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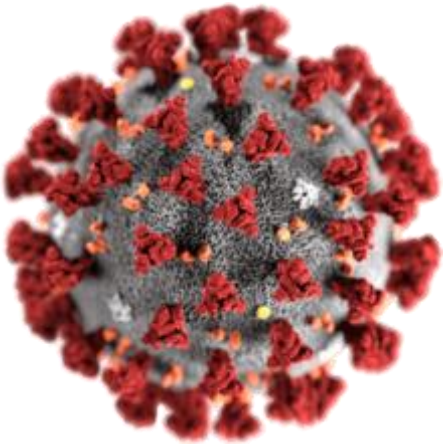

COVID-19 Science Report:

Lockdowns

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Contents

Lockdowns 1
Executive Summary 1
Learning from Case Study Examples 4
Key Considerations 7
Conclusion 11
Case Study Examples 11
1918 Influenza Pandemic 12
Timing of Measures 12
Waves and the Long Term 13
Economic Impact 14
Public Response 14
COVID-19 Pandemic 14
China 15
South Korea 23
Italy 30
Taiwan 34
Hong Kong 41
Japan 48
Sweden 52
New Zealand 54
New York 56
Search Methodology 58
Acknowledgments 58
References 59

Lockdowns

For regular readers of this report, the latest additions have been highlighted in yellow.

Some references were from preprints which are preliminary and yet to be peer reviewed, the results should be interpreted with caution.

Executive Summary

This report was developed and regularly updated during March and April 2020, the final update was on 17 April 2020.

The report explores the lockdowns from the 1918 pandemic and COVID-19 case study examples of China, South Korea, Italy, Taiwan, Hong Kong, Japan, Sweden, New Zealand and the city of New York in the US. Because of the time limitation, the rapid scan approach, the variability of available information of the various lockdowns, the case example descriptions vary in detail.

This report should be read alongside the evidence summaries related to containment strategies.

Lockdowns polarise commentators and the public, with some viewing them as damaging to civil liberties, draconian, ineffective, creating panic and resource constraints, and even conducive to transmissions.[1,2] This has been the case particularly with China. Looking beyond the sensationalistic headlines and emotional reactions however, there is much to learn from China, particularly when framed within the context of their phased strategy and the timing of the more extensive lockdown of Wuhan within the course of the epidemic in China.

Social distancing, physical distancing, or safe distancing are terms used to describe a set of measures wherein the community is discouraged or prevented from social interactions that may facilitate viral transmission, which intended to stop or slow down the spread of an infectious disease (eg COVID-19). This report uses the term "social distancing" throughout, as this is commonly used in media in Singapore and beyond.

The word “lockdown” is not a single intervention and has different meanings in different countries. Its implementation may vary in extent, scale and duration. Based on the 1918 pandemic and the COVID-19 experiences in China and Italy, the term is commonly interpreted to include the following social distancing measures:

- Mandatory isolation of ill people and the quarantine of those suspected of having contact with them.
- Closure of schools, non-essential shops, entertainment establishments (though food and pharmacies remain open).
- Bans on public gatherings and large events.

There is a high degree of variation in such measures and how they are carried out in practice. These are also separate from and usually implemented alongside wider travel restrictions.

The case series examples outlined in this report reflect this multiple-measure approach, which considers the scale and scope of what seems effective. WHO has stated that a comprehensive approach is required given the unprecedented nature of COVID-19. In the words of Tedros Adhanom Ghebreyesus, WHO Director General, *“Not testing alone. Not contact tracing alone. Not quarantine alone. Not social distancing alone. Do it all. Find,*

isolate, test and treat every case, to break the chains of transmission … do not just let this fire burn."[3]

Since 10 March, many regions across Europe and beyond have announced lockdowns or measures that effectively amount to lockdowns, in response to the same trigger points that Wuhan experienced, which was that their healthcare systems, especially hospitals, were being overwhelmed. However, apart from the general statements of closure, there is a paucity of detail on the exact measures and the anticipated durations for the measures.

In terms of Singapore, the nation experienced SARS in 2003, which infected 230 and killed 33 people, including many healthcare professionals. The experience of SARS prompted investment in emergency preparedness for infectious diseases. This included: improved surveillance and detection systems at borders and through regional networks; enhanced response capabilities in public hospitals (including the implementation of visitor management systems); trained healthcare professionals in infectious diseases; development of a primary care response infrastructure (including Public Health Preparedness Clinics); and the launch of the National Centre for Infectious Diseases in purpose-built premises.

SARS also raised the public awareness of infectious diseases and the important role that the public can play in assisting with the fight against such diseases, such as following quarantine and isolation orders as well as good hand hygiene and social distancing.

Singapore is highly connected. Singapore's Changi Airport is a key air hub, with more than 68.3 million passengers each year.[4] Of the five million people who left Hubei before Chinese New Year, over 10,000 flew to Singapore.[5,6] Some stayed while others went on to other destinations. It was no surprise when Singapore recorded its first case on January 23, a Chinese national from Wuhan.

Singapore took the COVID-19 emergency seriously, as evidenced in the leadership messages such as the Prime Minister's speech to the nation on February 8 and daily ministerial press conferences.[7] The early whole-of-nation response saw measures, both pre-planned and innovated, put in place across government, public and private organisations, and communities and residences.

Early measures included:

- Temperature and travel screening at border points, schools, workplaces, health facilities, tourist attractions, religious places and events.
- Rapid identification of possible cases at public healthcare facilities and Public Health Preparedness Clinics.
- Rapid identification of potential cases at entry points, including swab test checkpoints for suspected cases at Changi airport with a 3-6 hour result turnaround.
- Contact tracing of cases and their contacts, mobilising not only MOH staff but also members of the police and other partners.
- Regular recalibration of case definitions to optimise catchment of cases without overwhelming healthcare facilities with low probability cases.
- Quarantine Orders and Stay-Home Notices to isolate suspected carriers or the close contacts (violation of a SHN resulted in one case in the removal of visa status and barred re-entry).
- Travel declarations at schools and workplaces.
- Daily updates from the Ministry of Health and advisories across all sectors.

- Daily messages to the public from a Government WhatsApp group and constant messaging on hand washing and what to do if unwell.
- Parallel messaging through non-tech platforms (eg cartoons, print-media, posters).
- Rebuttal of fake news (in one case invoking the Protection from Online Falsehoods and Manipulation Act).
- Funding of research and development related to COVID-19.
- TraceTogether App to facilitate contact tracing after cases are reported.

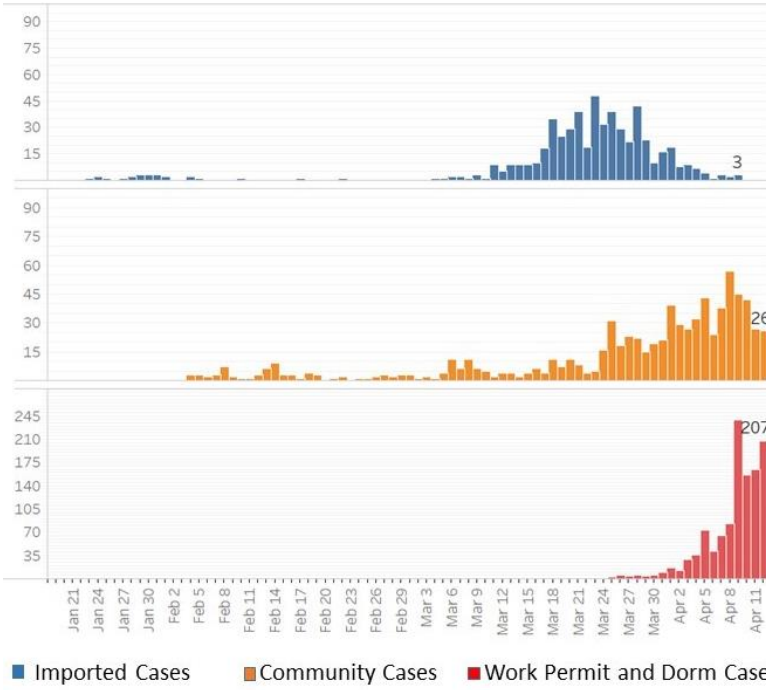
Singapore was praised for its early response.[8] WHO Tedros Adhanom Ghebreyesus called it *"a good example of an all-of-government approach".*[9] However, much must be said for the factors that make it somewhat easier for a small island state with strong borders, a previous experience of SARS, a culture that supports and actually welcomes many of the containment measures, a strong economy with adequate resources, and a political leadership that has been stable over decades and which is generally trusted by the population.

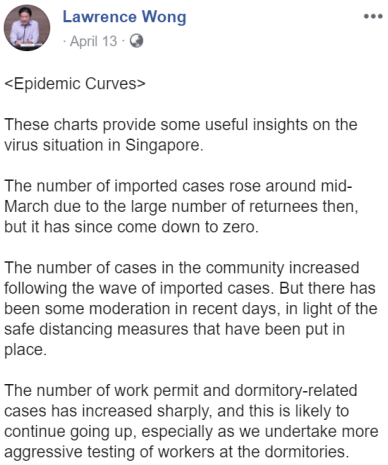
There have been unexpected challenges, common to other countries. Most evident would be the panic buying of masks, groceries and commodities when Singapore raised its alert levels (DORSCON). There has also been a rescheduling of some of the normal healthcare delivery, and the consequent health costs for the rest of the patient population is unknown.

Preparations have also focused more on how the healthcare community should respond to an international infectious disease emergency and less on the rest of the economy, especially small and medium enterprises. Although there are financial and legal measures to support businesses, there will inevitably be impacts from a prolonged social distancing policy. The ongoing pandemic is likely to have a significant impact on the local economy. As with all other countries, Singapore has downgraded GDP growth forecasts (−4 to −1 %) and is preparing to enter a recession this year.[10] The IMF has forecasted that Singapore's GDP will be minus 3.5% in 2020 and 3% in 2021.[11]

Overall, Singapore has adopted an evidence-based approach as far as possible and put in place measures to be "ahead of the curve" to prevent the sharp exponential increases in cases seen in other countries. There is also an emphasis that all Singaporeans take individual and social responsibility, with government WhatsApp messages repeating "do the right thing, the health of all depends on each one of us."

There was a spike in cases from travellers returning from areas with established community spread (Europe, US and ASEAN countries). This led to further measures being implemented such as: banning tourists and short-term visitors; 14-day self-quarantine for returning residents; workplace measures; closing pubs and entertainment outlets; closing clubs for children; and enforcing social distancing in restaurants and shops. However, people were still free to go to shops and restaurants, and schools and transportation remain open.





Cases in Singapore

Source: Wong (2020)[12]

From April 9, cases surged in Singapore, mainly due to infections in the high-density migrant worker dormitories. There was also increasing numbers of unlinked cases in the community. At this point Singapore instigated a month-long “circuit-breaker”.

The measures involved the closure of non-essential shops, workplaces and services, as well as the population staying home (only going out for food and exercising at parks at a safe distance).[13] Private social gatherings of any size, in homes or public spaces, are not permitted - first-time offenders may face a fine of up to $10,000, jail of up to six months, or both. Subsequent offences carry a fine of up to $20,000, jail of up to 12 months, or both.[14] Quarantine measures, testing and healthcare support were also put in place around migrant worker dormitories, due to increasing cases.[15,16] From April 14 it became mandatory for everyone to wear a mask when they step out as part of stricter measures to curb the further spread of the coronavirus, with $300 fines for those who do not wear a mask.[17]

So far, Singapore’s measures are more around layers of measures and flexible implementation based on in-depth analysis of the situation.

