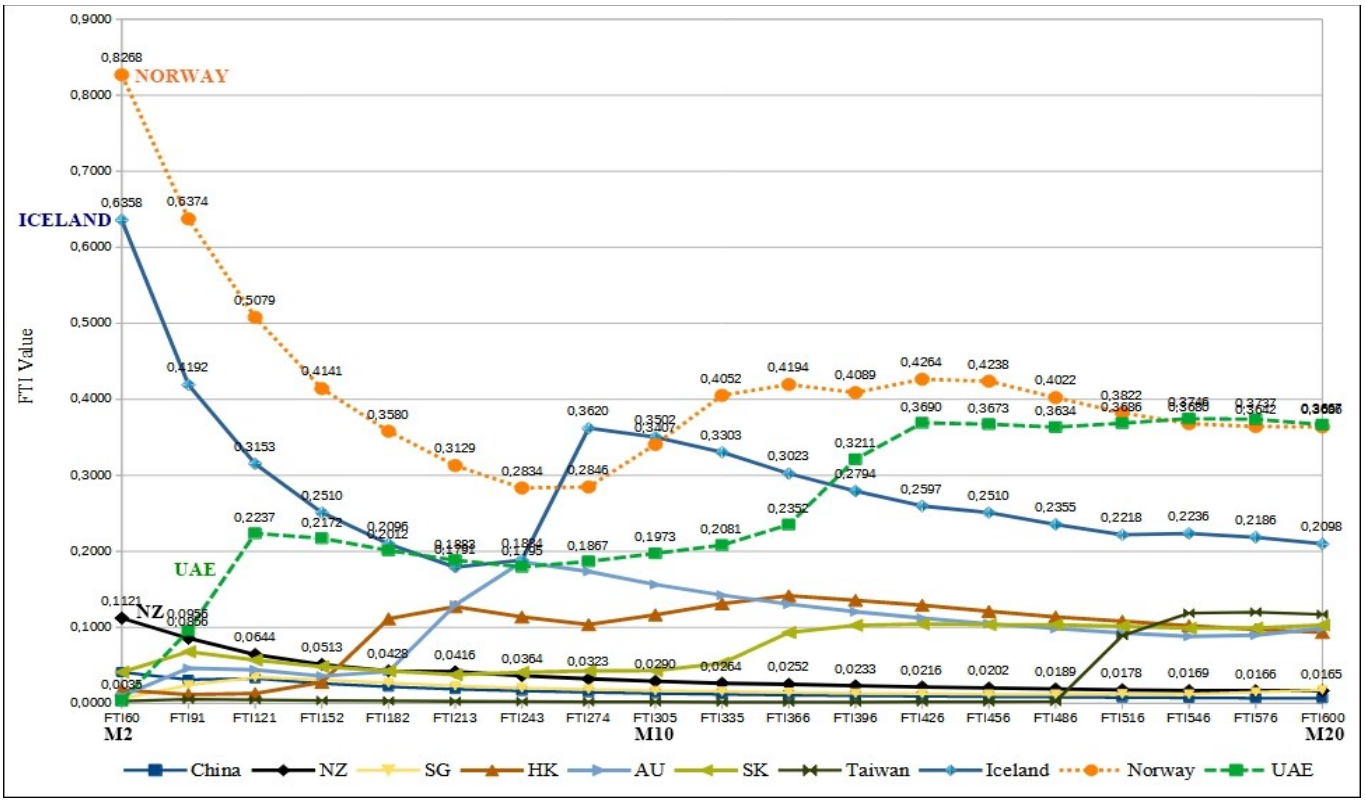


Chart 3: Evolution of each country FTI in terms of position overtime

Rank	FTI60	FTI91	FTI121	FTI152	FTI182	FTI213	FTI243	FTI274	FTI305	FTI335	FTI366	FTI396	FTI426	FTI456	FTI486	FTI516	FTI546	FTI576	FTI600
1	VT	VT	VT	VT	VT	Twan	Twan	Twan	Twan	Twan	Twan	Twan	Twan	Twan	Twan	VT	CN	CN	CN
2	TH	Twan	Twan	Twan	Twan	VT	VT	VT	VT	VT	VT	VT	VT	VT	VT	CN	SG	SG	NZ
3	Twan	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	CN	SG	NZ	NZ	SG
4	UAE	HK	HK	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	SG	NZ	VT	AU	HK
5	SG	SG	MY	MY	MY	MY	MY	SG	SG	SG	SG	SG	SG	SG	NZ	TH	AU	HK	AU
6	JP	JP	CN	HK	SG	SG	SG	MY	NZ	NZ	NZ	NZ	NZ	NZ	TH	Twan	TH	SK	SK
7	AU	CN	SG	SG	AU	SK	NZ	NZ	MY	MY	MY	MY	MY	SK	AU	AU	SK	Twan	Twan
8	MY	MY	AU	AU	SK	NZ	SK	SK	SK	SK	SK	SK	SK	AU	SK	SK	HK	TH	IS
9	HK	AU	SK	SK	NZ	JP	JP	JP	JP	JP	AU	AU	AU	MY	HK	HK	Twan	IS	NO
10	USA	SK	NZ	NZ	JP	CY	HK	HK	HK	HK	HK	HK	HK	HK	MY	IS	IS	NO	UAE
11	CN	NZ	JP	JP	HK	HK	CY	AU	AU	AU	JP	JP	IS	IS	IS	MY	NO	UAE	JP
12	SK	UAE	CY	CY	CY	AU	UAE	UAE	UAE	UAE	UAE	IS	JP	JP	JP	UAE	UAE	JP	TH
13	FI	QA	UAE	UAE	Latvia	IS	AU	CY	QA	QA	QA	QA	UAE	UAE	UAE	NO	JP	VT	FI
14	CA	CY	Latvia	Latvia	UAE	Latvia	IS	NO	FI	IS	IS	UAE	QA	NO	NO	JP	QA	QA	QA
15	QA	Latvia	IS	IS	IS	UAE	NO	FI	NO	NO	NO	NO	NO	QA	QA	QA	FI	FI	VT
16	DE	GR	GR	GR	GR	NO	Latvia	QA	IS	FI	FI	FI	FI	FI	FI	FI	MY	MY	CY
17	NZ	IS	Israel	Malta	Czech	LT	FI	IS	CY	CY	CY	CY	CY	CY	CY	CY	CY	CY	DK
18	CY	Israel	QA	Czech	NO	GR	QA	EE	DK	DK	DK	DK	DK	DK	DK	DK	DK	DK	MY
19	Latvia	Czech	Malta	Israel	Malta	QA	EE	DE	DE	DE	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel
20	Chile	Malta	Czech	NO	LT	FI	LT	DK	EE	Israel	EE	CA	CA	CA	CA	CA	CA	CA	CA
21	Malta	FI	NO	QA	QA	Czech	GR	Latvia	Israel	EE	DE	EE	DE	DE	DE	DE	DE	DE	DE
22	Israel	NO	LT	LT	FI	EE	AT	Israel	CA	CA	CA	DE	EE	AT	AT	AT	AT	AT	ND
23	GR	LT	PL	FI	EE	AT	DK	LT	Latvia	GR	GR	AT	AT	ND	ND	ND	ND	ND	AT
24	Czech	PL	FI	PL	PL	PL	DE	GR	AT	AT	AT	GR	ND	EE	EE	EE	EE	EE	LU
25	PL	EE	EE	EE	Israel	DK	PL	AT	GR	Latvia	Chile	ND	LU	LU	LU	LU	LU	LU	EE
26	FR	Chile	AT	AT	AT	Israel	Israel	CA	PT	Chile	LU	Chile	Chile	Malta	Malta	Malta	Swi	Swi	Swi
27	LT	AT	SI	DK	DK	DE	Malta	PT	Malta	LU	ND	LU	Swi	Swi	Swi	Swi	Malta	Malta	Malta
28	IS	DE	DK	SI	SI	SI	LU	LU	ND	Malta	Malta	Malta	Malta	Chile	Chile	Chile	PT	Chile	Chile
29	NO	SI	DE	DE	DE	Malta	PT	Malta	LT	ND	Latvia	Latvia	GR	Latvia	PT	PT	Chile	PT	PT
30	SE	DK	PT	HU	HU	LU	Swi	Swi	LU	Swi	Swi	Swi	Latvia	GR	Latvia	Latvia	Latvia	Latvia	SE
31	EE	CA	HU	PT	PT	PT	Czech	ND	Chile	PT	PL	PT	PT	PT	GR	GR	GR	IE	IE
32	AT	PT	LU	LU	LU	HU	SI	PL	IE	IE	FR	SE	SE	IE	IE	IE	IE	SE	Latvia
33	DK	HU	Swi	Swi	Swi	Swi	CA	Chile	Swi	PL	PT	IE	IE	SE	SE	SE	SE	GR	GR
34	SI	LU	CA	CA	CA	CA	ND	Czech	PL	USA	IE	FR	FR	FR	USA	USA	USA	FR	FR
35	UK	USA	Chile	ND	ND	ND	HU	FR	SE	SE	USA	PL	LT	USA	FR	FR	FR	USA	PL
36	HU	Swi	USA	Chile	Chile	Chile	Chile	IE	USA	FR	SE	USA	USA	LT	LT	LT	LT	PL	USA
37	PT	ND	ND	USA	USA	FR	FR	SE	Czech	Czech	LT	LT	PL	PL	PL	PL	PL	Czech	Czech
38	LU	SE	FR	FR	FR	IE	IE	USA	FR	LT	Czech	BE	BE	BE	BE	BE	BE	LT	LT
39	Swi	FR	SE	IE	IE	USA	USA	SI	BE	BE	BE	Czech	Czech	Czech	Czech	Czech	Czech	BE	BE
40	BE	IE	IE	SE	SE	SE	SE	BE	UK	UK	SI	SI	SI	SI	SI	SI	SI	SI	SI
41	ND	BE	BE	BE	BE	BE	BE	HU	SI	SI	Italy	Italy	Italy	UK	UK	UK	UK	UK	UK
42	IE	UK	UK	Italy	Italy	Italy	Italy	Italy	Italy	Italy	UK	UK	UK	Italy	Italy	Italy	Italy	Italy	Italy
43	Italy	Italy	Italy	UK	UK	UK	UK	UK	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU
