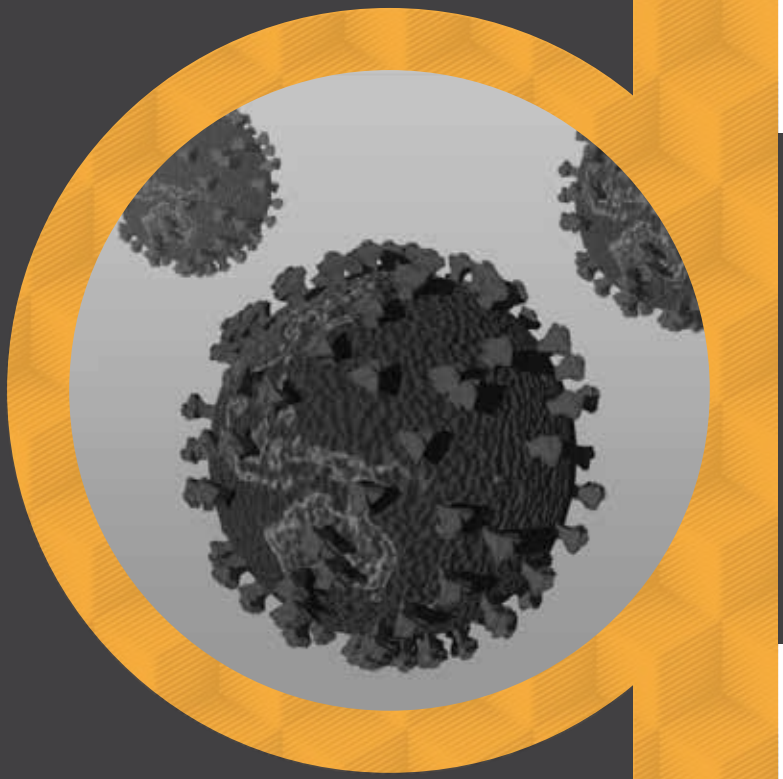
TEAM 7

ENGGEN 403: MANAGING A BUSINESS

MINI-SYSTEMS REPORT



AN ANALYSIS OF GLOBAL COVID-19 RESPONSES

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EXECUTIVE SUMMARY

The COVID-19 pandemic has compelled many nations around the world to take decisive action to minimise the consequences of the virus outbreak, despite the difficulty this challenge presents. In this report, the responses of several countries are compared - China, Vietnam, Japan, South Korea, New Zealand (NZ), Australia, Sweden, the United Kingdom (UK), the United States (US), and Italy.

The policies of each country are analysed based on the associated social, economic, political, and ethical effects. The impact that these consequences have had on key stakeholders has been investigated, and recommendations for future policies have been made.

The different responses have been identified to fit within three categories: Elimination, Mitigation and a Sustained 'stamp it out' approach. The New Zealand, Chinese, and Vietnamese governments' responses fall under the 'elimination' category; this strategy aims to eliminate COVID-19 transmission entirely. While these responses have not been able to indefinitely end community transmission, the total number of cases of COVID-19 in these countries have been relatively low, at an economic cost.

Responses that fall under the 'stamp it out' strategy were employed in Japan, the US, Australia, the UK, South Korea, and Italy. The 'stamp it out' strategy assumes a small but acceptable level of community transmission and aims to keep transmission low. Countries that used this strategy also experienced similar financial losses and had significantly more cases of COVID-19 than those using the 'elimination' strategy.

Sweden used the 'mitigation' strategy, with the goal of gradually developing herd immunity in the population. Sweden experienced a moderate level of COVID-19 cases and moderate financial losses when compared to the 'elimination' and 'stamp it out' strategies.

Regardless of the strategies a country may opt for, recommendations based on characteristics of the country have been provided to minimise the consequences of COVID-19. It is broadly advised that countries have strict border management, quarantine international arrivals, and encourage hygiene practices such as wearing masks, social distancing, and washing hands. COVID-19 testing should be free and contact tracing should be implemented. If this is not done, countries should at least implement a system to triage patients when capacity limits are reached. Healthcare workers will need access to quality PPE, and COVID-19 testing and treatment, and at-risk populations should be provided extra policies and guidelines. If the general population is cooperative with the government, it is advised that guidelines should be implemented; if not, policies and disincentives such as fines for breaching the policies should be put in place.

CONTENTS

INTRODUCTION

COVID-19 is a novel coronavirus that affects the respiratory system where patients exhibit similar symptoms to a cold or influenza [1]. The first human cases of COVID-19 were officially reported in Wuhan City, China, on December 31st 2019, but there is government data that shows cases dating back to November 17th [2, 3, 4]. Not long after, the first death was reported in China on January 11th 2020 [5]. On the 30th of January, COVID-19 was declared a public health emergency of international concern and was announced as a pandemic on March 11th [5]. Currently, worldwide, more than 25 million people are reported to have contracted this virus, with more than 860 thousand deaths [6]. Although more than 60% of reported cases have recovered there are concerns over the long-term health effects on patients [7].

Though COVID-19 bears similarities to a typical influenza, with similar disease presentation and transmission, statistics have shown that the mortality ratio from reported cases and deaths is between 3 to 4% (depending on healthcare availability), which is significant in comparison to the less than 0.1% from influenza [8, 9]. Additionally, COVID-19 is more contagious than influenza, with a longer transmission period. It is more difficult to detect as symptoms take 2-14 days to appear, whilst influenza takes between 1-4 days [10]. Furthermore, in addition to reducing lung and respiratory system functionality, COVID-19 can continue to affect the body after recovery, including blood clot formation and inflammation [7,10].