The following cases explore different country situations and highlight that most full lockdowns are triggered by an emergency situation of the healthcare system becoming overwhelmed.

Learning from Case Study Examples

The following should be read with the caveat that, because of the time limitation, the rapid scan approach, the variability of available information of the various lockdowns, the case example descriptions vary in detail.

1918 Influenza Pandemic

The 1918 influenza pandemic saw the implementation of lockdowns of a scale and scope unseen before. Prior to these, social distancing measures were associated with specific groups, eg children, immigrants.

The 1918 pandemic shows how far and fast a novel virus (with similar characteristics to COVID-19 in terms of transmissibility) can spread. Only a handful of remote islands, rural towns, walled hospitals and schools were unaffected. Urban areas that enacted early, sustained, well-communicated and layered social distancing measures were consistently associated with lower mortality and the smoothening out of the epidemiological curve in the first wave. This was particularly the case if the measures were implemented before the spread increased exponentially. These measures seem less effective on subsequent waves, although the mortality then may have been higher still without the measures.

China

Wuhan was the first city put in lockdown in China, followed quickly by other cities and regions in China. This report focuses on Wuhan which experienced the most extensive measures. Three distinct phases that China identifies can be compared to public health measures and also to other national approaches based on the contexts of their outbreaks.

Phase I	Uncontrolled spread and severe lockdown to control the source of infection, block transmissions and prevent further spread. Given the evidence from China, this approach seems effective when there is sudden and uncontrolled transmission in the community leading to hospital overwhelming. However, the effectiveness of implementation is critical. The measures adopted in Wuhan were likely effective after outbreak due to their extensive and controlled nature.
Phase II	This phase focuses on increasing healthcare capacity, actively treating patients, reducing deaths and preventing exportations. This involves developing robust protocols for diagnosis, treatment and epidemic prevention and control, including isolation and monitoring of close contacts, enforcement of social distancing, and public information being regularly released.
Phase III	This phase is when there is control of cases and individual clusters through a combination of “trace, test, treat” and technological and scientific advances and self-quarantine of travellers. Wuhan is moving towards this phase, following the rest of China.

Phase I could be criticised as infringing civil liberties, and Phase III as infringing privacy (as it requires access to personal data). Countries must consider this balance in light of the impact of COVID-19. The eventual compromise will depend on the country’s context, the degree to which the health system is overwhelmed, cultural acceptance (which could shift because of the impact of outbreaks) and also the ability to leverage technology and to manage systems and processes.

There has been consistent comment that China’s approach would be difficult to replicate in most countries.[18,19] However, as has been shown by other countries, the COVID-19 pandemic has meant that extraordinary measures that have to be implemented are supported by the public. The level of actual control may not however be equally high.

South Korea

After an initial outbreak, South Korea’s main approach has been “trace, test and treat” together with social distancing measures. This offers an interesting comparison to countries that have adopted more complete lockdown approaches.

The structure and processes that underpin “trace, test and treat” in South Korea were robust and allowed a more flexible approach, eg locking down individual buildings rather than whole communities. The approach is resource-intensive and requires supporting technological solutions. It might be possible for countries to replicate this approach if the public was

supportive of sharing personal data, there was high testing capacity and accuracy, and treatment was affordable.

Italy

Like Wuhan, after outbreak and hospitals were overwhelmed, Italy imposed a lockdown of northern towns which rapidly became a whole-of-country lockdown. The suddenness of the measures meant that there was some early confusion as to what was meant and how people were to respond. This has now levelled off with more communication and people are reported to be supportive of the measures. Some 89% of Italians supported the government's measures, with 78% saying they would back even tougher measures.[20]

Taiwan

Taiwan's response to the crisis shows swift action, effective use of technological infrastructure to support screening / surveillance / contact tracing, widespread vigilance, and community acceptance and participation. Taiwan implemented early travel bans from the original affected areas in China and later widened them. Taiwan has also focused on production and distribution of masks. Taiwan used new technology to improve operational efficiency and speed in border screening. It also leveraged its National Health Insurance system/database to quickly mobilise case identification.

Hong Kong

Initially, there was a slow and gradual rise in the number of cases. It is likely that early border control measures and extensive social distancing efforts were effective in reducing the curve. As with many countries, there have been cases from people returning from other countries and then subsequent community transmission - border controls and social distancing measures controlled the rise in cases.

Japan

Japan did not have high levels of testing early on and had a rise in cases in March, particularly in Tokyo, and has declared a state of emergency, which brings with it specific lockdown measures.

Sweden

Sweden is an outlier in terms of its strategy to manage COVID-19, as it has not gone for a lockdown. The strategy is to slow the spread of infection so that the health services are not overwhelmed and the population gradually acquires immunity.

The assumption is that the death rate will be the same but the economic impacts reduced, compared to ongoing or stop-start lockdowns. The early decision-making was led by experts at the Public Health Agency, rather than the government.

New Zealand

New Zealand has adopted an elimination strategy through a nationwide lockdown. This was successful in reducing cases. However, the impact on the economy of an elimination strategy is severe and it relies on ongoing strict border control with 2-week quarantine of all incoming travellers. The assumption would be to maintain this approach until a vaccine or effective therapeutic is available.

New York

New York is included as an example of a high-density city with high numbers of visitors each year. Initial testing deficits resulted in a lack of visibility of the increasing case numbers. A lockdown was implemented after hospitals had a surge in cases, and the lockdown was extended several times due to pressure on healthcare.

Key Considerations

At this stage it is difficult to determine which measures are more effective, as countries have put in place different combinations for different lengths of time. However, below are some broad conclusions.

Early, layered and sustained social distancing measures are consistently associated with reductions in mortality, particularly if implemented before the pandemic exponentially increases. It becomes easier to identify early cases and fewer people get infected. The earlier that measures are implemented, the less time they need to be in place. A article from Imperial College COVID-19 Response Team concluded that "suppression" (the definition used is similar to lockdown) is necessary at an early stage to reduce the R0 to close to 1 or below to prevent hospital overwhelming.[21] Similarly, modelling of the Singapore context found that implementing the combined intervention of quarantining infected individuals and their family members, workplace distancing, and school closure once community transmission has been detected could substantially reduce the number of infections.[22]

Uncontrollable community transmission and hospital overwhelming is leading to unprecedented lockdowns, often commencing at a late stage. To be effective at this point, they likely need to be extensive (as demonstrated by Wuhan), well observed and somehow tolerated for an extended period of time.[23] It has been estimated that China's lockdown for about 7 weeks reduced the R0 to below 1.[24] There is now a careful loosening of measures and the impact of this will inform subsequent strategies. However, future waves of the infection may occur in a population which acquires little immunity.

Short-term measures of only a few weeks are unlike to have an impact, especially in areas of widespread transmission. However, effective lockdowns over a longer duration may well be unsustainable for economic, political and social issues.

Modelling analysis, based on data from China, suggests that China's containment strategies are continuing to be effective as people return to work.[25]

Phases

The phase that the country is in enables decision making on the scale and scope of measures required to effectively reduce the curve. Some are forced into lockdown due to uncontrolled community transmission, while others are able to adopt more tailored approaches with high usage of "trace, test and treat".

Given the time lag in incubation and development of symptoms, and some of those individuals progressing to severe symptoms and requiring hospital care, it can be challenging to know which phase that an area is in. Acting "ahead" of the next phase seems the approach adopted by countries with control of the outbreak.

The following is a working model based on the emerging evidence. Measures in the last column are added for each increasing level of outbreak intensity.

Phase	Epidemiological Curve Objective	Additional Measures
No cases	Keep the line flat	Aggressive surveillance and testing of potential cases.
Sporadic cases	Keep the line down	+ Tracing and isolation of all cases. + Targeted social distancing measures.

Clusters of cases	Get the line down again	+ Shut down specific sites of transmission. + Enforce basic social distancing measures
Community transmission	Prevent the line rising rapidly, get it down again	+ Shut common areas of transmission. + Enforce extensive social distancing.
Country-wide transmission	Try to plateau the line	+ Country-wide lockdown

Healthcare Capacity

The capacity of healthcare, particularly the intensive care capacity, is likely the main influence on whether an extensive lockdown is triggered. Wuhan, Italy and other European countries have entered lockdowns based on healthcare overwhelming.

There are many limitations to estimates, but it is possible that areas that are prepared will see a fatality rate of less than 1% (South Korea, rest of China excluding Wuhan), and areas that are overwhelmed (Wuhan and areas of Northern Italy) a fatality rate of 3-5%.[26] It is uncertain how the pandemic will progress subsequently and other factors such as healthcare access and affordability will have an impact.

Flattening the curve, through social distancing and other measures, is essential in order to try to maintain enough capacity in hospitals to give care to those who require hospital and intensive care, estimated at 5% and 1.5% respectively according to one source.[27]

Another estimate suggested a similar percentage requiring hospital care of 4.4%, and that of these, 30% will require critical care (invasive mechanical ventilation or ECMO). This estimate was based on early reports from the UK, China and Italy. [28] Recent data from Italy suggests 25% of cases are severe and 5% are critical (this data is uncertain because of likely undercounting of milder cases).[29]

Age-group (years)	% symptomatic cases requiring hospitalisation	% hospitalised cases requiring critical care	Infection Fatality Ratio
0 to 9	0.1%	5.0%	0.002%
10 to 19	0.3%	5.0%	0.006%
20 to 29	1.2%	5.0%	0.03%
30 to 39	3.2%	5.0%	0.08%
40 to 49	4.9%	6.3%	0.15%
50 to 59	10.2%	12.2%	0.60%
60 to 69	16.6%	27.4%	2.2%
70 to 79	24.3%	43.2%	5.1%
80+	27.3%	70.9%	9.3%

Source: Ferguson NM (2020)

However, all of this research is based on early and incomplete data. Analysis from Stanford University in April 2020 estimated the case fatality rate for the US at 0.05-1% of those infected. Also, of note was the fatality rate on the Diamond Princess cruise ship (where 19% of passengers were infected) which was 1%, and the group was predominantly comprised of older people.[30]

Waves

WHO states that waves of infection can characterise pandemics, each wave spreading over months. When the infection levels decline, there can be many months before another wave, particularly if there is a seasonal impact.[31]

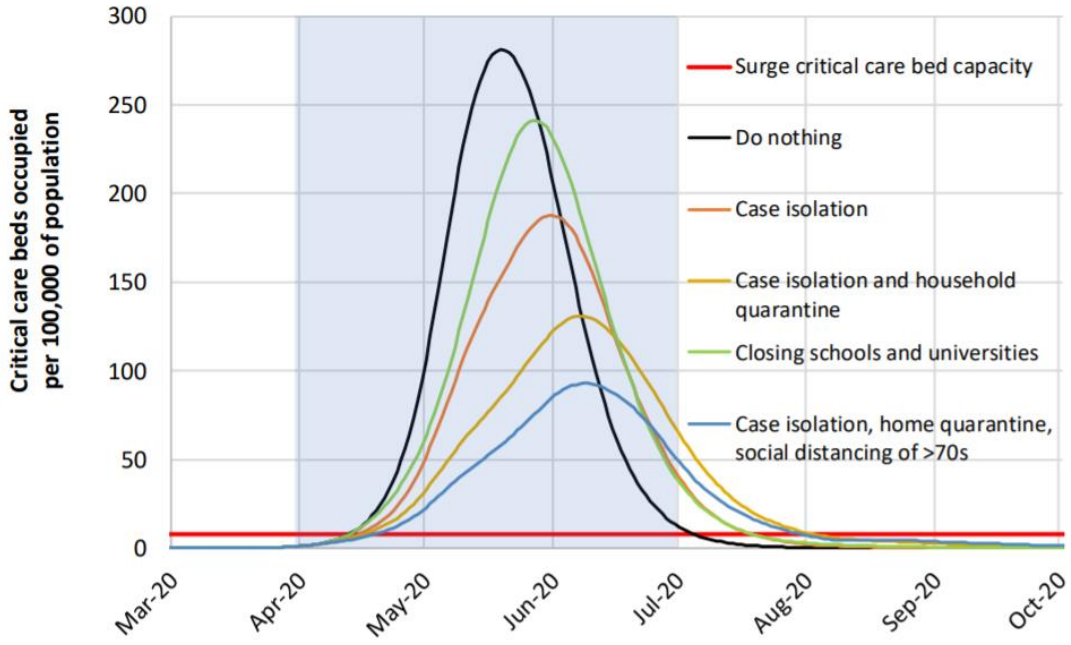
Given the characteristics of COVID-19 infections and pandemic spread, there will be ongoing peaks of cases in many countries for months and potentially years. Like 1918, it is likely that only “walled” communities, which must put in much resources and effort to maintain their defences, will remain virus-free in the long term.