44	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES

Table 8: Evolution of the 22 best countries FTI overtime organized in ascending order of FTI600

Countries	FTI60	FTI91	FTI121	FTI152	FTI182	FTI213	FTI243	FTI274	FTI305	FTI335	FTI366	FTI396	FTI426	FTI456	FTI486	FTI516	FTI546	FTI576	FTI600
China	0,0411	0,0312	0,0329	0,0262	0,0219	0,0187	0,0164	0,0145	0,0130	0,0119	0,0109	0,0100	0,0093	0,0087	0,0082	0,0077	0,0073	0,0069	0,0066
NZ	0,1121	0,0856	0,0644	0,0513	0,0428	0,0416	0,0364	0,0323	0,0290	0,0264	0,0252	0,0233	0,0216	0,0202	0,0189	0,0178	0,0169	0,0166	0,0165
Singapore	0,0061	0,0240	0,0346	0,0311	0,0270	0,0230	0,0202	0,0186	0,0167	0,0157	0,0144	0,0133	0,0128	0,0120	0,0120	0,0123	0,0120	0,0148	0,0176
HK	0,0175	0,0116	0,0130	0,0277	0,1113	0,1273	0,1137	0,1037	0,1165	0,1312	0,1416	0,1356	0,1291	0,1212	0,1137	0,1081	0,1022	0,0973	0,0934
Australia	0,0096	0,0462	0,0443	0,0359	0,0419	0,1295	0,1861	0,1735	0,1562	0,1424	0,1305	0,1206	0,1121	0,1048	0,0984	0,0927	0,0881	0,0897	0,0988
SK	0,0411	0,0680	0,0570	0,0483	0,0427	0,0378	0,0408	0,0428	0,0431	0,0528	0,0931	0,1026	0,1044	0,1036	0,1034	0,1015	0,0988	0,0992	0,1031
Taiwan	0,0028	0,0055	0,0048	0,0039	0,0032	0,0028	0,0024	0,0021	0,0019	0,0018	0,0016	0,0019	0,0020	0,0020	0,0026	0,0891	0,1186	0,1202	0,1172
Iceland	0,6358	0,4192	0,3153	0,2510	0,2096	0,1791	0,1884	0,3620	0,3502	0,3303	0,3023	0,2794	0,2597	0,2510	0,2355	0,2218	0,2236	0,2186	0,2098
Norway	0,8268	0,6374	0,5079	0,4141	0,3580	0,3129	0,2834	0,2846	0,3407	0,4052	0,4194	0,4089	0,4264	0,4238	0,4022	0,3822	0,3680	0,3642	0,3636
UAE	0,0035	0,0956	0,2237	0,2172	0,2012	0,1883	0,1795	0,1867	0,1973	0,2081	0,2352	0,3211	0,3690	0,3673	0,3634	0,3686	0,3746	0,3737	0,3667
JP	0,0065	0,0292	0,0806	0,0851	0,0757	0,0715	0,0836	0,0843	0,0865	0,1123	0,1675	0,2457	0,2851	0,2927	0,3301	0,3831	0,3842	0,3737	0,3822
TH	0,0003	0,0080	0,0085	0,0070	0,0058	0,0050	0,0044	0,0039	0,0036	0,0033	0,0033	0,0037	0,0037	0,0039	0,0195	0,0507	0,0935	0,2158	0,3850
FI	0,0480	0,5927	0,6794	0,5650	0,4733	0,4118	0,3706	0,3383	0,3374	0,4299	0,4800	0,4906	0,5077	0,5242	0,5107	0,4917	0,4709	0,4627	0,4586
QA	0,0667	0,1452	0,3640	0,4399	0,4290	0,4023	0,3790	0,3463	0,3203	0,2964	0,2811	0,2892	0,4182	0,4855	0,4844	0,4656	0,4407	0,4198	0,4658
VT	0,0000	0,0000	0,0000	0,0000	0,0000	0,0038	0,0043	0,0038	0,0034	0,0031	0,0029	0,0026	0,0025	0,0023	0,0026	0,0040	0,0217	0,3921	0,7955
CY	0,2615	0,2069	0,1643	0,1308	0,1264	0,1179	0,1205	0,2596	0,4836	0,6620	0,6716	0,7079	0,8250	0,8373	0,8179	0,8879	0,9847	1,0115	0,9972
DK	1,7343	1,5211	1,2165	0,9828	0,8355	0,7425	0,7110	0,7257	0,9620	1,4913	1,5700	1,4862	1,4193	1,3425	1,2696	1,2024	1,1484	1,1169	1,0926
MY	0,0112	0,0362	0,0319	0,0267	0,0227	0,0197	0,0184	0,0281	0,0380	0,0450	0,0632	0,0923	0,0985	0,1058	0,1637	0,3073	0,4861	0,8362	1,2513
Israel	0,4204	0,4203	0,3467	0,3878	0,6094	0,8194	1,2925	1,3795	1,4096	1,7290	2,0890	2,1194	2,0423	1,9232	1,8133	1,7147	1,6971	1,7948	1,8186
CA	0,0513	1,6651	3,1296	3,1362	2,7376	2,3920	2,1336	2,0431	2,1829	2,5002	2,9874	3,0978	3,0064	2,9541	2,9268	2,8437	2,7222	2,6098	2,5548
DE	0,1105	1,2714	1,3318	1,1215	0,9552	0,8298	0,7408	0,7074	1,0014	1,7196	2,8565	3,3585	3,3900	3,4250	3,4464	3,3417	3,1839	3,0352	2,9457
ND	7,7653	6,6895	5,2031	4,1691	3,5232	3,0860	3,0309	3,4878	3,7335	4,2275	4,3794	4,2898	4,1405	3,9818	3,7645	3,5582	3,3961	3,2493	3,1390