The most significant difference between COVID-19 and influenza is the availability of vaccines, antivirals, therapeutics and lack of herd immunity. Globally, many people have built up immunity to seasonal flu strains, and those that catch it usually recover in under two weeks [8, 9, 10]. In contrast, licensed vaccines or therapeutics are not yet available for COVID-19, and little is known about its long-term effects or immunity status.

Statistics have shown that COVID-19 has been handled well in certain countries. In particular, NZ has managed to contain COVID-19 to just 0.035% of its population and has had fewer than 15 cases per day since April 16th [11]. This is significantly different from other countries like the US, which has had 1.8% of its population contract COVID-19, and has consistently had over 20,000 new cases per day since March 29th [12].

This report analyses, compares, and discusses the responses of China, Vietnam, Japan, South Korea, NZ, Australia, Sweden, the UK, the US, and Italy to identify common factors leading to a successful response to COVID-19. With the comparison of each country's responses and impacts, a summary of recommendations for future policies is constructed for producing better responses to global pandemics such as COVID-19 in the future.

STAKEHOLDERS

PEOPLE/COMMUNITIES

Any pandemic will have profound effects on the lives of all people and communities. This group of stakeholders represents the general populace as well as vulnerable communities; they have high interest, but low influence. They require effective communication from their leaders and have concerns for their health, job security, education, and rights.

HEALTHCARE INDUSTRY

Healthcare systems are strongly engaged and have high interest and influence on any pandemic response. The needs and requirements of health professionals, health workers and health agencies are essential. Health workers need to avoid being overworked and need sufficient PPE as well as clear communication and guidance from the government.

EDUCATIONAL INSTITUTIONS

Stakeholders in the education sector have high interest, but often low influence. Closing educational institutions to limit spread can have negative effects on students' mental health and academic performance. Tertiary education institutions' revenues may also drop due to fewer enrolments. Therefore, educational institutions require close communication with governments regarding the topics on lockdown rules and gathering restrictions.

BUSINESSES AND CORPORATIONS

Businesses and corporations have high interest and some influence on pandemic response policy. Business' concerns often overlap with those of their employees in the People/Communities stakeholder category. Fiscal support may be needed to minimise widespread job losses, bankruptcy and economic recession. Significantly affected sectors include tourism, hospitality, retail and some goods exports [13].

GOVERNMENTS

Governments have high interest and the highest level of influence amongst identified stakeholders. They are required to balance many factors, keeping in mind other stakeholders' interests. Pandemic response measures can have long-lasting effects on a country's health and economy.

WORLD HEALTH ORGANISATION

The World Health Organization (WHO) is a United Nations agency which has significant responsibility in pandemic situations. They play a significant role in global public health and have high interest in minimising international health risks [14].

CHARITIES (NGOS)

Charities/NGOs have high interest in the pandemic response as they are typically concerned with providing financial support and medical assistance, however they have limited influence on policy.

MEDIA

The Media has high interest in pandemic responses and can significantly influence other stakeholders. The Media broadly includes the traditional (TV, radio, newspaper news) and the more modern news commentaries (social media, online news). There is a need for accurate and reliable information to be available to all, yet this may sometimes clash with the inherent interest of the Media to attract viewers for revenue.

OPTIONS

ELIMINATION

To eliminate transmission until a vaccine or treatment becomes available. Any new cases are from entry at the border, which would be tightly managed.

NEW ZEALAND

New Zealand's response to the COVID-19 outbreak was characterised by a decisive move into lockdown to eliminate the virus once it began circulating in the community. NZ formed a level-based approach to its response with four alert levels, as described in Figure 1 [15].

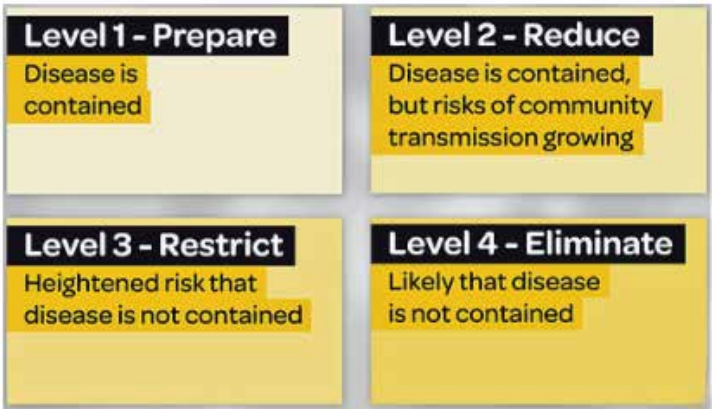

FIGURE 1

In March, mandatory self-isolation was enforced for all international returnees, followed by the closing of borders and some public spaces. On August 12th, a new cluster emerged in Auckland, but it was largely contained as a result of the alert level restrictions [16].

NZ has a comprehensive low-cost health system. This, coupled with the fast transition into lockdown, resulted in only 1729 cases and 22 deaths as of August 31st [17]. Testing was made a priority early one, with approximately 670,000 people being tested to date [18].

To aid businesses, the government announced large financial aid packages and wage subsidies totaling NZ$12.1 billion (US$8.1 billion) [19]. Employment rates remained mostly consistent, although the work hours fell by around 9 million (a 10% drop) [20]. This was likely due to wage subsidies keeping those unable to work employed.

There was a 23% increase in mental health hotline calls, with 45% of the calls being about the lockdown [21]. The first wave response did not enforce much stricter protocols on aged care facilities, compared to the rest of NZ. However, the second wave saw aged care facilities nationwide placed into alert level 3 [22,23].

CHINA

China is a developing country with multiple states and land borders. However, due to the one-party nature of Chinese politics, the states themselves do not have much say in their own governance.