How the outbreak will respond as measures are lifted has yet to be discerned. It could possibly result in a second peak or wave later on, unless sufficient immunity levels have been reached to prevent sustained transmission.

Decision-making must consider this as measures that ameliorate the first wave may unintentionally lead to a more severe subsequent course of events, with greater net consequences and impact, especially in countries with annual winter.

The UK initially announced a different approach to many other countries, viewing strict measures and multiple waves of epidemic (as measures relaxed) as unsustainable in the long term. The UK Chief Science Officer initially referred to herd immunity as a goal for sustainable protection which led to much protests.[32] However, the government distanced itself from this statement as scientific modelling has indicated that the UK does not have the healthcare surge resources to handle what would be a "catastrophic epidemic".[33,34]

Based on modelling the UK has now put in place a lockdown approach with an additional focus on older and vulnerable people. The strategy includes a combination of case isolation, household quarantine and social distancing of those at higher risk of severe outcomes (older individuals and those with other underlying health conditions). The approach sits alongside the hope of increasing levels of immunity, although there is not enough information yet to know if immunity after infection is long lasting.



Source: Ferguson NM (2020)

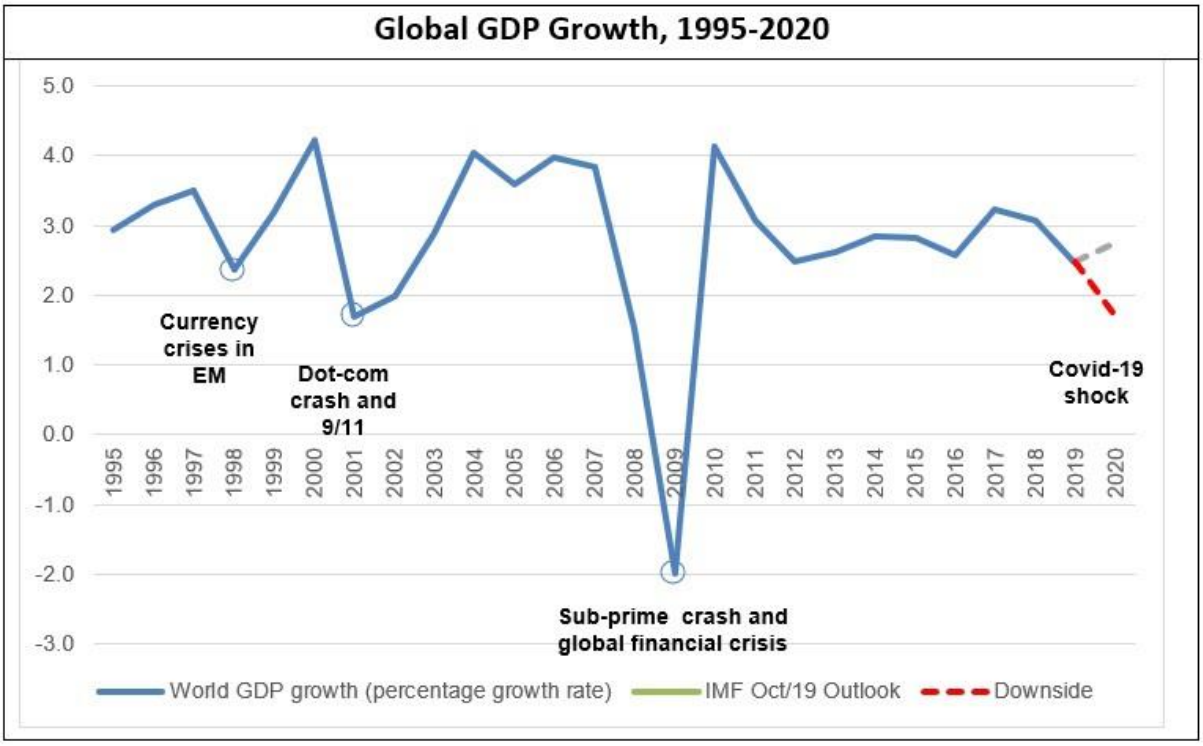
UK has said people should stop all unnecessary travel, work from home if possible, avoid pubs, clubs and other social spaces. Ministers are also not ruling out ordering the closure of all bars, restaurants and nonessential shops. School and colleges are closed, except for

those looking after children of key workers and vulnerable children. Nurseries, private schools and sixth forms are also being told to close. The government advises that children "should not be left" with grandparents or others in groups vulnerable to contracting coronavirus. In response to panic buying UK supermarkets brought in strict limits on purchases.[35] These measures are alongside other social distancing measures, travel advisories, financial aid, hospital redesign and so on.

Whole households are asked to self-isolate for 14 days if any individual in it develops symptoms. People over 70 are asked to stay at home for up to four months to protect themselves from the risk of catching the virus.[36] Those who are at increased risk of severe illness to be particularly stringent in following social distancing measures. A list of at-risk people is provided, which includes all those over 70, those with an underlying health condition and those who are pregnant. The UK government has said that there are some clinical conditions which put people at even higher risk of severe illness and will directly contact these people with advice on the more stringent measures to take.[37,38]

Economic Impact

In terms of economic impact, some comment is provided within case studies. Globally the lockdowns, travel restrictions, and social-distancing measures are likely to result in a dramatic fall in spending (both consumer and business) leading to a recession. UN Conference on Trade and Development forecasts a recession in some countries and that global annual growth will be depressed to below 2.5%, the recessionary threshold for the world economy.[39]



Source: UN[40]

In April, the World Economic Outlook projects global growth in 2020 to fall to -3 percent. This would make the pandemic lockdown the worst recession since the Great Depression, and far worse than the Global Financial Crisis of 2008/9. The cumulative loss to global GDP over 2020 and 2021 from the pandemic was estimated by the IMF to be 9 trillion dollars.[41]

Fundamentally COVID-19 is a health issue, but as more is understood around true infection rates (through serological testing), case fatality rates, and potential effective treatments then

more and more countries are likely to consider the balance of impact of COVID-19 epidemics vs economic realities.

Measures taken to control the spread of the virus, such as lockdowns and travel restrictions, have led to supply chain disruptions and a sharp decline in travellers.

There are also specific considerations related to the unique population demographics of each country. Singapore has around 1,400,000 migrant workers, of whom some 284,000 construction workers are in high density accommodation such as dormitories.[42]

Other Aspects

The following were out of scope of the review but likely to be critical considerations, particularly if a lockdown is continued over an extended period of time: detailed analysis of national and regional economies, public responses and social isolation, communication on the course of the outbreaks and on measures taken, availability and distribution of food, and education. Commentary on some of these areas is provided in the case study examples and the COVID-19 Science Report on Containment Measures.

Conclusion

Apart from differences in concept and implementations across the examples, lockdowns as interventions to control outbreaks of infectious diseases are highly complex. In the case of Wuhan and Italy, lockdowns were initiated because their healthcare facilities were in imminent danger of being overwhelmed and were actions of last resort and desperation.

The more measured “trace, track and treat” and social distancing approaches of Taiwan and South Korea appear to have achieved similar outcomes (to the extent that one may compare them) for less cost and in less dire straits.

It is difficult however to see how the total approaches of even the more successful case examples could have implemented or achieved benefits in the same way in the others. Local factors and the “other areas” (mentioned above but beyond the scope of this rapid review) require that each region’s approach be tailored to its own circumstances, contexts, capabilities, cultures and economic resources.

It may be more beneficial to think in terms of *combinations* of interventions (including “trace, track and treat”, social distancing, protecting older people and the vulnerable, limited quarantine by areas/buildings/regions, among many others) to selectively target and appropriately contain and/or mitigate the outbreak (the most extreme combinations amounting to what is defined as a lockdown) rather than considering a “lockdown” as a single entity that can be executed or not.

Consideration should also be given to the trajectory and timings of the interventions. While wholesale lockdowns have had to be executed in some countries, there could be value in considering a measured series of deliberate interventions and de-escalations that are designed to slow the outbreak and conserve healthcare resources while minimising economic and societal consequences. Instead of pulling the handbrake which risks flipping the car, so to speak, it might be possible to tap the brakes towards a gentler stop.

Case Study Examples

The following section outlines social distancing measures in the 1918 influenza pandemic and then goes on to explore country case examples in relation to measures taken in response to the COVID-19 pandemic. The following should be read with the caveat that, because of the time limitation, the rapid scan approach, the variability of available information of the various lockdowns, the case example descriptions vary in detail.

1918 Influenza Pandemic

Prior to COVID-19, the 1918 influenza pandemic was the most severe pandemic in recent history. It too can be categorised as a Phase 6 Pandemic where the infection causes sustained community outbreaks across many regions.[43]

Estimates suggest that 500 million people or one-third of the world's population became infected with the 1918 influenza. The number of deaths was estimated to be at least 50 million worldwide with about 675,000 in the United States.[44] Unlike COVID-19, mortality for the 1918 influenza pandemic was high in people younger than 5 years old, 20-40 years old, and 65 years and older. The high mortality in healthy people, including those in the 20 to 40-year age group, was a unique feature of this pandemic. [45]

The 1918 pandemic is a useful comparison. It was a rapidly spreading virus that very few had immunity to and for which there was no vaccine. There was the challenge of identifying the sick (as symptoms are similar to other respiratory illnesses) amid asymptomatic spread.[46] With COVID-19, it is impractical to test everybody on an ongoing basis, despite the increasing capabilities in some countries. Asymptomatic spread for COVID-19 is estimated to be around 25%.[47]

Given the challenges above, it was social distancing measures that were relied upon in 1918 to affect the spread of the virus. A key difference is that aggressive and sustained testing is emerging as a powerful tool for fighting COVID-19. Extensive testing can give countries a better picture of the extent of an outbreak to aid decision making (eg China, South Korea, Singapore).

The following section pulls out key issues related to lockdown measures during the 1918 pandemic in the US.