Concerning to Resilience Index, Tables 9 and 10 results revealed that:

First) Among the ten top countries, most (80%) is considered resilient, and NZ (RI_{600}=85%), Iceland (RI_{600}=81%), China (RI_{600}=80%), Taiwan (RI_{600}=66%), and Singapore (RI_{600}=54%) were the five best performers, with the highest number of days without presenting fatal cases during 20 months (600 days) of combating Covid-19, while Norway was the last resilient (RI=9%), calling the attention South Korea, and UAE performance, since they were not resilient, meaning that they were not able to record any period equal to or above 14 days without reporting Covid-19 fatal cases.

Table 9: Resilience Index of the Top ten countries

Country	**$Plife_N$**: Five longest period (=> 14 days) without deaths	**ND_L**	**TND_L**	**Resilience Index RI**	**Total Deaths / 1M (TD1M)** (Pop. 2021)
CN	P1 = 17 April – 16 May/2020	30	30	30 *100/ 138 = 22%	4633 / 1439 = 3.219
	P2 = 17 May/20 – 13 Jan/2021	**242**	272	272*100/ 380 = 72%	4634 / 1439 = 3.220
	P3 = 26 January – 22 Aug/21	**209**	**481**	**481 *100 / 600 =80%**	4636 / 1439 = **3.221**
NZ	P1 = 06 – 27 May/20	22	22	22*100 / 90 = 24%	21 / 5.002 = 4.198
	P2 = 28 May – 03 Sep/20	**99**	121	121*100 / 189 = 64%	22 / 5.002 = 4.398
	P3 = 16 Sep/20 – 15 Feb/21	**153**	274	274*100 / 354 = 77%	25 / 5.002 = 4.998
	P4 = 16 February – 03 Sep/21	**200**	474	470*100 / 554 = 86%	26 / 5.002 = 5.197
	P5 = 04 Sep – 07 Oct/21	34	**508**	**508*100 / 600 = 85%**	27 / 5.002 = **5.398**
SG	P1 = 13 jun – 13 July/20	31	31	31*100 / 173 = 18%	26 / 5.9 = 4.406
	P2 = 14 July – 11 Oct/20	**90**	121	121*100 / 263 = 46%	27 / 5.9 = 4.576
	P3 = 12 October – 27 Nov/20	47	168	168*100 / 310 = 54%	28 / 5.9 = 4.746
	P4 = 28 Nov/20 –12 March/21	**105**	273	273*100 / 415 = 66%	29 / 5.9 = 4.915
	P5 = 13 March – 30 April/21	49	**322**	**322*100 / 600 = 54%**	30 / 5.9 = **5.085**
HK	P1=14 March – 19 Jun/20	**98**	98	98*100 / 118 = 83%	4 / 7.572 = 0.528
	P2 = 25 September – 03 Nov/20	40	138	138*100 / 255 = 54%	105 / 7.572 = 13.867
	P3 = 01 May – 24 Jun/21	55	193	193*100 / 280 = 69%	108 / 7.572 = 14.263
	P4 = 05 July – 12 Sep/21	70	263	263*100 / 567 = 47%	212 / 7.572 = 27.998
	P5 = 13 Sep – 15 Oct/21	34	**297**	**297*100/600 = 49%**	213 / 7.772 = **27.406**
AU	P1 = 23 May – 23 Jul/20	62	62	62*100 / 181 = 34%	102 / 25.865 = 3.943
	P2 = 28 October – 29 Nov/20	33	95	95*100 / 310 = 31%	907 / 25.865 = 35.067
	P3 = 30 November – 27 Dec/20	28	123	123*100 / 338 = 36%	908 / 25.865 = 35.105
	P4 = 28 Dec/20 – 12 April/21	**106**	229	229*100 / 444 = 52%	909 / 25.865 = 35.144
	P5 = 13 April – 10 Jul/21	89	**318**	**318*100/ 600 = 53%**	910 / 25.865 = **35.183**
SK	No period	-	-	No Resilience	-
Twan	P1 = 16 Feb – 19 March/20	33	33	33*100 / 59 = 55%	1 / 23.870 = 0.0420
	P2 = 10 April – 10 May/20	31	64	64*100 / 111 = 58%	6 / 23.870 = 0.2514
	P3 = 11 May 2020 – 29 Jan/21	**264**	328	328*100 / 375 = 87%	7 / 23.870 = 0.2932
	P4 = 04 Feb – 05 March/21	30	358	358*100 / 410 = 87%	9 / 23.870 = 0.3770
	P5 = 06 March –10 Ap/21	37	**395**	**395*100 / 600 = 66%**	10 / 23.870 = **0.4189**
IS	P1 = 20 April – 15 Oct/20	**179**	**179**	179*100 / 231 = 77%	10 / 0.343 = **29.154**
	P2 = 8 – 29 Dec/20	22	201	201*100 / 306 = 66%	28 / 0.343 = 81.632
	P3 = 30 Dec/20 – 25 May/21	**147**	348	348*100 / 453 = 77%	29 / 0.343 = 84.548
	P4 = 26 May – 25 Aug/21	**92**	440	440*100 / 545 = 81%	30 / 0.343 = 87.463
	P5 = 29 August – 20 Oct/21	44	**484**	**484*100 / 600 = 81%**	33 / 0.343 = **87.463**
NO	P1=17 July – 02Aug/20	16	**16**	16*100 / 159 = 10%	255 / 5.473 = **46.592**
	P2 = 20 August – 09 Sep/20	21	37	37*100 / 197 = 19%	264 / 5.473 = 48.237
	P4 = 21 July – 04 Aug/21	15	**52**	**52*100 / 600 = 9%**	799 / 5.473 = **145.989**
UAE	No period	-	-	No Resilience	-