Tight border control measures have been implemented and thorough contact tracing systems have been in use since the outbreak began [24,25]. Additionally, wearing of face masks was made mandatory [26]. Healthcare infrastructure was rapidly built where it was needed and COVID-19 cases were prioritised - often at the expense of other patients [27]. Lockdowns were put in place with little to no warning, limiting the spread of the disease but affecting businesses and the population negatively. A 6.8% decrease in GDP for Q1 versus Q1 2019 has been reported, indicative of the economic impact of the epidemic and response [28]. Early information regarding the extent of the virus' spread was suppressed and censored, initially hampering international efforts to combat the epidemic. Lastly, the method of contact tracing requiring invasions of privacy has been brought into question [29].

People in the community mostly welcomed the decisive and aggressive approach taken. However, it is hard to know the true opinion of the community due to heavily censored media outlets. Overall their response may be considered successful. The healthcare industry was supplied with plenty of PPE and the economy was mostly maintained.

ELIMINATION

VIETNAM

Vietnam dealt with the SARS outbreak in 2003 and thus had experience responding to an epidemic. Currently, the country has one of the lowest numbers of cases and deaths from COVID-19. After a 2-week lockdown at the start of April, the country saw no cases of community transmission until late July, when a second wave broke out in the city of Da Nang [30].

Vietnam's response to COVID-19 has focused on speed, aggressive contact tracing and strategic testing. Vietnam has a comprehensive contact tracing framework that focuses on proactively quarantining those with an epidemiological link even if they are asymptomatic. Tracing apps are used to aid contact tracing, including a neighbourhood watch application that allows citizens to report suspected cases, report their own health status, and watch real time activities of people under quarantine [31].

The government has also leveraged the widespread use of social media to release several public health campaigns. Text messages were sent to citizens with phrases such as "fighting the epidemic is like fighting against the enemy" and "social distancing is a form of patriotism" [32].

Despite COVID-19, Vietnam's GDP increased by 3.4% in Q1 2020 compared to Q1 2019 [33]. To help the economy, the government released a 280 trillion VND (US$12 billion) credit support and fiscal

SUSTAINED 'STAMP-IT-OUT'

This strategy aims to keep transmission low until a vaccine or treatment becomes available. A small degree of community transmission is accepted, but is aggressively managed through a combination of control measures.

JAPAN

Japan's response was dependent on citizens abiding official government guidelines. Early into the outbreak, Japan had a relaxed approach, with relatively low testing rates [35]. As increasing numbers of tests returned positive, there was an apparent need to change their strategy. Due to Japan having a well developed national medical system, the country was able to handle the initial cases well. However, a shortage of medical equipment, hospital space and resources soon emerged [36]. As a result, the government issued a state of emergency, urging prefectural leaders to act appropriately as the government could not enforce strict mandates themselves [37,38]. Japan's economy showed a downward trend and the unemployment rate reached 2.8%, compared to 2.29% in 2019 [39]. In response to this 27 trillion Yen (US$254 billion) was allocated to a financial aid program for businesses and individuals [40].

Reports also emerged detailing public discrimination targeting infected families and those who did not follow government guidelines [41]. Japan has a public culture of wearing masks, keeping environments clean and safe, and keeping up with general hygiene; upholding this culture and avoiding the "Three C's" (closed spaces, crowded places and close-contact settings) are recognised as social duties. Despite limited government involvement, a low infection rate was maintained. Only 7 out of the 47 prefectures implemented lockdowns [37], which demonstrated that the public was able to effectively limit transmission without strong government intervention.

USA

The US had a poor public health response overall, with responses varying on a state level [42]. The division formed by state and political alignment, combined with an individualistic culture resulted in poor societal compliance to response measures like lockdowns [43]. This has resulted in the US having one of the highest infection rates with 1,857 cases per 100,000 people [44].

Testing for the virus is free, and the US has one of the highest testing rates per capita of any country [45]. However, treatment is costly for those uninsured given the private healthcare system [46]. The services-dominated nature of the US economy resulted in a large economic shock following the outbreak, which led to unemployment rising from 3.5% in February to 14.7% in March [47].

A two-trillion dollar stimulus package called the Coronavirus Aid, Relief, and Economic Security Act (CARES) was introduced to cushion the shock to the economy, support businesses, and provide stimulus checks to individuals. Monetary policies were also quickly implemented by the Federal Reserve to ensure that the financial system didn't amplify the shock to the economy.

AUSTRALIA

Australia's response to COVID-19 was initially relaxed, and was primarily left to individual states to formulate and enforce measures. Each state has followed a general framework of preparedness, prevention, response and recovery [48]. International borders were closed in late March and a mandatory 14-day quarantine period was introduced for returning citizens.

Hard borders between states, travel restrictions within states, limiting social/work/educational gatherings, and closing non-essential businesses were common practice. The most severe response arising in Victoria who remain in strict lockdown as of September 2020. Australia has a high-quality, developed healthcare system and has provided free COVID-19 testing. To date, 6 million tests have been conducted, returning 25,448 positive cases. Those cases resulted in 583 deaths, with 85% of deaths coming from Victoria [49]. The federal government urged citizens to use their COVID-19 tracer app which was met with scepticism as many distrusted the government's intentions[50].

Social workers reported a significant increase in domestic violence and telephone counselling services. This necessitated an additional allocation of AU$150 million (US$110 million) for domestic support services [51]. The unemployment rate is the highest it has been in 19 years at 7.4% with 600,000 job losses [52]. The Federal government released financial aid packages to those affected; these include increased subsidized health care, doubling the jobseekers allowance, and a AU$66 billion (US$48billion) support package for businesses.