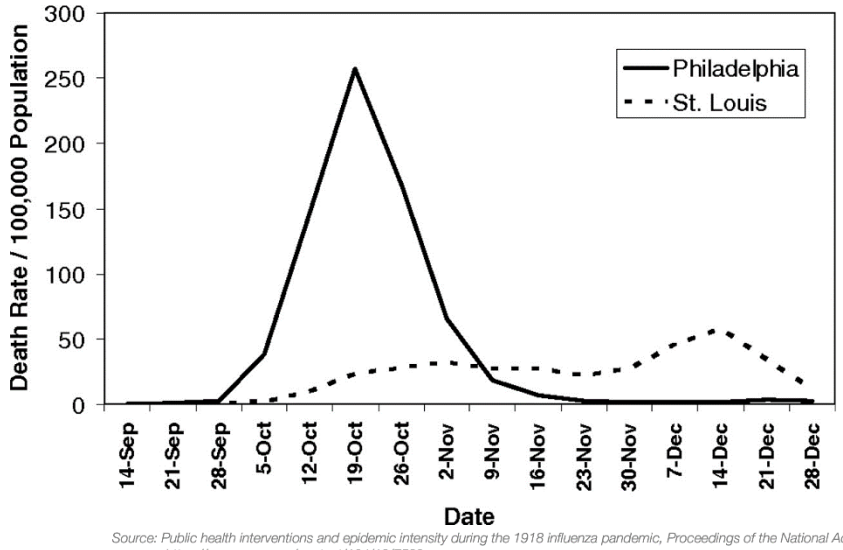
Timing of Measures

A review of historical data and measures implemented in over 40 US cities, covering about 20% of the US population, concluded that well-communicated, early, sustained, and layered social distancing measures were consistently associated with reductions in mortality. This was particularly the case if the measures were implemented before the pandemic exponentially increased in cities. Much of the following information is taken from the historical review.[48]

The timing of some 1918 pandemic lockdowns was in response to the scale of illness and death rates (Boston and Philadelphia). In those cases, the measures came too late to prevent widespread infection of influenza.[49] This would be similar to Wuhan and some cities in Northern Italy.

St Louis however took measures about a week before Pittsburgh and reported a far lower number of deaths. On average, taking measures 20 days earlier halved the death rate. Italy seems to have realised this. Although they initially locked down Lombardy, they rapidly moved to lock down the entire country. Similarly, Spain initially announced lockdown of a defined area but has now moved to a lockdown of the whole country.

It would seem that the earlier measures are implemented, the less time they are needed. It becomes easier to identify early cases, and the fewer people get infected. However, the data is not consistent as the arrival of future waves can have an impact on mortality.



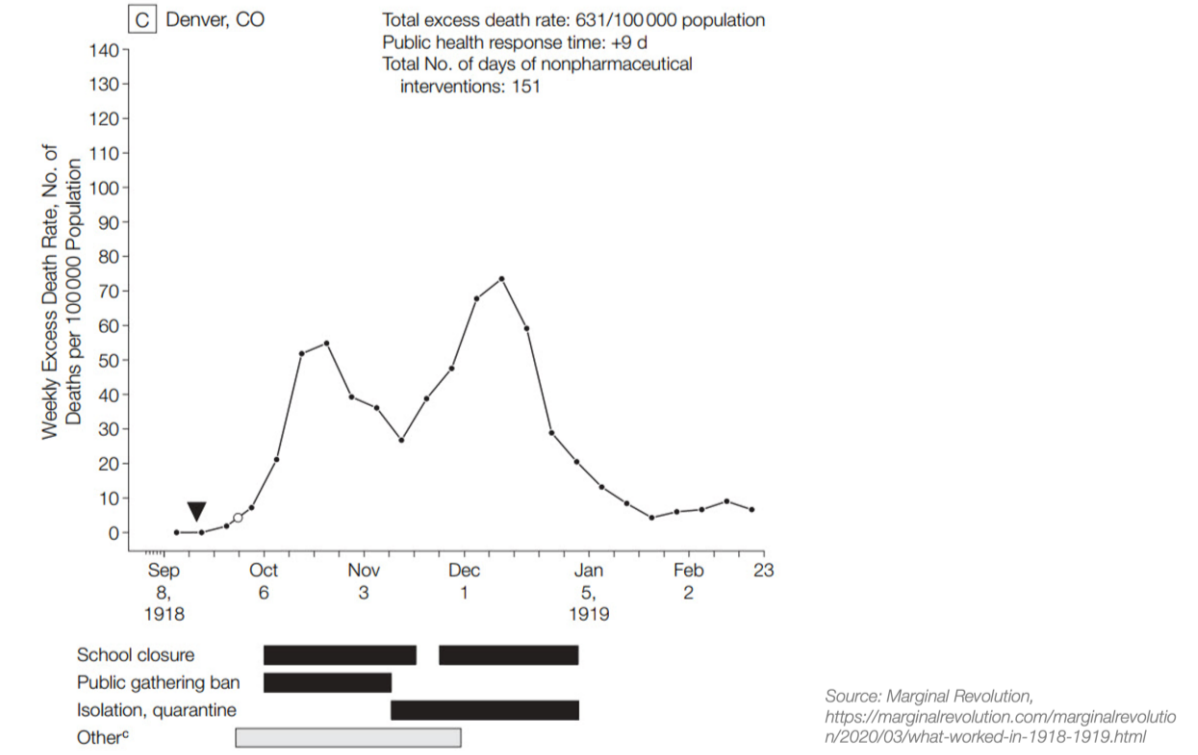
The first cases of disease among civilians in Philadelphia were reported on September 17, 1918, but authorities downplayed their significance and allowed large public gatherings, notably a city-wide parade on September 28, 1918, to continue. School closures, bans on public gatherings, and other social distancing interventions were not implemented until October 3, when disease spread had already begun to overwhelm local medical and public health resources.

In contrast, the first cases of disease among civilians in St. Louis were reported on October 5, and authorities moved rapidly to introduce a broad series of measures designed to promote social distancing, implementing these on October 7.

The difference in response times between the two cities (≈14 days, when measured from the first reported cases) represents approximately three to five doubling times for an influenza epidemic.

Source: Public health interventions and epidemic intensity during the 1918 influenza pandemic, Proceedings of the National Academy of Sciences of the USA https://www.pnas.org/content/104/18/7582

Denver enacted measures and then loosened them. They had a double peak, with the second one higher than the first.



Source: Marginal Revolution, https://marginalrevolution.com/marginalrevolution/2020/03/what-worked-in-1918-1919.html

Implementing social distancing early in the 2009 Swine Flu pandemic also helped slow transmission. There was closure of schools, large gatherings, religious gatherings and entertainments. Social distancing and personal hygiene measures were also adopted. Public communication and a call centre to provide information to those concerned was also thought to stem panic (it took over 5 million calls in one month in 2009).[50]

Waves and the Long Term

Social distancing measures in the second wave of the 1918-1920 influenza pandemic did not seem to be effective (apart from full “walled” isolation). US cities put in place the same measures, but most communities sustained significant illness and death. Whether these measures prevented even more deaths is unclear.[51] In terms of the timeline, the second

wave coincides with a high number of sickened soldiers returning back to the US from Europe and Africa.[52]

The 1918 pandemic shows how far and fast a novel virus with similar characteristics to SARS-CoV-2 in terms of transmission can spread. Isolated communities in Alaska succumbed to the influenza in 1918, and only a handful of remote islands, rural towns, walled hospitals and schools were left unaffected. These avoided the pandemic by shutting themselves off from the outside world.[53]

The 1918 pandemic showed that through social distancing measures, it is possible to reach a point of immunity over years and reduce the overall mortality of the infection. Virus burn out or mutation to less severe strain has been hypothesised as a cause of the end of the pandemic (a detailed analysis is out of scope of this review.)[54]

Economic Impact

As with now, economics and the impact of closing commerce, entertainment and transport affected decision making. In cities that were early to lockdown, there was resistance from affected businesses as the economic impact was dramatic. [55] (A review of the full economic impact is out of scope of this rapid review.)

Public Response

Some city leaders in 1918 viewed that there would be mass panic that would lead to loss of social cohesion and lowered immunity. The “don’t panic” message then could have contributed to public confusion about the actual level of risk which affected behaviours. [56] This is similar to some countries in relation to COVID-19.

Managing expectations of what constitutes essential versus nonessential activities is a key factor to learn from 1918. Tensions were expressed when food stores were allowed to remain open but places of worship closed (in this case it was priests that protested; it is unclear if the general public held the same sentiments).[57]

COVID-19 Pandemic

Many countries have taken measures that can be interpreted as “lockdown” in response to the COVID-19 pandemic. Overall, there is a lack of detail on *how long* measures will be in place for and variation between countries. The precise detail of each have not been extensively researched. However, common features have emerged:

- Measures are often put in place alongside travel restrictions into the country and closure of borders
- They last around 4 weeks (2 incubation cycles of COVID-19)
- Essential shops remain open (food, pharmacy, banks and sometimes tobacconists and hairdressers)
- Requirement for the population to stay home unless key workers. Only permitted out to shop for food and exercise outside at a safe distance from others
- Targeted measures for the most vulnerable to stay home fully (eg deliveries of food and medicine)
- Working from home where possible
- Workers that can’t work often provided with financial support from the government

Vietnam was reportedly the first country outside of China to enact a lockdown on February 13. Son Loi, a town of 10,000 was locked down for 20 days. [58] During March many more countries followed suit across every continent.

The following sections explore the lockdown approaches taken by China, South Korea, Italy, Taiwan, Hong Kong, Japan, Sweden, New Zealand and the city of New York in the US.

China

It has been reported that the first case of someone suffering from COVID-19 can be traced back to November 17, although it is possible that there were earlier cases.[59]

In December 2019 there was an emerging cluster of people with atypical pneumonia in Wuhan, Hubei Province, who would later be identified as COVID-19 infections. On 10 Jan, the first death and 41 confirmed cases of the novel COVID-19 viral infections were reported. By 22 Jan, there were 571 cases and 17 deaths reported. On 23 Jan, a lockdown in Wuhan and other cities in Hubei province was announced.

As at April 15, China reported that the total number of confirmed cases stood at 82,295, with 3,342 fatalities.[60] To note, there has been ongoing concern over the validity of data from China regarding COVID-19 (as well as other countries). On February 12 there was an increase in cases of 742%, which then fell back to previous levels. The change was reported to be down to counting methodology, which was then reversed.[61]

The main measures and timeline are outlined at the end of this section. China imposed one of the most comprehensive and effective lockdowns that is unprecedented in recent times. Specific containment measures were adjusted to the provincial, county and even community contexts, the capacity of the setting, and the nature of novel coronavirus transmission.

At an early stage, the Communist Party of China Central Committee and the State Council launched the national emergency response. The Central Leadership Group for Epidemic Response and the Joint Prevention and Control Mechanism of the State Council were established. They put in place a three-phase timeline strategy to gain control of the spread and to go forward with a careful return to work.

Studies estimated that the Wuhan lockdown resulted in a 3-5 days delay in the national spread of the disease within China. The impact was likely reduced due to widespread travel prior to the lockdown of Wuhan and surrounding towns.[62,63]

Although there was a residual effect of travellers from Wuhan and surrounding areas seeding some local transition in other parts of China, analysis suggests that the spread slowed due to the strict control measures carried out by government agents and communities across China.[64,65,66] The R0 decreased from 3+ to <1,[67,68,69,70] more outside of Hubei. [71] However, modelling published in April and based on Chinese data put the RO at 5.7.[72]

One study found that 30 days of substantial social distancing reduced RO from 2.2 to 1.58 in Wuhan and Hubei and from 2.56 to 1.65 in other provinces.[73]

The measures also affected mortality by reducing hospital overwhelming. WHO reported that as of 20 Feb, the case fatality rate (CFR) in Wuhan was 5.8% vs. 0.7% in other areas in China.[74]

One study projected epidemic end time in Wuhan (end time being when increment of confirmed infected equals zero) at 136 days from 28 Jan (with total of 62,577 infected) with moderately strict measures versus epidemic end time at 299 days (with total infected as large as 8,923,823) with no rigorous control measures. The study found resumption of work on 9 Feb was projected to result in a short rebound with peak of outbreak postponed by 10 days and its magnitude increased by 50% versus scenario of continued implementation of

combined control measures.[75] Most of the studies recommended continued implementation of these measures in China until the epidemic is under control (March or April).[76]

Modelling analysis, based on data from China, suggests that China's containment strategies are continuing to be effective as people return to work.[77, 78]

Approach

Timing

Early implementation of lockdown was a key factor in the effectiveness, the number of infections could be reduced up to 98.9%, and the number of deaths could be reduced by up to 99.3% if implemented very early.[79] It was estimated that cases would have increase 67-fold across mainland China without lockdown measures. There would have been a 51-fold increase in Wuhan, a 92-fold increase in other cities in Hubei, and 125-fold increase in other provinces by 29 February 2020.