It is worth noting that when the Relicience Index is used together with Total Deaths (cumulative confirmed Covid-19 deaths) per million people (TD1M), it was found that not always high Resilience Index means that a country has the lowest TD1M, as observed in Iceland (RI600=81%; TD1M600=87.463), reason by which it is necessary to use both indicators to better evaluate and rank the countries performance.

Second) Among the ten last countries (Table 10), most (80%) were not considered Resilient, except Slovenia and Lithuania, but both reported low RI600 (8%) and high values of TD1M600, respectively equal to 52.857 and 23.703.

Table 10: Resilience Index of the Last ten countries (critical)

Country	**Plife$_N$**: Five longest period (=> 14 days) without deaths	**ND$_L$**	**TND$_L$**	**Resilience Index RI**	**Total Deaths / 1M (TD1M)** (Pop. 2021)
ES	No period	–	–	No Resilience	–
HU	No period	–	–	No Resilience	–
IT	No period	–	–	No Resilience	–
UK	No period	–	–	No Resilience	–
SI	P1 = 01 – 27 Jun/20 P2 = 28 Jun – 18 Jul/20	27 21	27 48	27*100/116 = 23% **48*100/600 = 8%**	109 / 2.1 = 51.904 111 / 2.1 = **52.857**
LI	P1 = 02 – 17 Jul/20 P2 = 18 Jul – 04 Aug/20 P3 = 05 – 19 Aug/20	16 18 15	16 34 49	16*100/141 = 11% 34*100/159 = 21% **49*100/600 = 8%**	62 / 2.7 = 22.963 63 / 2.7 = 23.333 64 / 2.7 = **23.703**
BE	No period	–	–	No Resilience	–
Czech	No period	–	–	No Resilience	–
USA	No period	–	–	No Resilience	–
PL	No period	–	–	No Resilience	–

5.4 Perceptions of 131 people living in NZ

Between 21st June and 10th November 2020, nine Boost Posts run for a total of almost 100 days with the invitation and link of the questionnaire. The Posts reached 18298 people living in NZ, from which 131 (0,71%) respondents accepted voluntarily to participate in the survey.

5.4.1 Respondents profile

a) most (127=97%) informed the age, 64 years old is the average, the median age is 65 years old, the youngest respondent has 21 years old, and the oldest has 86 years old. This indicates that adult and old people are more motivated to participate in the survey.

b) most (85=65%) is native, while 46 (35%) are foreigners. Most foreigners (44=96%) accepted to inform the time living in NZ, with the average and median time being like 32 years, meaning that most respondents know the country. Only one foreigner is living there for less than one year.

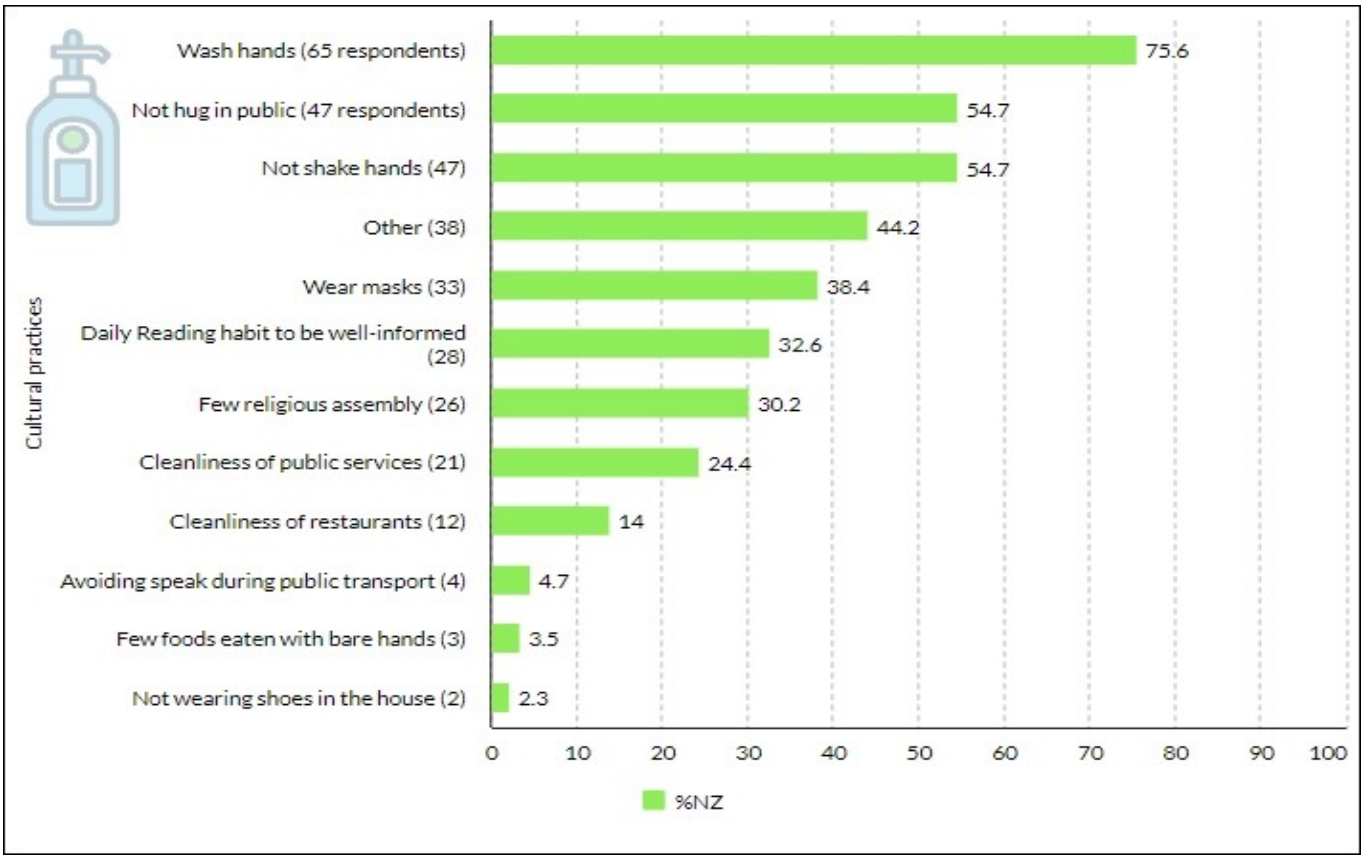
5.4.2 Cultural practices from the perception of 86 respondents