THE UNITED KINGDOM

The UK had an initially relaxed approach and was slow to respond to the epidemic, particularly as case numbers began to increase rapidly. Early testing rates following the first cases in the country were comparatively high; however, this failed to be ramped up sufficiently by March/April [53]. By March 26th (England, Scotland, Wales) and March 28th (Northern Ireland), lockdown measures were implemented to slow the virus' spread [54]. While there are differences in lockdown measures, exact restrictions and exit strategies between the constituent countries of the UK, the broad response has been similar across the four [54]. Lockdowns are currently in place on a localised basis in response to outbreaks [55].

Testing measures were set up in early April so that it could be done at home or at regional drive-through testing

SUSTAINED 'STAMP-IT-OUT'

By early May, testing rates had caught up significantly [52]. Additionally, £31.9 billion (US$42.4 billion) was quickly allocated to the National Health System (NHS) for PPE, ventilator and other equipment procurement and to fund the new contact tracing scheme [56]. As of August 31st, there have been 334,467 confirmed cases and 41,499 deaths in the UK [57].

To counteract the economic downturn, the UK Government formed an initial £176.7 billion (US$235 billion) fiscal response package which included £54.0 billion (US$71.8 billion) for its job retention scheme. Furthermore, £50 billion (US$66.5 billion) was allocated for tax deferrals and £340.3 billion (US$452.6 billion) for loan guarantee programs [56]. Unemployment rates have not significantly increased, however there has been a record reduction in total hours worked - 203.3 million hours fewer over April-June than the same period in 2019 [58]. Despite the large allocations of funding for the COVID-19 response, public trust in the UK Government has decreased from 67% in April to 44% in August [59] and 'clinically significant' mental distress prevalence in the population increased from 18.9 to 27.3% through April [60].

SOUTH KOREA

South Korea had a well prepared health system, with ample human resources, infrastructure, and strong relationships with key health institutions after learning from their poor response to MERS in 2015 [61].

In early January, days after the first COVID-19 case in Wuhan, quarantine and screening measures were implemented for travellers from Wuhan. The government made swift and informed decisions after their first positive cases, introducing contact tracing and closing their borders to Hubei.

In February, South Korea announced a mass production of COVID-19 test kits enabling a testing capacity of 5,000 per day. By April, this has been increased to 15,000-20,000 per day [61]. South Korea defended the first wave successfully, but was unable to maintain this indefinitely, with a number of outbreaks occurring over the next 6 months, primarily at churches and nightclubs [62].

South Korea's government prioritised the country's economic health, providing funding for small businesses and covering all medical costs associated with COVID-19 [61]. This improved the country's morale and incentivised transparency regarding COVID-19 infected individuals. As a result, the Korean Composite Stock Price Index has recovered to and continues to grow from its previous index value of 2020 by June, despite dropping more than 26% during the first outbreak in February (compared to 2019) [63] . This shows that many investors, part of the general public, also had confidence in the government's strategy.

ITALY

Italy had an outdated pandemic plan, with their health response differing within each region [64]. The government initially implemented stricter health checks at borders and stopped direct flights from China after the first cases were identified. However, these control measures were insufficient and led to community transmission. The country gradually entered lockdown, beginning with the most affected provinces, then eventually nationwide. There was an initial shortage of healthcare equipment, PPE, and test kits. In response, the government invested €13 million ($15.4 million USD) in healthcare equipment and PPE, and issued additional funding for new hospitals, testing, and tracing [65]. As a result of the nationwide lockdown, the service-oriented economy has been greatly affected, with a 17.3% reduction in quarterly GDP [66]. The Liquidity Decree was issued to grant €200 billion ($236 billion USD) to small and medium scale enterprises, who account for half of Italy's annual GDP [67]. The government also released the Relaunch Decree to support healthcare, the economy, and employment, with several tax credits and exemptions [68]. Politically, the government's response was unified and the statistics showed average to good support and trust in the government.

MITIGATION

This strategy aims to develop herd immunity through one long sustained period of infection in the population, with some measures put in place to prevent excessive simultaneous infections.

SWEDEN

Sweden managed to flatten the epidemic curve without any lockdowns, which was a government decision driven by two reasons. First, there is a great sense of mutual trust shared between the government and its citizens [69], so the government found making strong recommendations such as social distancing and staying at home [70] to be more appropriate than mandating control measures. Secondly, the government expects the virus to remain present for a few years [71], so the goal was to dampen its spread whilst minimising community fatigue. SEK 672 billion (US$78 billion) was allocated to supplement the health response. This included loan guarantees, government fiscal policy and measures to improve business liquidity [72-77].

Many citizens complied with the government's recommendations, with a 20-40% reduction in travel and 8 in 10 Swedes reportedly social distancing, washing hands, and avoiding shaking hands more than usual [78]. However, many have also started to lose confidence in their government with polls showing more than a 10 percentage point reduction in approval [79].

Sweden has observed higher case fatality rates (12.6% peak, April 2020) than other similar countries and had a death toll of 5900 [80, 81, 82]. Moreover, Sweden has had to pay a high price to double their ICU capacity despite their prior-known critical shortage of beds [83, 84]. As a result of the surge in cases between March and April, contact tracing was impractical and was temporarily stopped while testing was limited to only at-risk citizens [85, 86].

COMPARISON, CONSEQUENCES, & TRADEOFFS

HEALTH

Strict isolation within the community and between countries effectively suppressed the spread of COVID-19 in the countries who implemented the 'elimination' strategy: Vietnam has very low case numbers and death counts at 1036 cases and 30 deaths [88], followed by NZ at 1378 cases and 22 deaths [89]. Both countries enforced lockdowns from the start to the end of community transmission, which lasted two to three months. Controllable second waves have occurred in NZ [90], China [91], and Vietnam [92].