It was also estimated that if the measures had been implemented one week, two weeks or three weeks earlier in China, cases could have been reduced further by 66%, 86%, and 95% respectively.[80]

It has been suggested that locking down an epicentre can have negative impacts on cases and mortality rates due to a surge in cases from close contacts forcibly confined in homes, healthcare being overwhelmed, and an inability to effectively quarantine individual cases.[81]

Early Detection and Isolation of Cases

The early detection and isolation of cases likely prevented infections (by 5-fold), as did social distancing (by 2.6-fold). The combination of measures achieved the strongest and most rapid effects.[82]

Severity of Measures Subsequently

Research suggests that earlier resumption of work after only 14 days would result in the outbreak returning.[83] Although the R0 has reported to have dropped below 1, the contact rate needs to be at least 30% or less of normal levels until April to ensure the rapid ending of the epidemic.[84] This also relies on other countries undertaking the same level of measures as returning travellers could seed new clusters (China thus implemented a 14-day traveller quarantine).

Although the full lockdown approach of China was found to be highly effective, there is a potential scenario where early activation of social distancing at low strength level (about 0.25 of the severity of social distancing actually implemented in China) could be effective if the outbreak is not substantial.[85] This aligns to China's gradual and careful return to work approach now that the R0 is reduced.

Multi-interventional approaches therefore need to be tailored according with balanced consideration of infection and death numbers, confining epidemic regions, and maintaining socioeconomic activity.

Relaxation of Lockdown Measures

In March, measures were gradually lifted across China, with a careful return to work. However, the lockdown in Hubei and the epicentre of Wuhan remained. From March 24, travel restrictions were lifted in Hubei (with the exception of Wuhan).

Hubei residents require a "Green Code" to travel, this is based on the AliPay monitoring app.[86] The QR colour code generations (green, yellow or red) are based on an individual's current location, travel history, basic health information and the individual ticking a box to say if they have been in contact with an outpatient or anyone hospitalised in the last 14 days. QR

colour codes are refreshed daily.[87] Residents with a green code in Wuhan will be allowed to travel after April 8.[88]

There is concern that case numbers increased in late March due to travellers returning from other countries and developing the infection.[89] After China put in place restrictions on entry and quarantine measures, it was reported that daily case numbers reduced.[90]

However, on March 31, China reported 1,541 "asymptomatic" positive cases. It was unclear if these people are in quarantine or have since recovered and been released. Of these cases, 205 were reported to be people returning from abroad.[91]

Russia became China's largest source of imported cases in mid-April. In response China said it would build hospitals and set up quarantine facilities in border regions.[92]

Implementation Issues

The WHO recognised that, while measures taken in China were effective, they required an unusual and unprecedented speed of decision-making, operational thoroughness by public health systems and societal engagement. Such conditions may be unique to China's political system as a one-party state.[93]

Measures have been described as *"the most ambitious, agile and aggressive disease containment effort in history",* and parts of its social distancing measures as the *"largest and most draconian quarantine in history".* While these have drawn praise from WHO and helped contain the spread, these measures may not be replicable in other cultures and parts of the world.[94]

The unique conditions supporting the swift and effective implementation of containment measures in the country include:

- The community largely accepting the efforts and fully participating in the management of self-isolation and enhancement of public compliance. Civil society organisations were mobilised to support prevention and response activities, and community volunteers were organised to help solve practical difficulties for isolated residents. These contributed to the speed of implementation and efficacy.
- Extremely proactive surveillance to immediately detect cases, very rapid diagnosis and immediate case isolation, rigorous tracking and quarantine of close contacts.
- The rapid adaptation and adoption of technology to support various containment measures, such as social or workplace/school distancing and contact tracing. These include the massive adoption of online education and work tools by Chinese schools and workplaces. Medtech developments are also deployed to support triaging/detection of at-risk individuals seeking consultation advice or in the community, and to aggregate and estimate regional case estimates and risk at near real time. These solutions help to relieve the administrative burden of public health services, to increase accessibility to health services, and to free up capacity in the healthcare systems.[95]

Economic Impact

A survey of Chinese firms reported a 10-11% GDP contraction in the first quarter, with analysts predicting the lowest growth since 1976 – when the Cultural Revolution ended.[96] It was reported that GDP fell 6.8% in January-March 2020.[97]

China International Capital Corporation downgraded the growth forecast for China from 6.1% to 2.6% for 2020. Although China is slowly returning to work, the impact of the global pandemic is predicted to lead to a global recession for two or three quarters and the country's exports severely impacted, predicted to reduce by 18% in 2020.[98]

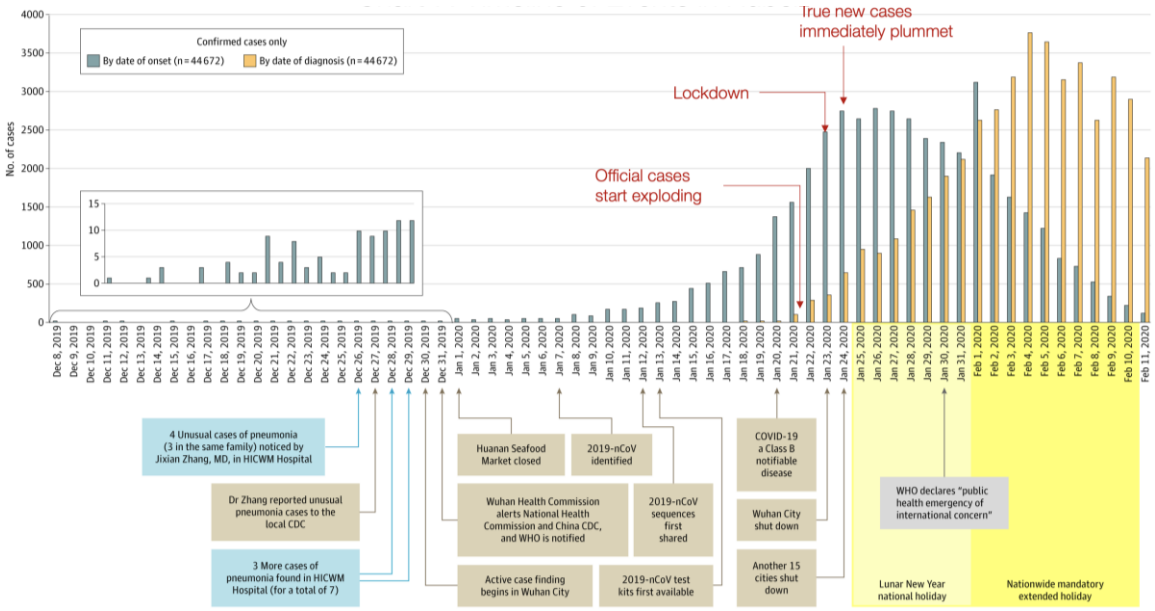
China has put in place measures to try to mitigate the financial impact. For example: small and medium sized businesses can defer repayment of principal and interest expenses for the first six months of the year and overdue loan repayments won't be subject to penalties; reducing and postponing social security, medical and housing contributions; deferring tax payments and reducing goods tax; borrowing schemes; and sector specific support.[99]

The IMF forecasted that GDP in China would fall from 6.1% in 2019 to 1.2% in 2020 and rebound to 9.2% in 2021, also that unemployment would go from 3.6% to 4.3% in 2020.[100]

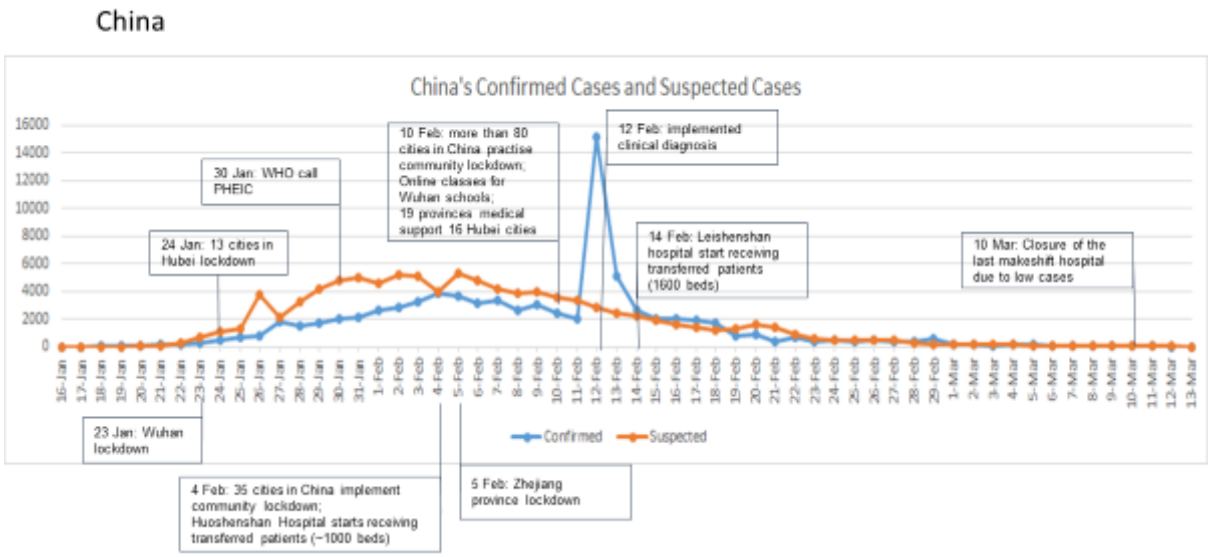
Impact on the Epidemiological Curve

The early data shows that after 12 days of the lockdown in Wuhan, cases were reduced. However, the long-term outcome is uncertain as the city returns to normal functioning as there is yet the potential of a second wave.