Forty-five (22 foreigners; 23 natives) respondents (34%) don´t believe that cultural practices were decisive to the low rate of Covid–19 in NZ, while 86 (66%) believe in that. It is worth noting that the percentage of believers in NZ is lowest when compared with Thailand (91.67%) Taiwan (95.41%), and Vietnam (94.4%) as found by Gomes da Silva (2020 p.113), Silva (2021a p. 453), and Silva (2021b p. 755), which may indicate that such practices are more present in these Asia countries than in NZ.

From the group that believe (Figure 13), the most decisive cultural practices were: first) wash hands (75.6%), 2nd) not hug in public (54.7%), 3rd) not shake hands (54.7), 4th) Other (44.2%), and 5th)

wear a mask (38.4%). On the other hand, the less decisive were 12th) not wearing shoes in the house (2.3%), 11th) few foods eaten with bare hands (3.5%), 10th) avoiding speak during public transport (4.7%), 9th) cleanliness of restaurants (14%), 8th) cleanliness of public services (24.4%).

Figure 13: Cultural practices that were decisive to reduce the rate of Covid–19 deaths in NZ



When the NZ results were compared with Gomes da Silva (2020 p. 135), Silva (2021a p. 453), and Silva (2021b p. 755), it was observed that:

a) Not shaking hands, washing hands, and not hugging in public is among the top five culture practices, while cleanliness of restaurants, few foods eaten with bare hands, and not wearing shoes in the house (except Thailand) appeared among the less decisive cultural practices that saved lives against Covid–19;

b) the highest difference is concentrated in NZ Others practices with 44.2% (5th place) of the believers, the highest value when compared with Taiwan (7.69%; 12th place), Vietnam (23.8%; 10th place), and Thailand (26.74%; 7th place). Here is interesting to note that in NZ there is the traditional Maori greeting called the Hongi, where two people touch and press their noses together, especially from the Maori tribe. However, during the pandemic, local Hauora (Maori philosophy of health and well-being) and Iwi (largest social units) leaders were active, advising people to modify their social engagement practices and restrict hongi (pressing of noses), kihi (kisses), and harirū (handshakes), which Maori elders understanding about the Covid-19 and experience during the pandemic was investigated and described by the team leader Muru-Lanning et al (2021);

c) Although Wear Mask appeared among the top five culture practice in NZ (38.4%; 5th place), when the % is compared against Thailand (97.67%; 1st place), Taiwan (87.5%; 1st place), and Vietnam (84.16%; 1st place), it is observed a considerable difference of respondent perceptions, which indicate that Wear Mask is stronger adopted as cultural practices among the three Asian countries than in NZ.

5.4.3 Trust in the National Government of NZ

All respondents rated from 0 to 10 the level of trust in official statistics released by the National Government of NZ about the number of death cases by Covid–19.

The average of trust is high (X=8.72; S=2.41; CV=27.62%) and the median is 10, with most (112=88%) giving a rate equal to or over 7 points, while 12% rated lower than 7 points.

When the answers are compared by the foreigners and natives, only 2.2% of foreigners rated lower than 7, while 17% of natives did so, showing that the suspicion is higher in native people.

5.4.4 The perception of the respondents on the main policy measures adopted that saved lives

Concerning the respondents' perception, all respondents selected at least one (multiple choice) of 19 measures provided.

As a result, for the 131 respondents (Figure 14), the ten main policy measures adopted by the Central Government of NZ that saved lives against the Covid–19 are: international travel control (81.68%), 2nd) public event cancellations (75.57%), 3rd) restriction on internal movement (70.23%), 4th) public information campaigns (64.89%), 5th) schools closures (64.89%), 6th) support the expansion of testing system (61.07%), 7th) wage subsidies for workers (60.31%), 8th) workplac1es closures (56.49%), 9th) increase the medical and personal equipment capacity (45.04%), and 10th) effective public-private collaboration (40.46%).

Figure 14: Main NZ Central Government policies that saved lives against Covid–19

On the other hand, the policy measures that respondents considered less decisive to save people lives are 18th) reduction of bureaucracy (6.11%), 17th) low–interest loans (10.69%), 16th) online training programs (14.5%), 15th) Other (15.27%), and 14th) Tax Relief (15.27%).

When the NZ results were compared with other countries investigated by Gomes da Silva (2020 p. 135), Silva (2021a p. 453), and Silva (2021b p. 755), it was observed that:

a) only International Travel Control measure was considered as the common best national government measure to save lives against Covid-19, situating in the first place not only in NZ (81.68%), but also in Taiwan (77.98%), Vietnam (87.7%), and Thailand (88.54%). Other measures well evaluated among these countries were: a1) Public Event Cancellation, situating in the second place in NZ (75.57%) and Thailand (81.25%), fourth place in Vietnam (66%), and seventh place in Taiwan (44.95%); a2) Public Information Campaign, situated in the second place in Vietnam (71.7%), third place in Taiwan (52.3%), fourth place in NZ (64.9%), and sixth place in Thailand (59.4%); and a3) School closures, well evaluated by the respondent from Thailand (77.08%; 3rd place), Vietnam (68.8%; 3rd place), and NZ (64.9%; 5th place) with exception to Taiwan (15.6%; 10th place);

b) and the less decisive measure considered common by the four countries were: b1) Low-interest loans (2.75% in Taiwan; 9.4% in Thailand and also in Vietnam; and 10.7% in NZ); b2) Reduction of bureaucracy (6.11% in NZ; 11.5% in Thailand; 14.68% in Taiwan; and 16% in Vietnam); b3) Tax relief (9.2% in Taiwan; 12.5% in Thailand; 15.7% in NZ; and 16% in Vietnam); b4) Online training (7.34% in Taiwan; 14.5% in NZ and also in Thailand) with exception to Vietnam (30.2%).