A delayed, and/or partial lockdown was commonly implemented in the countries who fall into the sustained 'stamp it out' strategy, with restrictions being tightened after a significant number of cases entered and spread. Countries with delayed responses saw a high number of cases and deaths, like the UK at 334,467 and 41,499 respectively [93]. The duration of the first transmission wave was generally longer than for countries with the elimination' strategy. However, the sustained 'stamp it out' strategy does not necessitate lockdowns in all cases, as they were not implemented in the entirety of cities in Japan and South Korea. Instead, these countries imposed strict contact tracing and border controls which allowed them to maintain low levels of local transmission. South Korea stands out among the countries who opted for sustained 'stamp it out' strategies, with only 19,947 cases and 324 deaths.

Sweden fell into the 'mitigation' strategy and did not implement lockdowns, strict border controls, or thorough contract tracing. When compared to similar countries, Sweden has seen a high number of cases and deaths at 83,958 and 5,821 respectively [94].

ECONOMY

With the virus straining supply chains, disrupting demand and necessitating closed borders, the global economy was dealt a heavy blow. The table below shows how much certain country's GDP decreased for the quarter of their first COVID-19 wave.

RESPONSE	ELIMINATION		STAMP IT OUT			MITIGATION
COUNTRY	CHINA	NZ	US	ITALY	UK	SWEDEN
GDP DECREASE	10% [92]	1.6% [93]	31.7% [94]	12.4% [95]	20.4% [96]	8.3% [91]

TABLE 1

Regardless of the response measures taken, all major stock markets saw drastic sell-offs between 10 and 30% in March due to the uncertainty surrounding the pandemic. Countries like China that took the 'elimination' approach saw a decline in the business confidence index from 97.48 in December to 94.52 in February. In contrast, countries that employed the 'stamp-it-out' approach had a steadier decline in confidence over the first half of 2020, including Japan who saw the index drop from 100.2 in December to 98.19 in June.

To cushion the shock to economies, governments were quick to introduce a range of fiscal policies which aimed to jumpstart the economy's recovery. NZ's initial NZ$12 billion COVID-19 Economic Response Package was one of the largest stimulus packages representing 4% of its GDP [102]. It aimed to support businesses and protect jobs - with success reflected by the small 0.2% rise of the unemployment rate in the March quarter [103]. Vietnam employed a similar strategy to NZ and also only saw a small rise in unemployment rate of 0.51% in the July quarter [104]. Australia's more relaxed response saw unemployment rise from 5.2% in March to 7.5% in July [105]. This may have been due to Australia's initial AUD$17.6 billion economic stimulus package which only represented approximately 1.25% of GDP [106]. With a similar response, South Korea's unemployment rate rose from 3.8% in April to 4.5% in May [107]. The most drastic jump was in the US where unemployment rose from 3.5% in February to 14.7% in March.

POLITICS

China and Vietnam - who implemented the 'elimination' strategy - are both one-party states with centralised authority. The nature of these governments make it easy to implement public health strategies consistently and stringently [108]. Despite being a democracy, NZ took a similar approach, but there were issues regarding the legality of the government's actions. The NZ High Court ruled the initial 9-day stay at home order was unlawful [109]. All three countries had strict lockdowns and border closures, and 'elimination' of the virus was mostly successful. Some governments that opted for the 'stamp it out' approach also implemented lockdowns, though some of these were regional or localised. For instance, multi-state countries like the US and Australia delegated implementation of lockdown procedures to their states. For the US, this led to a divide in approaches, with the handling of the virus becoming strongly politicised.

In Australia, there was no major divide between political parties in handling the virus. In the UK, country governments are also in charge of their own public health policies.

ETHICS

By tackling the pandemic with different levels of aggressiveness, countries trade-off various ethical issues with others. Countries aiming to eliminate all transmissions tend to have tighter time margins, such as Vietnam's immediate lockdown which gave citizens and businesses no time to prepare [110], and NZ's second lockdown given with less than a day's notice [111]. NZ's second lockdown resulted in protests, arguing that rights had been breached [112]. In contrast, Sweden's relaxed measures to avoid restricting citizens' freedoms resulted in a much larger health toll on its population compared to neighbouring countries.

Citizens need to feel secure that personal data is handled appropriately. Regardless of the country's strategy, many countries like Australia, NZ, and South Korea, implemented location tracking or surveillance systems, raising privacy concerns [113, 114, 115]. Challenges with recent confidentiality breaches to patient data are also recognised with one in Japan leading to 20 million Yen (USD$370) compensation in total [114], and another in NZ leading to resignation of a member of parliament [115].

SOCIETY

The effect on society varies for each strategy and country, with China and Sweden standing out as having large societal impacts on opposite ends of the response spectrum.

Notably, China's 'elimination' response was aided by measures such as "community policing" which involves residents monitoring each other's activities, potentially leading to distrust within the community. Their response also disproportionately affected low and middle-income families as costs of food and medicine drastically increased. Only healthy people were permitted to move around, restricting poor and sick citizens' abilities to make ends meet.

Sweden's 'mitigation' response maintained citizens' freedom to travel. Despite this, the public took it upon themselves to follow government recommendations to reduce travel, leading to a 20 to 40% reduction, on average. Sweden's public's confidence in the government has, however, lowered following their response to COVID-19, showing a reduction "from 56% having 'strong confidence' in April to 45% in June" [117].