Issues regarding case definition and data quality remain. For example, in April 2020, China revised up the death numbers in Wuhan from COVID-19, adding 1,290 fatalities (to a total of 3,869).[101]

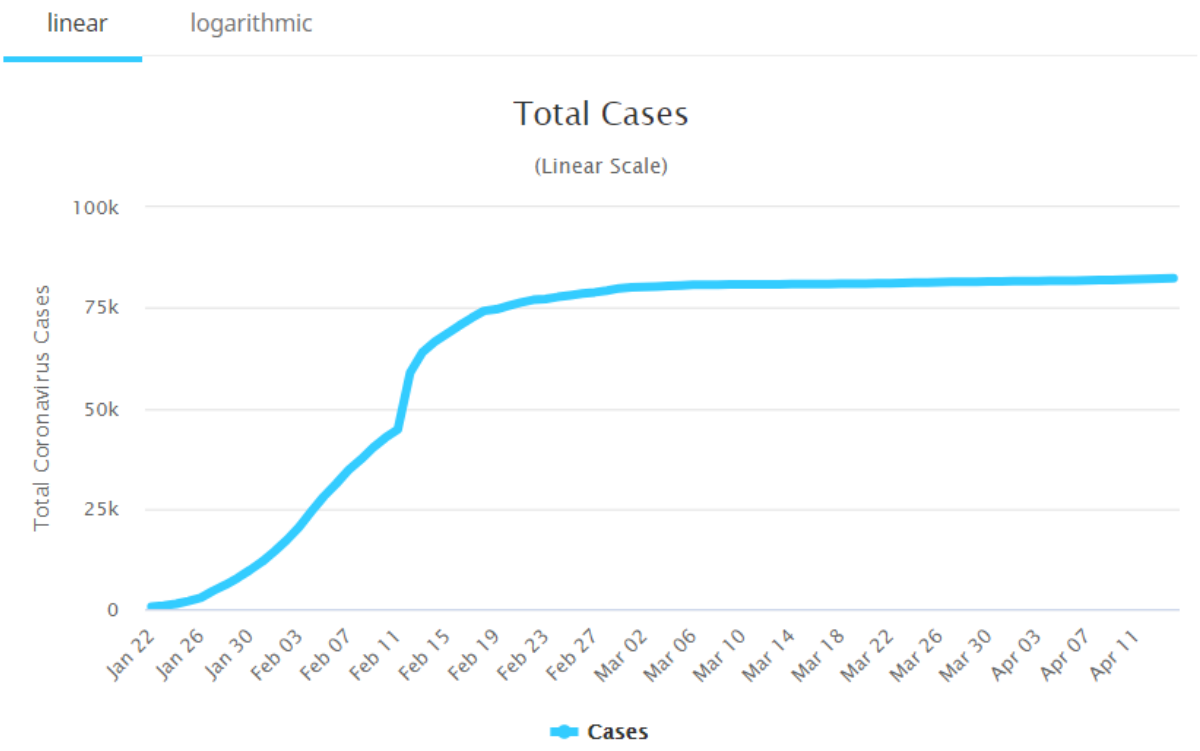


Source: Pueyo T (2020) [102]



Source: SSHSPH (2020)[103]

The above graph shows that the measures enacted reduced the case numbers over a 6-7 week period. It will be essential to understand the impact on case numbers of relaxing some measures.



Source: Worldometers (2020)

Provincial Example

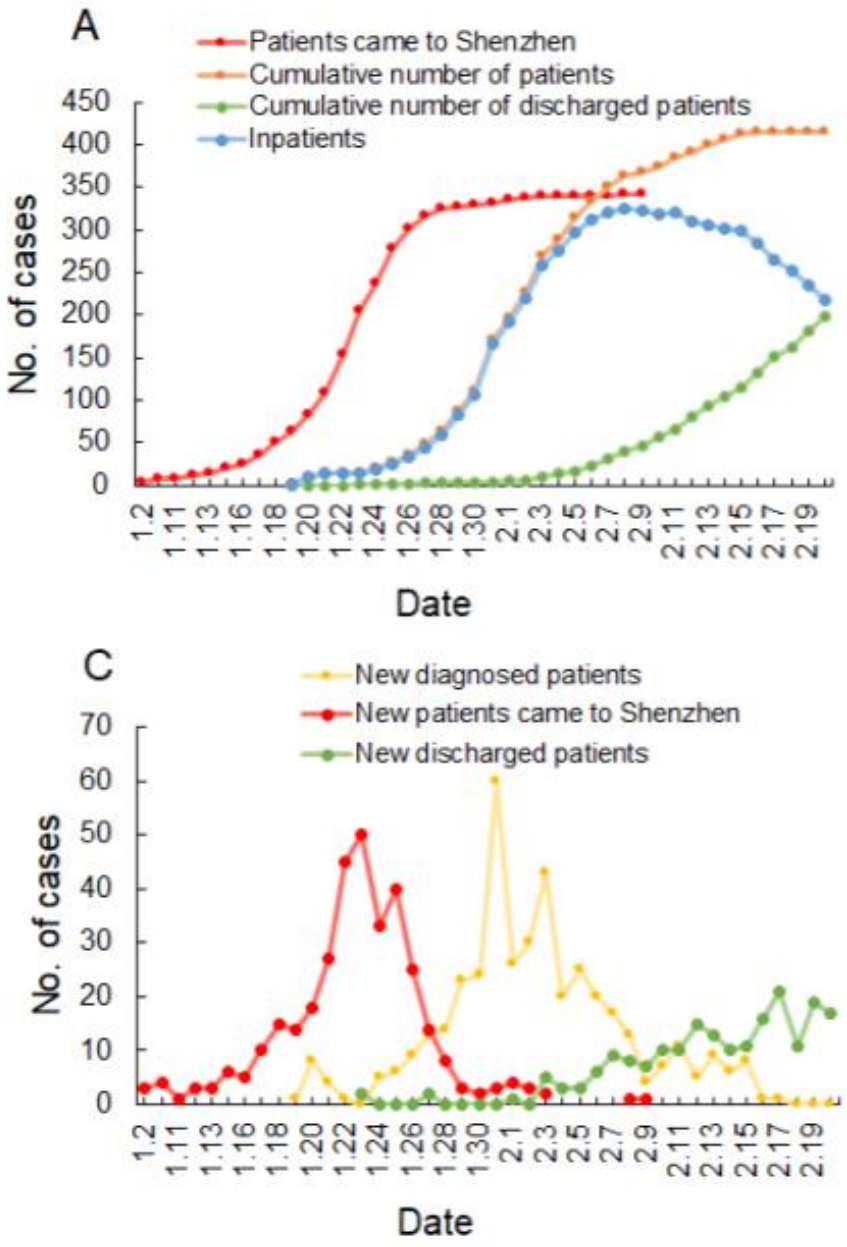
The implementation of early preventive strategies and measures in Shenzhen were successful in early identification of COVID-19 cases and this prevented a major outbreak occurring in Shenzhen.[104] Measures included temperature screening, banning crowds, fever clinics to isolate cases, and 14 days self-isolation for all arrivals to Shenzhen from Hubei.

We note the following phases.

- Slow increase phase from 19 to 28 January.
- Rapid increase and plateau phase from 29 January to 5 February.
- Decline phase since 6 February.

In the three phases, the number of patients from Hubei decreased, and the number of familial clustering cases increased. The newly diagnosed COVID-19 cases reached their peak around January 31, which was 7 days after the peak date of cases arrival at Shenzhen.

After the implementation of measures, cases started to decline from February 6. There were almost no community transmission and nosocomial infection reported in Shenzhen.



Source: Yang (2020)[105]

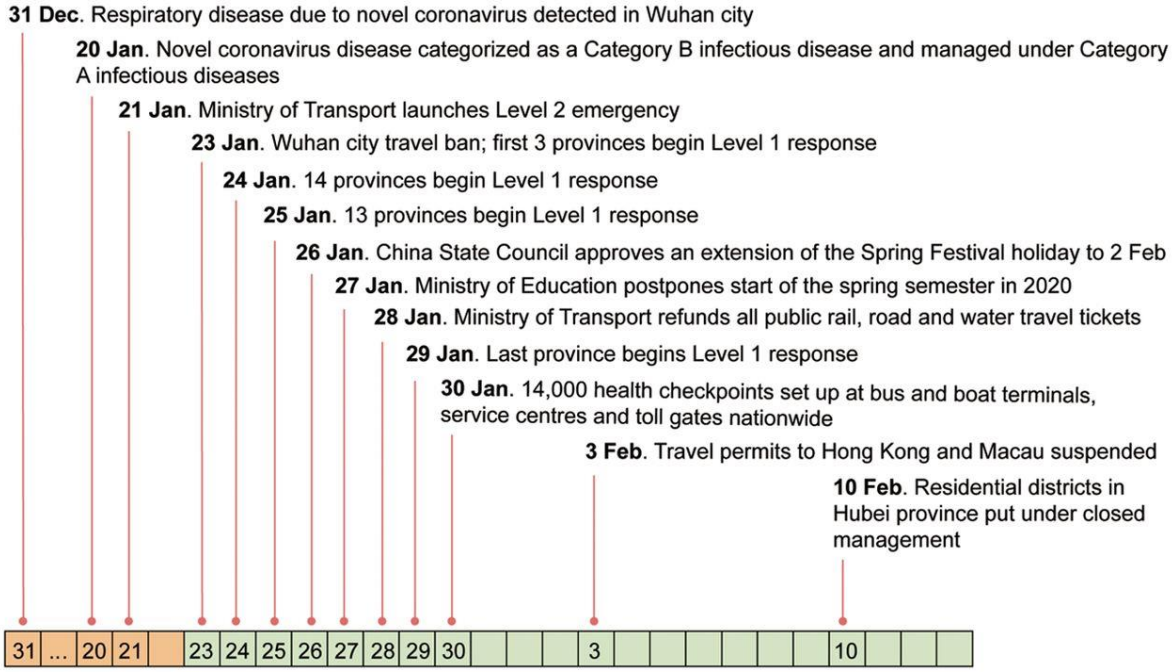
Implemented Measures

From the WHO Joint mission report, the key measures adopted are outlined below. A research article outlines some of these measures in more detail.[106]

Scientific and technological measures	A huge number of COVID-19 studies, scientific research projects and product R&D efforts are ongoing in China A comprehensive program of emergency scientific research is being carried out to develop diagnostics, therapeutics and vaccines, and to delineate the spectrum of disease and identify the source of the virus Whole-genome sequencing of COVID-19, followed by sharing with WHO

	Development of diagnostic kits
	Continuing focus on improving key performance indicators (eg enhancing the speed of case detection, isolation and early treatment)
	Aggressive use of cutting-edge technologies
	Shifting to online medical platforms for routine care and schooling
	Use of 5G platforms to support rural response operations
	Application of new technologies (eg use of big data and artificial intelligence) to strengthen contact tracing and management of priority populations
Contact Tracing	Formulation of protocols for COVID-19 management of close contacts
	Launch of relevant surveillance activities and epidemiological investigations
	In Wuhan, more than 1800 teams of epidemiologists, with a minimum of 5 people per team, are tracing tens of thousands of contacts a day. The high percentage of identified close contacts complete medical observation. Of these contacts traced, 1-5% of contacts were subsequently laboratory-confirmed cases of COVID-19 (depending on location)
Surveillance	COVID-19 included in the list of a notifiable report of Class B infections
	Launch of relevant surveillance activities and epidemiological investigations
	Formulation of protocols for COVID-19 surveillance, epidemiological investigation and laboratory testing
	Launch of relevant surveillance activities and epidemiological investigations
	COVID-19 testing for all visitors to fever clinics
	Routine Influenza-Like-Illness (ILI) and Severe Acute Respiratory Infection (SARI) surveillance. Routine respiratory disease surveillance systems to explore if COVID-19 is circulating more broadly and undetected in the community in China. RT-PCR testing for SARS-CoV-2 in ILI and SARI patients. Very few cases were picked up in Jan/Feb – in Wuhan only 4 cases, in Guangdong only one case, and no cases in a Beijing hospital or Shenzhen hospital.
Community Measures	Close wet markets, try to identify the zoonotic source. Wildlife and live poultry markets place under strict supervision and control measures
	Close all wildlife markets and wildlife breeding facilities
	Wuhan public transport suspended (including buses, metro and ferries) started on 23 Jan. Strict traffic restrictions out of Wuhan (23 Jan). Limit on car travel
	Implementation of temperature checks, health care declarations and quarantine against COVID-19 instituted at transportation depots by law
	Regular release of epidemic and prevention control information to the public

	Universal recommendation of hygiene practices (ie temperature monitoring, masking, and handwashing)
	School cancellation
	Lockdown of residential units where: confirmed COVID-19 patients stay / suspected cases / fever patients not excluded from having COVID-19. Close contacts of these individuals to also be quarantined at home
	Set up of temperature detection stations
	Extension of Spring Festival holiday
	Traffic controls and control of transportation capacity to reduce the movement of people
	Cancellation of mass gathering of people
	Quarantine for returning travellers from other countries
Food resources	Maintain a stable supply of commodities and their prices to ensure smooth operation of society continues
	Community organisation of food delivery for those in quarantine
Treatment and healthcare	Training of health workers in PPE
	Formulation of protocols for COVID-19 diagnosis and treatment
	New hospitals built and new facilities created for milder cases
	Re-allocation of medical supplies. Reserve beds were used and premises were repurposed
	Continual sending of healthcare workers and vital PPE supplies to Hubei province and Wuhan city
	Health insurance policies promulgated on health insurance payment, off-site settlement and financial compensation
Controlled return to activities	Pre-school preparation was improved
	Work resumed in phases and batches
	Health and welfare services were provided to returning workers in a targeted and ‘one-stop’ manner
	Normal social operations restored in a stepwise fashion
	Knowledge about disease prevention popularized to improve the public’s health literacy and skills
Travellers	International travellers quarantined for 14 days at their own expense
	Travel allowed if the individual has a QR “green-code” based on risk assessment
	Restrictions on entry into China. Reduction in international flights.