Concerning the best policy, **international travel control**, it is possible to mention several early responses related with, as shown in Appendix A, such as 50 Armed Force personnel supported the NZ Police with vehicle checkpoints established as the Auckland region moved to Alert Level 3 from 14 February 2020; Non-residents of NZ who have been to China or Iran in the ending of February 2020, were not allowed to enter the country from 13 March 2020; From 14th March 2020, all new arrivals from other countries must self-quarantine for 14 days (except for those arriving from selected Pacific countries); Cruise ships was not permitted to enter in NZ's territorial waters from 23:59 Saturday 14 March 2020, remaining in place until at least 30 June 2020; NZ's borders were closed to almost all travelers from 23:59 on Thursday 19 March 2020, etc.

One example of **public event cancellation** in NZ is the Auckland's Pasifika Festival, canceled on 13 March 2020, a two days festival that was expected to involve 400 local and international artists to attract 60000 people to Western Spring Park. In addition, from 19 March 2020, Gatherings or events where 500 or more people are together in one place outdoors, or 100 people indoors, at one time were canceled. Other events canceled or postponed overtime are Auckland Baby Show, Auckland Fried Chicken Festival, NZ Fashion Week, Pukekohe Duathlon, Vietnam Veterans` Day, Visa Wellington on a Plate, Tales from the Trail, Helping Hands, Spa World Winter Splash, NZ Agriculture Show, etc (STUFF, 2021; NZ HERALD, 2021).

Concerning to **public information campaign**, the Ministry of Health launched 29 February 2020 the campaign "Our health is in our hands" with tips to protect each other from germs and viruses <https://bit.ly/3mLsZbg>.

The NZ Government team opted to focus to spread a very human message and the second campaign was "United Against Covid-19" delivered from 18 March 2020, by using a website <https://covid19.govt.nz/> as the government´ single source of truth, followed by the support of radio, television and digital media, some of them described in the section 5.2.2 of this article, which contributed for 700 million views after three months of use (THE GUARDIAN, 2021).

As mentioned in section 5.2.2, Public Campaign Awareness Getting Through Together was launched on 07 April 2020 to help New Zealanders share ways to help people living in NZ cope with the stress of COVID-19. The Campaign was developed by All Right? in partnership with Canterbury DHB and the Mental Health Foundation.

5.4.5 Innovative products and services developed in NZ against Covid–19 until October 15th, 2021

For question 5 of the questionnaire and additional search, some examples are:

Led by Public Sector: a) Operation Protect (OP), a militar operation to support all NZ government Covid-19 response; b) Four Level Covid19 Alert System supported by Daily TV update and Regular Press Conference; c) Set up Drive-through hubs for testing; d) development of plan (Maori Response Action Plan), platform and allocation of resources to protect traditional communities such as $56 million to support Māori communities & businesses, Ki te Ao Márama Platform, where Ministry of Education launched the Learning from home and Ki te Ao Márama websites to support teachers, parents, and whānau in helping children to continue to learn; e) Business Support Package for Covid-19 (NZ$ 9.3 b); f) $27 million package for NGOs; g) $ 25m Covid-19 Innovation Acceleration Fund to develop new products and services that could help to detect, diagnose, treat or prevent Covid-19, by supporting Research & Development, prototyping and pre-production activities; h) National Action Plan 2.0 and 3.0 to direct the national response during the current COVID-19 Alert Level 4; i) Covid-19 research database to make sure the sector is well coordinated, able to share ideas and work together; j) $50 million support for media industry; l) Tools to assist job seekers, a New Zealand Working online recruitment tool <https://www.-jobs-during-covid.workandincome.govt.nz/hello> that connects job seekers directly to the employer making it quicker and easier for people to find work. The tool, now live, also provides online training courses; m) $25m Relief Package for Sports Sector; n) NZ COVID Tracer app, allowing NZ people to create a digital diary of places that visited by scanning the official QR codes. This helps contact tracers to quickly identify and isolate anyone who may have been exposed to COVID-19 if there is a further outbreak in New Zealand; o) $50 billion COVID-19 Response and Recovery Fund (CRRF); p) Unite against Covid-19 campaign and site <https://covid19.govt.nz>; p) Wage Subsidy Scheme for business; q) Callaghan Innovation's R&D Loan Scheme to help businesses continue their research and development activities impacted by COVID-19; r) Apprenticeship Boost Initiative Programme that provides financial support to employers to keep existing or take on new first and second year eligible apprentices, who are employed and in training towards their qualification, as New Zealand recovers from the impacts of the COVID-19 pandemic; s) Set up 15 testing centres open for Aucklanders to get swabbed for Covid-19; t) $35m Oxygen Supply and Related Environmental Systems, which provides funding for the purchase of supplies and installation of equipment to ensure that if there is a surge in the number of COVID-19 patients, they can receive oxygen at appropriate pressures and treatment areas are safe; u) $50m Personal Protective Equipment (PPE), which provides funding to ensure the provision of personal protective equipment (PPE) in 2020/21 that will protect New Zealanders, including health and disability workers, from communicable diseases, such as COVID-19; v) $ 76 million to Increase Hospital ICU Capacity and Ventilators; x) New N95 mask guidelines for frontline MIQ workers; z) Flexi-wage Employment Assistance Programme, which provides special assistance for eligible people who are disadvantaged in the labour market or at risk of long-term benefit receipt by supporting them into employment or providing training or in work support until they the gain employment skills required and meet the entry level requirements of that job, etc…

Led by Corporation Sector: a) Nacional Contact Trace Solution (NCTS) developed by Delloit NZ and MoH; b) Sanitising conveyor project under development by Dyno Ldta; c) Mechanical ventilator developed (RespiratorNZ) by ES Plastics Ltd; d) AIRVO 2 Nasal System, and other respiratory support and humidification products developed by Fisher & Paykel Healthcare; e) Medinz Communication Platform developed by Health Point Ltda to support public health agencies to get sensitive, time-critical messages to Gps, enabling NZ to coordinate the healthcare community response, stop the spread and manage resurgences; f) Improvements of long life antiviral and antimicrobial coatings by Inhibit Coatings Ltd, in order

to prevent transmission from touch surfaces in high-risk environments; g) Melon app from Melon Health to provide a health journal, resources and self-awareness tools to help people to manage his/her emotional wellbeing; h) Anti-Viral Aerosol Protection System for Dental and Medical Personnel from Rhondium Ltd; I) Thermal cameras to screen for individuals from The Cacophony Project Ltd; I) Liberty16 (mobile RT-PCR testing) from Ubiquitome Ltd, to bring mobility to PCR testing and reduce cost; m) In Case of Crisis App from Wright Communications, which enablesteam to collaborate better, respond faster and engage protocols intelligently; n) Nasal Swab to secure DNA/RNA samples for detection of mucus/saliva based illnesses, under development by Zoom Tech Limited, etc…