RECOMMENDATIONS

OPTIMAL SOLUTION

After assessment of countries and stakeholder recycling, it is recognised that there is no “one-size fits all” approach. We assume that high-level stakeholders, including the government and health officials, are able to make informed decisions on which method fits best, whether it be ‘elimination’, sustained ‘stamp it out’, or ‘mitigate’, based on the characteristics and specific needs of their country. Success can be achieved through all these methods, but require further refinement depending on the country. An optimal solution can therefore be reached when high-level stakeholders apply the various characteristics of their country with the recommendations outlined below to form decisions to satisfy the needs of other stakeholders. The full form of this solution has been presented in a matrix format, illustrated in the appendices.

COUNTRY CHARACTERISTICS

Country characteristics are generalised into state and territories, islands, and their stage of development. Border lockdowns with good quarantine measures are recommended for all, but with flexibility around their degree of stringency, based on the aforementioned characteristics. Due to the varying levels of lockdowns recommended, stakeholders face different risks. These stakeholders include businesses, industries, families, and general community wellbeing. To combat this, financial resources in the sense of subsidies and support will be needed for those specific groups. We recommend fast action while avoiding neglecting existing health issues and food supply. Fast action is encouraged to lessen the blow on economies and locals, and support from the International Monetary Fund (IMF) or the World Bank should be sought when necessary.

HEALTHCARE CHARACTERISTICS

Healthcare characteristics are divided into three categories: “good pre-existing healthcare system”, “privatised healthcare system”, and “poor existing healthcare system”. In general, it is recommended to develop a classification system to triage patients. The government should encourage high testing numbers to avoid undetected community transmission. For countries with good pre-existing healthcare systems, we recommend they focus on preventing an outbreak in order to not overload the

Some countries constructed temporary health infrastructures to cope with the pandemic, which is a good option for those countries that can afford it. Generally, a privatised healthcare could provide good quality treatment, but it is largely unaffordable. We recommend countries with a poor healthcare system develop an efficient contact tracing system while protecting users’ private information. Lastly, frontline healthcare workers need good PPE, along with financial and mental health support channels, regardless of the healthcare system.

POLITICAL CHARACTERISTICS

Although crude, the political characteristics of each country are sensitive and diverse, so generalisations based on “democratic governments”, “federal and state governments” and “one party governments” have been applied. These suggest an approach that governments could take within their organisations, and possible methods of communicating decisions to their citizens. Key recommendations include thorough communication between governments and a unified response to avoid sending conflicting messages to citizens. This best respects the complexity of each government by providing flexible recommendations to their responses. Risks include disagreements or unethical approaches. Funding will be needed for stimulus packages and enforcement of supporting policies.

POPULATION CHARACTERISTICS

Different considerations have been given towards “at risk”, “frontline”, “cooperative”, and “uncooperative”, populations. It is recommended that early engagement, extra policies, and language barrier accommodations are applied to at risk populations. A possible risk is the further ostracisation of already marginalised groups due to perceptions of special treatment. Cooperative and uncooperative populations can have approaches which differ in terms of policies and enforcements respectively, where uncooperative populations should have increasing strictness and clarity as required. Naturally there are high risks associated with public response but we believe these to be optimal. Financial resources are needed for each category, for specific funding towards the support of these groups such as subsidies and the set up of supporting organisations.

ASSESSMENT OF COUNTRY APPROACHES

ELIMINATION

NZ, China and Vietnam took the 'elimination' strategy. NZ and Vietnam were successful when comparing it to stakeholder requirements. China's response succeeded in containing the virus, but had heavy impacts on society. All these countries had tight border control, quarantine was made mandatory for arrivals, and thorough contact tracing was put in place swiftly after the outbreak. These are some of the main recommendations from our optimal solution.

For NZ, we would have recommended that further support should have been provided to low-decile schools, where accessibility to education in low socio-economic areas is less prevalent. Likewise, early engagement and extra policies should have been applied to rest-homes, where many clusters and deaths occurred. These responses would have been preferred to current realities as NZ's Human Capital suggests they are in a position to alleviate those consequences.

China has followed most of the recommendations applicable to them. Healthcare infrastructure was rapidly built where needed. Part of the recommendation for a cooperative population was followed, with contact tracing methods being provided and face masks being mandated. However, the main areas of improvement are mainly ethical and social. Information about the extent of the virus was suppressed and censored, hampering international efforts to combat the epidemic. Additionally, concerns have been raised regarding the invasion of privacy for the method of contract tracing purposes.

Vietnam has followed our recommendations for closure of borders, and suspension of international travel was rapidly implemented. Giving more notice before lockdowns would have eased the sudden strain on the economy, but this, in turn, would have allowed for the virus to spread further before action was taken. Vietnam is currently in the tail-end of a second wave, which may suggest that some changes are needed to their response plan; the source of the second wave remains unclear. Overall, the response was good and followed the recommendations we had for a country such as Vietnam.

STAMP IT OUT

Japan, USA, Australia, UK, South Korea, and Italy took the 'stamp it out' approach. Japan and South Korea have an overall positive response to COVID-19. This is in part due to their government's early encouragement of social distancing, wearing masks, and leaving the house only when necessary. In Japan and South Korea, most people are cooperative and follow the guidelines set out by the government. Japan has a large vulnerable elderly population but Japan has relatively few deaths despite this. This is due to a low infection rate as Japan has taken the same actions we recommend.

The Japanese government also highly values patients' privacy and personal information; increases trust in the government. This alleviates the patient's psychological pressure to a great extent and we recommend the government focus more on long term control by increasing the testing numbers, ensuring a unified response from all of society, and providing extra support to vulnerable populations. This way, Japan can avoid any future third wave.