Source: Tian H et al (2020)[107]

South Korea

South Korea reported its first case on 20 January. As of 15 April, 10,591 cases were recorded and 225 deaths have been reported, out of a population of 50 million.[108]

“Trace, test and treat” was the initial strategy, which kept cases under control through January and February. South Korea experienced a rise in cases from imports from the US and Europe in late February and into March, which resulted in implementation of social distancing measures.

Approach

Information Campaign

After an initial outbreak. South Korea implemented aggressive and sustained public awareness which provided detailed information on the extent of the outbreak.[109] South Korea releases a high level of information to the public about COVID-19 cases. This is due to learning from MERS, *"We experienced a public backlash after a mass infection took place during the MERS outbreak five years ago because we didn't make public where those patients had gone,"* a health official, who declined to be identified because of the sensitivity of the matter, told Reuters.[110]

High Volume Sustained Testing

As of 15 April, South Korea had undertaken 527,438 tests.[111] South Koreans managed to rapidly design and create a test and set up a network of labs across the country. 96 public and private laboratories test for coronavirus. Health officials believe this approach may be saving lives. The fatality rate for coronavirus in South Korea was reported as 0.7%. Globally the World Health Organization has reported 3.4%, although scientists estimate that the death rate is lower because not all cases are reported.[112]

Multiple municipalities have set up “drive-thru” COVID-19 testing pods where medical staff in protective clothing take samples from people in cars. The process takes only 15 minutes, costs less than US$20, and reduces the risk of infection to health workers and others compared to people waiting in crowded clinics for tests.[113]

Four companies have been given approval to make tests. It means the country has the capacity to test 140,000 samples a week. Accuracy of South Korea's COVID-19 test is believed to be around 98%.[114]

From 22 March, COVID-19 diagnostic testing was compulsory for travellers entering South Korea.[115]

In April, KCDC’s National Institute of Health announced plans to conduct serum epidemiology studies such as COVID-19 antibody testing. [116]

Tracing

To aid targeted measures the government accesses personal data, including CCTV footage, GPS tracking data from phones and cars, credit card transactions and immigration entry information. The authorities can then make public information on hot-spots, so anyone who may have been exposed can get tested.[117]

Citizens and those entering the country use the app to report health status. A similar app tracks those who are under quarantine and can flag up if people leave quarantine with their phone.[118]

As at April 13, epidemiological links had been found for 81.5% of the total cases; 9.7% were either under investigation or unlinked cases.[119]

Quarantine of Infected Individuals

As of 12 March, 29,000 people are in self-quarantine. In the words of Dr Kim Yeon-Jae, an infectious disease specialist from the Korea National Medical Centre, *"We can't quarantine and treat all patients. Those who have mild symptoms should stay home and get treated…We should change our end goal strategy to lower death rates. So other countries like Italy, that see huge numbers in patients, should also change their strategies as well"*.[120]

All Korean citizens and long-term stay foreigners returning from abroad are required to self-quarantine for 14 days, and short-term visitors should undertake active monitoring.[121]

Treatment of Those in Need

There is technology to support the management of cases and the overall pipeline. People who test positive self-quarantine and are monitored remotely through a smartphone app, or checked regularly in telephone calls, until a hospital bed becomes available. When a bed is available, an ambulance picks and takes the patient to a hospital with air-sealed isolation rooms. All of this, including hospitalisation, is free of charge.[122]

Knowledge on effective treatments was documented and a standard clinical guideline was developed.[123]

Disinfection of Contaminated Environments

Areas that positive cases visited are disinfected. Images in the media of large-scale disinfection measures are common.

Source: Yonhap via Reuters (2020)[124]

Social Distancing

South Korea has imposed lockdowns on some facilities with outbreaks, but not whole areas or regions.[125] However, schools remain closed, offices are encouraging people to work from home, and large gatherings have stopped. Many people wear masks (when available) and there are thermal imaging cameras in the entrances to major buildings. Hand sanitisers are available in many common use areas (eg lifts, subway). [126]

On March 21, South Korea advised on voluntary social distancing for 15 days.[127]

South Korea is consulting with health authorities regarding school reopening. There is pressure from communities to reopen due to the social, educational and economic costs of continued closure.[128]

Implementation Issues

The following points are from expert commentary in the media:

- Cases of non-compliance. These have led to changes in the law to make noncompliance imprisonable. [129]
- Some older people have a lower health and science literacy level and so there can be some misunderstanding and a lack of cooperation. Family members were important in supporting compliance for this group. [130]
- Getting the cooperation of religious establishments was a challenge. Reaching out to religious organisations well in advance of an outbreak to share information and to prevent outbreaks through faith-based ceremonies is essential. [131]
- Politicisation of outbreaks and negative coverage of public health measures can have an impact on public support. [132]
- Panic buying has been noted.[133]
- South Korea's sick leave system (only 7% companies with more than 10 employees offer paid sick leave) and the attitude towards working while sick with common illnesses such as the flu, fever and cough has been a challenge.[134]

- The KCDC has asked citizens to avoid discrimination against those infected, and for the media to avoid sharing sensitive information that are potential identifiers.[135]

Economic Impact

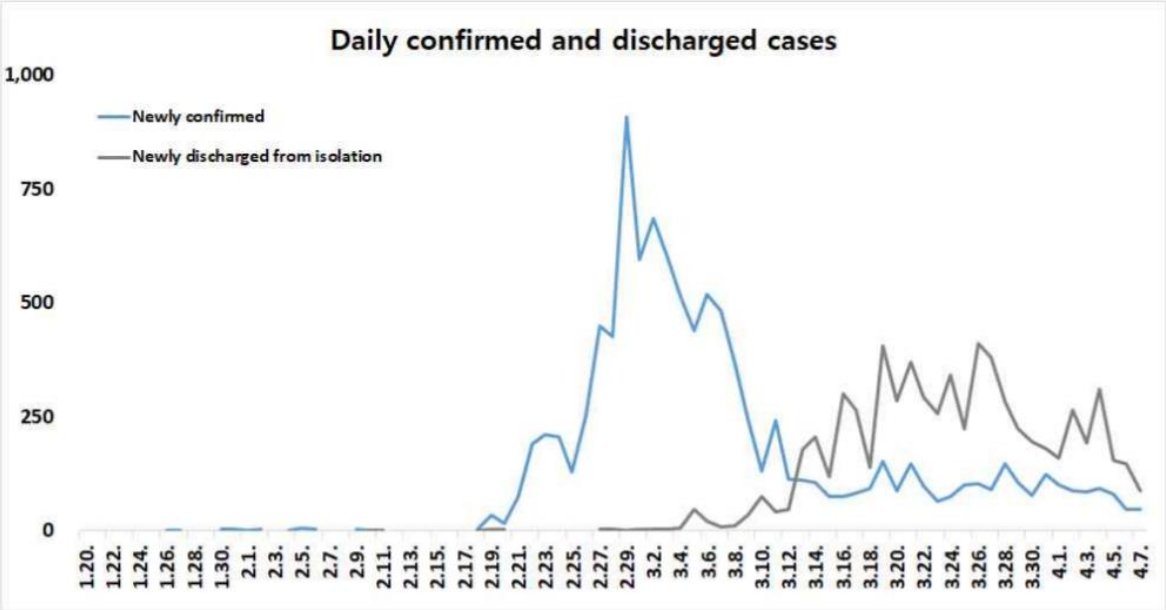
Economic analysts and South Korea's Prime Minister have warned of a recession due to the global pandemic.[136]

South Korea has outlined an economic support plan worth 100 trillion won (S$116 billion). The government has set up an emergency loan scheme for smaller businesses and 210,000 applied in the first three weeks of its operation.[137]

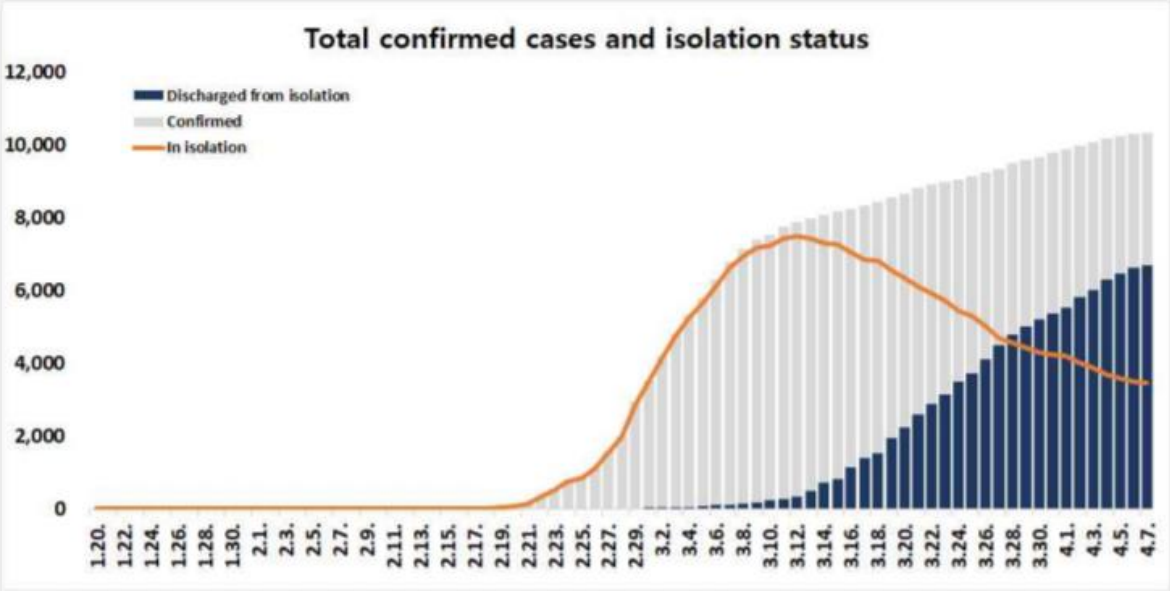
Some small to medium-sized businesses are also now exempt from paying partial insurance and utility bills. In addition, emergency cash payments are being provided to most families.[138]

The IMF forecasted that South Korea will see its GDP go from 2% in 2019 to minus 1.2% in 2020 and rebound to 3.4% in 2021.[139]