Led by Universities: a) from Auckland University of Technology: a1) Antibody-based tests for SARS-CoV-2; a2) Antiviral therapeutics and development platform for COVID-19; a3) Covid-19 well-being app; a4) Improvement of Aroha chatbot to help teenagers; a5) Low-cost non-invasive lung imaging system for continuous patient monitoring during mechanical ventilation; a6) Mobile solution to disinfect and potentially reuse PPE; b) from Massey University: b1) Dipstick assay for direct detection of Covid -19 (antigen); b2) Protocols to rapid diagnosis and genome sequencing to follow Covid-19 outbreak; c) University of Canterbury: c1) Safely and effectively doubling ventilator capacity, with a technology that provides a simple, clever way to safely and effectively provide ventilation for 2 patients on 1 ventilator, doubling capacity to manage overwhelming waves of patients (if required), etc…

Led by Start-Ups and Others: a) Light sterilization and MicroRNA-based diagnosis of Covid-19 in asymptomatic people developed by AgResearch and partners; b) Health and Safety Management app/ web developed by Auditz, a cloud-based safety management system to help small to medium-sized businesses; c) Getting Through Together from Healthy Christchurch & Canterbury DHB & MHF, to provide tips and advice on how to cope with stress in times of difficulty during the pandemic; d) Smart Cart Cashierless Checkout from IMAGR, an integrated shopping cart scans products in real-time, eliminating the need for traditional checkouts; e) Kami app to support digital children education; f) Karma For Education and Chat from Karma Bot, an online platform that motivates employees or students, keep high levels of engagement, increase attendance, productivity and happiness; g) Kode Technology SARS-CoV-2 (Covid-19) Antibody Diagnostic, from Kode Biotech Ltd; h) Aunt Dee from Le Va, a free online tool for anyone who needs some help working through a problem or problems; i) Covid-19 Safe Working Guide from NZ PC (Prostitutes Collective), to offer safe working, guidelines, and advice to sex workers; j) Robot Management Software/Robot Operations Platform from Rocos, a robot management software that provides a complete and secure service that shortens the time-to-market for companies looking to automate physical robot fleets and reduce the overheads of operating them; l) Queue management software for retailers developed by Safe Lines to help retailers stagger the number of customers in their shops at one time. It could also help speed up the queuing process post-Covid-19; m) ZEDOC Remote Monitoring developed by The Clinician, which allows patients to be clinically monitored from home, including the seamless collection of vitals from wearable devices; n) Timedock online solutions to manage employees from distance; o) Well Revolution App that permits to chat with a doctor 24/7, etc.

6. Conclusions and recommendations

This research investigated the NZ performance and management practices used to save lives during 600 days of battle against the Covid-19.

From the data collection and analysis, it is possible to conclude and recommend:

a) **Public Sector fast responses based on science is crucial**. During the first 100 days, from 31 December 2019 until 09 April 2020, at least 116 responses were adopted in NZ to protect and save lives against Covid-19, most (75; 65%) developed by the Public Sector, which played an important role to im-

plement plans and measures to stimulate life adaptation, provide efficient and transparent communication based on scientific findings, as well as provide economic, fiscal and other forms of support to the population.

Further research should be done to investigate the effective contribution and impact of NZ Parliament Acts, Regulations, Notices, Rules, and amendments on the low rate of fatal cases of Covid-19 since they represented 68% of all 25 measures related to Life Adaptation. This is an important point since several authors focus more on the Public Executive actions than on the contributions of the Parliament or Justice during a pandemic. In addition, further research is recommended to investigate which measures related to Information/Communication, as well as Economic, Fiscal, and Support contributed decisively to develop a national sense of integration and cooperation to support the NZ national agile elimination strategy against Covid-19;

b) **Exemplar Leadership and empathy of the top Public Leaders provide trust and contribute to national integration against the virus, and they dont forget traditional people**. Until 15 September 2021, 360 responses were found to prevent and/or protect the population against Covid-19 in NZ, with most of responses leaded by Public Sectors (240; 66.7%), followed by Corporations (41;11.39%), Universities (32; 8.89%), Others (30; 8.33%), and Start-Ups (17; 4.72%).

Some uniqueness of top NZ Public leaders responses, taken since the beginning of the pandemic is b1) the development and dissemination of the four-level Covid-19 Alert System, supported by main leaders participating actively in the Daily TV update and Regular Press Conference. This system became a kind of a standard that permitted most actors of the country to understand their roles and support the actions developed during each level; b2) development and improvement of National Action Plan, working in synchrony with the four-level Covid-19 Alert System; b3) development of national campaign and website "United Against Covid-19" with the main message "Be Strong, Be Kind" as the government's main source of truth, followed by the support of radio, television, digital media, and others described in the section 5.2.2; b4) development of Maori Response Action Plan, with platforms and allocation of resources to protect traditional communities, an investment that was neglected by critical countries like Brazil, where until 30th October 2021, 1228 Indians from 162 tribes officially died of Covid-19 without a specific plan, correct assistance and empathy from Brazilian National Government leaders (APIB, 2021);

c) **Compared against 43 countries, NZ is the second-best performer to save lives against Covid-19.** When is analyzed each country FTI600, estimated number of Covid–19 fatal cases by one million population during the first 600 days (20 months) facing the pandemic, China is the best performer, followed by NZ, Singapore, HK, Australia, SK, Taiwan, Iceland, Norway, and UAE, all considered the top ten benchmark nations.

On the other hand, the ten last countries (critical) with the highest value of FTI600 are Spain, Hungary, Italy, the UK, Slovenia, Lithuania, Belgium, Czech, USA, and Poland. In addition, some differences were noted in the median of the two groups, when other variables were considered, reason by which additional research could be done with the two groups, considering the use of advanced statistical techniques to investigate the correlation between the ratio of fatal cases of Covid-19 with each of this variable by considering the same period of analysis: c1) size of the population; c2) the percentage of vulnerable people with age equal or over 65 years old; c3) number of cardiovascular death rate per 100000 individuals; and c4) the percentage of smokers, especially female smokers rate;

d) **NZ was a unique country able to continuously reduce its FTI value and keep the pace of this position overtime**. When the position of every country is organized based on FTI ascending order (Chart 3) overtime, it was noted that only China and NZ were able to keep pace without losing position,

with special emphasis on NZ, since it was the unique country to reduce its FTI overtime, ascending continuously from FTI60 = 0.1121 (seventeenth place) to FTI600 = 0.0165 (second place).