The South Korean government also encouraged many people to get tested; where testing and treatment fees are covered. Patients are categorised based on risks and provided suitable treatment. Korean people have a culture that respects the greater good of the group over the needs of an individual. Therefore, Korea has strong contact tracing, despite accompanying privacy issues. It is recommended the country should work on developing health systems that have infrastructures and capacity to deal with extreme circumstances. The government should ensure tracing data is only used for prevention and tracing for contract cases and should hold for no other purposes.

Australia has followed the recommendations in most of their states apart from Victoria. Their early engagement with Aboriginal communities was a large success, however, this same engagement was not replicated for the elderly. Our recommendations are for early and specialised engagements with rest homes. When considering Victoria specifically, recommendations based on population and "Federal and State governments" could have been applied better. This includes better communication between governments and stricter enforcement of policies. This is preferred as we are able to compare the performance of Victoria with other territories, who are able to benefit from lower lockdown levels with state border enforcement. A majority of stakeholder requirements have been met outside of Victoria. If Victoria had followed the recommendation, their response could be more successful.

The USA, UK, and Italy were not successful with their COVID-19 response, at least at first. The initial testing in the US, UK, and Italy was very low, considering their number of deaths. For all three of these countries, our recommendation is that a larger number of tests need to be carried out at the beginning of any potential future outbreaks; this will help give a better idea of the transmission rate and allow for control measures to be put in place.

The USA international border control was strong, while state border control was weak. There was poor communication between federal and state governments, which is crucial for its governing structure. Additionally, the population is divided and uncooperative due to strong political stances. We recommend enforcing strict border controls and maintaining a good supply of PPE for front line workers; these are examples of solutions that would have drastically improved the US's response even with an uncooperative population.

A financial stimulus package was introduced, but due to the nature of the government's unsuccessful response, there have still been negative consequences for small businesses, the general public, and healthcare workers.

The UK has taken guidelines to ensure people who are at risk are safe from COVID-19, which is the recommended approach. However, due to the delayed response, the people's (a key stakeholder) trust toward the government has decreased. The government has since begun to spend significantly more money on PPE, which is essential for frontline workers. Even though the UK had an unsuccessful approach at the beginning, the country now keeps new cases under much more control, due to following the actions we recommend. Many more stakeholder requirements are now being met that weren't being met initially.

Italy did not take adequate measures for its at risk communities, causing a large number of cases in aged care homes. The strict lockdown strategy that Italy eventually implemented did prove successful in terms of stakeholder satisfaction. The successful enforcement of lockdown and an adapting healthcare system proved beneficial for the

MITIGATION

Sweden established guidelines for people to follow rather than establishing laws. However, even with a cooperative population, this is risky, as some people might choose not to follow the guidelines. Our recommendation is to implement a proper contact tracing method and increase the number of testing right from the beginning of the pandemic. Analysing regions with larger clusters would help in deciding future actions that need to be taken by the government. Sweden has not been very successful regarding their COVID-19 response, considering their number of deaths. A key stakeholder, the public, has had their trust in the government decrease due to the government's actions. However, due to no lockdown being implemented by the government, business has not been significantly affected, when compared to other countries that went into lockdown. This outcome will satisfy the business stakeholders. However, a more reliable and strict response in terms of testing and contract tracing would have helped Sweden keep COVID-19 under control, with little downside.

CONCLUSIONS

COVID-19 is arguably the most pressing issue the world has faced in recent years. It has caused tremendous damage to human society, and will leave a lasting impact even after eradication. To overcome this challenge, various measures have been taken around the world.

In this report, responses to COVID-19 from different countries have been assessed. Influenced stakeholder groups have been identified, and a stakeholder analysis has been conducted to assess their levels of interests and influence. Ten countries from different regions have been selected to represent influenced countries around the world, with further evaluation on their eradication options moving forward and their relevant consequences. This allowed the determination of recommendations for the optimal COVID-19 response.

The US, the UK, Italy, Sweden, South Korea, China, Vietnam, Japan, Australia, and NZ were selected to represent countries with a wide range of characteristics all affected by COVID-19. Different government responses have been reviewed and categorised into three groups; these are elimination, sustained 'stamp it out' and mitigation. By studying the unique situation of each country and their outcomes, the performance of each was assessed. Consequences and trade-offs of different options were evaluated in a number of aspects, including health, economy, politics, ethics and society.

Specific recommendations could not be made due to the uniqueness of each country. Addressing COVID-19 means balancing conflicting stakeholder needs; the consequences of resulting policy differs in different countries. Therefore, general recommendations have been made based on the characteristics of each country.

VIDEO-PITCH LINK

Group Seven Mini Systems Project Presentation Presented by Connor McDowall, Team Lead
https://drive.google.com/file/d/1WthP6_GUzztnFX_XGcouVHSsbVxcyNjo/view?usp=sharing

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Appendices

Optimal Solution

After assessment of countries and stakeholder recycling, it is recognised that there is no "one-size fits all" approach. We assume that government officials make an informed and high-level decision on which method to use, whether it be 'elimination', sustained 'stamp it out', or 'mitigate'. We recognise success is able to be achieved through all these methods, but perhaps with different approaches. An optimal solution can therefore be made when considering the characteristics of a country as outlined in the matrix below. The matrix intends to make recommendations based on these characteristics, but with flexibility to account for the higher-level methods opted for.

Country Characteristic	
Multiple states/territories	**Recommendation:** - Strong border lockdown. - Limit arrivals to those from other states who have contained the virus - Mandatory 2-week supervised quarantine on arrival **Risks:** - Tourism/ hospitality industries will be critically affected - Businesses will be significantly affected - Societal pushback - Negative affect on individual mental health **Financial Resources Needed:** - Wage subsidies for affected businesses and individuals
No land borders/island	**Recommendation:** - Close international borders. - Regional lockdowns in the event of clusters - Mandatory 2-week supervised quarantine on arrival. **Risks:** - Businesses will be affected - Mental health and vulnerable groups (eg. domestic violence victims) will be exposed to more harm - Societal pushback **Financial Resources Needed:** - Wage subsidies for affected businesses and individuals
Developed	**Recommendation:** - Strict and immediate border control. - Ensure adequate quarantine facilities for travellers - Increase the testing rate as necessary - Provide financial aid/support packages for those who are highly affected -Encourage people to have good hygiene habits, mask wearing and social distancing **Risks:** - Significant political and economic resources plus careful planning required for success - Strategies must be followed carefully to be effective **Financial Resources Needed:** - Resource procurement should be quick to avoid financial borrowing from unions/banks
Developing	**Recommendation:** -Stricter border management measures -Encourage people to have good hygiene habits, mask wearing and social distancing -Ensure other health problems do not get neglected, food supply is a priority, and continual supporting of education **Risks:** - May have insufficient resources to prevent the outbreak at an early stage - Economic and/or diplomatic disadvantage in terms of equipment procurement **Financial Resources Needed:** - International support regarding procurement of crucial medical equipment (e.g. ventilators) - General emergency support/funding (e.g. from the International Monetary Fund (IMF) or World Bank)

Healthcare Characteristic	
Good pre existing healthcare system	**Recommendation:** - Categorise patients based on risk and provide suitable responses - Respond as fast as possible to the virus as to not overload the healthcare system - Provide easy and funded access to testing kits - Provide extensive, efficient and transparent methods of contract tracing (i.e use apps) -Support patients and frontline workers's mental health. **Risks:** - Ensure that all the methods/processes work properly and are transparent - Unpredictable success rates for some treatment options **Financial Resources Needed:** - Resources needed for PPE, medical equipment, temporary testing stations or even hospitals
Privatised healthcare system	**Recommendation:** - Subsidize tests and treatment or; - Provide free testing separate from the private health system - Provide extensive, efficient and transparent methods of contract tracing (i.e use apps) - Implement prevention methods which will mean less interaction with costly healthcare -Support patients and frontline workers's mental health. **Risks:** - Expensive healthcare systems so some of the population can't afford this - Some recommendations rely on the affordability of healthcare **Financial Resources Needed:** - Financial burden falls on the people to afford their own healthcare - A small amount of subsidies is needed for people who cannot afford healthcare
Poor pre-existing healthcare system	**Recommendation:** -Begin setting up a cost effective system that is able to deal with contract tracing and disease management in future outbreaks. -Focus more on preventing than treating (eg. categorising patients to treat critically ill first) -Provide PPE for frontline workers -Provide support for patients and frontline workers's mental health **Risks:** - Not enough medical equipment for increasing infection rates -High death rate; mitigation approach. **Financial Resources Needed:** - Lots of time and financial resources to develop the healthcare system

Political Characteristic	
Democratic government	**Recommendation:** -Democratic government who has the support of the people is able to implement and control stronger measures -Clear information given to the public and common approach nationwide **Risks:** -Democratic government putting policies in place only to look good in the public's eyes. **Financial Resources Needed:** -Funding to accommodate the policies of the government. -Stimulus packages for the public and businesses

Federal and State governments	**Recommendation:** - Constant and clear communication - Create National priorities and guidelines as a federal government - Allow state governments to enforce policies and rules as appropriate **Risks:** - Possible miscommunication or disagreements between federal and state governments - If decisions are not clear, the public could be confused or misinformed **Financial Resources Needed:** - Funding to enforce local lockdowns and control methods - Funding to communicate policies to the public
One party government	**Recommendation:** - Utilize their authority to rapidly enact and enforce policies - Ensure that a unified response is undertaken at all levels of society **Risks:** - Stringent measures can be seen as unethical among citizens and in the internationally - Potential unrest, protests - Because there is no opposing political power, poor decisions can be made without pushback **Financial Resources Needed:** - Funding to enforce policies e.g. police/military for lockdowns

Population Characteristic	
At risk populations	**Recommendation:** - Early engagement with supporting authorities and healthcare bodies - Additional policies and guidelines for people at risk - Guidelines to be translated to required languages **Risks:** - Perception of 'special treatment' could lead to ostracisation of the most vulnerable **Financial Resources Needed:** - Specific funding allocation for vulnerable population groups and communities
Frontline workers	**Recommendation:** - Provide free and accessible testing schemes, PPE, and treatment - Safety measures should be implemented to protect health-care workers (HCWs) - Financial, mental, social and spiritual support must be available for HCWs and families **Risks:** - Incorrect PPE usage or PPE shortages will place frontline workers at heightened risk - Shortage of health personnel in particular countries. **Financial Resources Needed:** - Cost of PPE and medical equipment - Wage/welfare subsidies for frontline workers
Cooperative population	**Recommendation:** - Establish policies and guidelines rather than enforceable measure - Provide effective, convenient contact tracing methods **Risks:** - Reliance on individual responsibility to follow issued guidelines **Financial Resources Needed:** - The government needs financial support to implement an efficient way of contract tracing
Uncooperative population	**Recommendation:** - Enforced border measures and policies, fines/disincentives for breaches - Heightened support for healthcare and frontline workers **Risks:** - Societal/public pushback from strict approach such as lockdowns - Civil protests resulting from the above may create 'hotspots' **Financial Resources Needed:** - Funding for significant testing and control measures at the border

Business confidence index (BCI) Amplitude adjusted, Long-term average = 100, Sep 2019 – Jul 2020