In addition, it is necessary to act with caution concerning China Covid-19 Statistics since d1) National Government controls main media and has rigid internet control, censorship, and surveillance (KHALIL, 2020; ZHONG et al, 2020; MOYNIHAN AND PATEL, 2021); d2) at times, WHO and others authors have complained about the Chinese Government slowness and lack of transparency to provide data, especially related to the origin of the virus (AP NEWS, 2020; ROMANIUK, and BURGERS, 2020; SCMP, 2021; TIEZZI, 2021); d3) China was considered the 78th nation in terms of Corruption Perception Index 2020 (E.V., 2020), while NZ was considered in the first position, meaning that people living in NZ trust much more in the transparency of public sector than people living in China;

e) **Concerning to Resilience Index, it was found the NZ was considered the most resilient country with 85% of the period of 600 days without reporting officially fatal cases**. When calculating the Resilience Index of each ten top and ten last countries, it was observed that 80% of the top countries were considered resilient, while only 20% of the ten last countries were considered resilient. In addition, to better rank the nations, the Resilience Index should not be adopted alone, but it is recommended to be used with other indicators related to fatal cases, such as FTI or Fatal Cases per one Million people;

f) **International travel control is perceived as the main national policy that saved lives against Covid-19**. For the 131 respondents, the ten main policy measures adopted by the Central Government of NZ that saved lives against the Covid–19 are: international travel control, 2nd) public event cancellations, 3rd) restriction on internal movement, 4th) public information campaigns, 5th) schools closures, 6th) support the expansion of the testing system, 7th) wage subsidies for workers, 8th) workplac1es closures, 9th) increase the medical and personal equipment capacity, and 10th) effective public-private collaboration.

When the NZ results were compared with other countries investigated by Gomes da Silva (2020 p. 135), Silva (2021a p. 453), and Silva (2021b p. 755), it was observed that only international travel control measure was considered as the common best national government measure to save lives against Covid-19, situating in the first place no only in NZ, but also in Taiwan (109 respondents), Vietnam (107 respondents), and Thailand (96 respondents). Other measures well evaluated by the respondents of these countries were Public Event Cancellation, Public Information Campaign, and School closures, the reason by which public decision-makers should pay special attention to those measures when dealing with a pandemic. In addition, further research should be done to identify the best guidance, protocols, and technologies adopted by these countries concerning the implementation of these measures;

g) **In any plan against a pandemic, is necessary to insert strategies to help the population adopt new habits, especially when traditional cultural practice could spread the virus**. Among 131 respondents, 45 don´t believe that cultural practices were decisive to the low rate of Covid–19 in NZ, while 86 believe in that.

It is worth noting that the percentage of believers in NZ is lowest when compared with Thailand, Taiwan, and Vietnam as found by Gomes da Silva (2020 p.113), Silva (2021a p. 453), and Silva (2021b p. 755), which may indicate that such practices are more present in these Asia countries than in NZ.

From the group that believes, the most decisive cultural practices were: first) wash hands, 2nd) not hug in public, 3rd) not shake hands, 4th) Other, and 5th) wear a mask. On the other hand, the less decisive were: 12th) not wearing shoes in the house, 11th) few foods eaten with bare hands, 10th) avoiding speaking during public transport, 9th) cleanliness of restaurants, 8th) cleanliness of public services (24.4%).

As noted in section 5.4.2, during the pandemic, local Hauora (Maori philosophy of health and well-being) and Iwi (largest social units) leaders were active, advising people to modify their social engagement practices and restrict hongi (pressing of noses), kihi (kisses), and harirū (handshakes), which contributed to avoiding the spread of the virus, especially among traditional communities

h) **several products or services implemented in NZ considered as innovative are different from the traditional concept of innovation, where a product is expected to be launched in the market and bring profit to the providers.**

In NZ, among the 360 responses collected, the majority of new products or services were led by Public Sector, not to get profit, but to save lives against the Covid-19, while trying to perform the challenging task of balancing health, economics, and social impacts. Some of them are Operation Protect, Four Level Covid19 Alert System, Set up Drive-through hubs for testing, development of electronic platform and allocation of resources to protect traditional communities such as $56 million to support Māori communities & businesses, business support package for Covid-19 (NZ$ 9.3 bi), $27 million packages for NGOs, $50 million support for the media industry, $25m Covid-19 Innovation Acceleration Fund to develop new products and services that could help to detect, diagnose, treat or prevent Covid-19, National Action Plan 2.0 and 3.0 to direct the national response during the current Covid-19 Alert Level 4, development of Covid-19 research database to make sure the sector is well-coordinated, able to share ideas and work together, etc. Other innovations found from Companies, Universities, Start-Ups, and Others (See Appendix A), open several opportunities not only for new research but also for market or policy-makers interested to learn more about them;

i) **Although NZ is among the best performers, it still has areas for improvements and challenges.** Some areas for improvements are level of technological advancement, criminal penalties for violating quarantine, economic support for quarantined citizens, epidemiology system level of development, and Covid-19 equipment availability (DEEP KNOWLEDGE GROUP, 2020 p. 144), reason by which new research and investments should focus on these areas.

Among the challenges are i1) due to Delta and other possible variants, it is necessary to accelerate the vaccination against Covid-19, since 64.58% of people there are fully vaccinated (30th October 2021); i2) with the acceleration of vaccine, NZ should adopt a new vision and make a safe transition from the elimination strategy to a strategy able to reopen the country to the world, while keeping strong attention on quarantine and isolation process on international travel and border control, especially from those coming from countries with the low rate of vaccination and high level of Covid-19 transmission; i3) increase international cooperation to help other countries to accelerate the vaccination process, especially low-income countries close to NZ (Vanuatu 9.7%; Kiribati=9.3%; the Solomon Islands 4.4%; Papua Nova guinea=1.17%), since until ending of October 2021, their percentage of people fully vaccinated is lower than 10% (OUR WORLD IN DATA, 2021);

The research has limitations, it identified the responses considered as management practices (including Non-Pharmaceutical Interventions and Culture Practices), however, it did not evaluate their effectiveness and costs overtime, which can open several opportunities for new studies.

New research can be done in NZ with a higher number of participants to get more representative data.

Finally, new research should be done to investigate Singapore since this country was considered the third benchmark nation against the Covid-19 pandemic.

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8. Appendix A – 360 Responses adopted in NZ against Covid-19

Due to space limitation, it can be viewed as a spreadsheet by accessing the link <https://bit.ly/2ZJc6Gw>

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