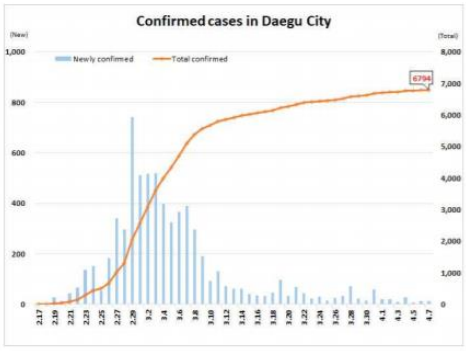
Impact on the Epidemiological Curve

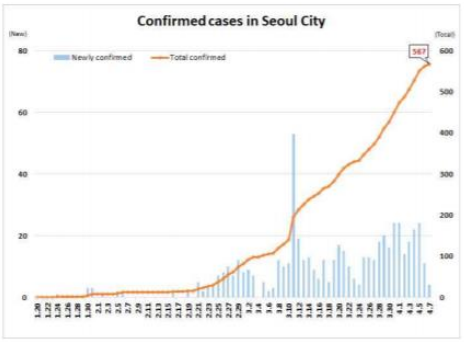


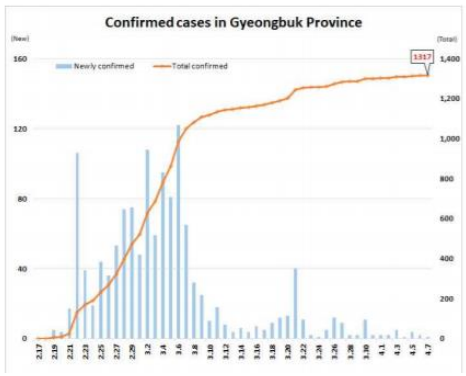
Source: KCDC (2020)[140]

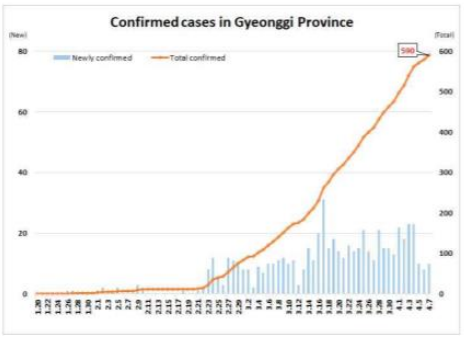


Source: KCDC (2020) [141]









Source: KCDC (2020) [142]

Implemented Measures

Border Controls	3 Jan	Enhanced quarantine and screening for visitors from Wuhan
	28 Jan	Expansion of case definition to include entire China
	4 Feb	Special immigration procedures for all inbound travellers from China
	12 Feb	Quarantine of visitors from HK and Mexico
	9 Mar	Expansion of special immigration procedures to cover all inbound travellers from Japan

	11 Mar	Designated Italy and Iran as quarantine inspection required areas
	15 Mar	Special Immigration procedures expanded to the European region - France, Germany, Spain, the U.K. or the Netherlands
	1 Apr	All overseas arrivals to undergo 14-days of mandatory self-quarantine.
Increased Community Testing and Reporting		Korea concentrated on testing large numbers of people to identify infection “hotspots”
	11 Feb	Launch of KCDC app that informs people if they are within 100m of a location visited by someone with COVID-19
	18 Mar	In Daegu, testing is being done for every person at high-risk facilities eg nursing homes
	22 Mar	Inbound travellers from Europe tested
Hospital-level isolation and treatment	28 Jan	Designation of 29 national hospitals (total 161 beds) to isolate confirmed and suspected COVID-19 cases
	24 Feb	Change to mitigation strategies - Isolation and treatment of potential cases instead of tracing individual cases for high-risk areas (Daegu and Cheongdo)
	2 Mar	Cases who have a low necessity for inpatient treatment but need to be isolated for the purpose of minimising the transmission and monitoring will be provided with medical support at ‘Life treatment centre’ which set up at each region.
Community-level isolation and Social Distancing	29 Jan	KCDC advice to avoid outdoor activities
	18 Feb	Announcement of school closure (and extension of school holidays)
	19 Feb	Museums and cultural centres in Korea closed indefinitely
	20 Feb	Anyone who attended Shincheonji Church or visited Cheongdo Daenam hospital in February should stay home
	21 Feb	Postponement of major sporting events
	22 Feb	KCDC Recommended to minimize gathering events and outdoor activities (especially for vulnerable population)
	25 Feb	Government is strengthening the monitoring at nursing homes and community facilities
	2 Mar	Roll-out of 2-week social distancing campaign “Let's Take a Break from Social Life”
	8 Mar	KCDC recommends everyday preventive actions to help prevent the spread of respiratory diseases, and social distancing to avoid population crowding and cancellation of gathering activities
		School term start postponed to April

	22 Mar	15 days voluntary Enhanced Social Distancing campaign. Government advised high-risk facilities, businesses and sectors to limit operation, advise people to stay home and refrain from going outside, and minimise contact with coworkers at work. Government urged people to refrain from attending religious gatherings, going to indoor fitness or sports facilities, or otherwise engaging in activities that make it easy to come in close contact with other people in an enclosed space.
		Enhanced Social Distancing campaign extended to 19 April.
	5 Apr	Penalties put in place for violation of mandatory home quarantine (self-quarantine). Failure to comply with mandatory home quarantine is punishable by imprisonment up to 1 year or a fine up to 10 million won in accordance with the Infectious Disease Control and Prevention Act.
	15 Apr	Elections held, measures included: social distancing, mask wearing, glove wearing, temperature checks on voters, separate booths for those with fever (disinfected after each use), special polling stations for the quarantined.
Corporate/ Work Environment Measures	11 Mar	Recommendation to work at home or adjust desk locations to keep a distance at offices
	12 Mar	Guidelines for intense management of business entities for COVID-19 prevention created by Korea's Public Health Authorities and released to high risk areas. Areas include: call centres, internet cafes, gyms, religious gatherings, private academies etc.
	12 Mar	KCDC encouraged businesses and workplaces to adopt remote working environments for employees such as work-at-home and online collaboration
Government Level/ Legal/ KCDC intervention	3 Jan	Alert level raised from Blue (1st level) to Yellow (2nd level)
	28 Jan	Alert level raised to Orange (3rd level)
	23 Feb	Alert level raised to red (Highest)
	c 21 Feb	Lockdown of all military bases (exact date unknown)
	4 Mar	Passing of laws to allow prosecution of suspects who do not cooperate with testing. Refusal of entry to people confirmed or suspected to have the disease
	4 Mar	Banned the export of masks and other items
	7 Mar	KCDC advised to designate a reporting person at every community facility so that suspected cases could be immediately reported to the local government and public health authority upon the onset of symptoms. The staff at the facilities should strictly follow personal hygiene practice, avoid going out when having fever or respiratory symptoms, and monitor the symptoms for 3-4 days

12 Mar	Infection control guidelines for high-risk workplaces released by Central Disaster and Safety Countermeasure Headquarters. Guidelines developed and distributed through relevant ministries and local governments

Note: Shift of strategy from containment to mitigation on 2 Mar. KCDC has released 7th edition of COVID-19 protocol and guideline.

Italy

As at April 15, Italy has recorded 162,488 cases and 21,067 deaths.[143]

Italy was the first nation in Europe to suspend flights to and from China. It was however possible to circumvent this restriction by transiting through other countries. This may have led to a false sense of security regarding potential exposure to COVID-19 infections and meant that the number of people from Wuhan and China within Italy were not well tracked.[144]

There is a suggestion that the early cases were not tested rapidly enough and were not isolated, contributing to community transmission.[145] Italy, as with other countries in Europe and beyond, has been criticised for a lack of a proactive response in January and is now having to be reactive (and to resort to lockdown measures to gain control of the outbreaks).[146]

The lockdown in Italy was triggered by the overwhelming of their hospitals and an exponential curve progression. On 30 Jan, two cases for Italy were reported.[147,148] However, there was then a jump in reported cases on 23 Feb, likely due to expanded testing. On 23 Feb, 67 cases were reported (out of a total 76 reported cases at that time) and two deaths in Northern Italy.[149]

Approach

The first lockdown measures were implemented in selected towns in Lombardy and Vendeto, triggered by a rapidly escalating situation and healthcare becoming overwhelmed.

On 8 March, lockdown measures were extended to further areas of Northern Italy. There was by then a total of 5,883 total cases, of which 1,247 were reported on 8 Mar. The total deaths were at 234, of which 37 were new deaths on 8 Mar.[150]

On 10 Mar, a nationwide lockdown was implemented. At this time there were a total of 9,172 cases, of which 1,797 were new cases reported on 10 March. The total deaths were at 463, of which 97 were new deaths on 10 Mar.[151]

Italy's nationwide lockdown measures included inter-regional travel restrictions, suspension of events, closing of commercial businesses, closing restaurants at 6pm and mandating distances between diners, and mandating of social distancing. Streets and public spaces have emptied, with many only going out to work if they can't work at home.[152]

Although there was some early confusion, the measures are supported by the majority of Italians. Some 89% of Italians support the government's measures, with 78% saying they would back even tougher measures.[153] There is a sense of the severity of the situation and Italians grasped the importance of being socially responsible as a collective.[154] There are multiple accounts (and online media) of Italians in quarantine spontaneously singing and playing instruments by their windows and balconies to lift the spirits of each other and also pass the time.[155]

The Italian government has reported that the lockdown is effective in reducing infections and are hopeful that the trend will lead to sustained reductions.[156] The Italian approach has the support of some academics who have modelled the disease and studied its characteristics.[157]

Experts stated that the effectiveness of the measure will depend on its citizens' adherence to the rules.[158] People found leaving their home without legitimate reason faced fines of between 400 euros to 3,000 euros (up from 206 euros).[159]

Towards the end of March, daily reported cases started to decline and there is discussion of a "stop-go" approach, re-opening some aspects of society for specific lengths of time and then closing them again based on case numbers.[160]

In April, authorities in northern Italy began testing health workers for antibodies that may help identify individuals with immunity. The aim would be to allow authorities to issue "licences" for individuals with proven immunity to the virus to return to work.[161]

There was pressure from companies and academics to reopen factories to prevent an economic catastrophe. A published open letter stated that "the social and economic consequences would risk producing irreversible damage, probably more serious than those caused by the virus itself".[162]

In Mid-April, Prime Minister Giuseppe Conte extended the country's lockdown to May 3.[163]

Implementation Issues

The following issues were identified.

- The rapid adoption of lockdown led to initial confusion (not helped by the media leaking the lockdown plan and so resulting in people leaving the area in Northern Italy) which improved over time, after people realised the severity of the situation.[164] The response of people in leaving Northern Italy may have triggered a whole-of-country lockdown.
- Italy is in unchartered territory and it is taking time to clarify the detail of guidance (eg what constitutes exceptional case for travel), particularly with the overlay of the European Union policies (eg Freedom of Movement).[165] Inevitably there is a sense of confusion and uncertainty.
- There is not yet an equivalent technological solution to facilitate tracing and tracking of people like in China and South Korea. Privacy concerns may be of concern.
- Economic impact is likely to be severe if the lockdown stretches on.[166]
- Emotional impacts of isolation and the fear instilled in a pandemic lockdown are a concern.[167] This was illustrated in prisons across Italy, where there were protests.[168] There were also psychological impacts when there was limited scale lockdown of specific areas, resulting in some reporting feeling like pariahs.[169]
- An article in Harvard Business Review stated the following lessons to learn from Italy's early experience of COVID-19: [170]
    - Recognise confirmation bias - a tendency to seize upon information that confirms our preferred position or initial hypothesis. In this case ignoring warnings from scientists.
    - Avoid partial solutions. Italy implemented gradual measures. An effective response to the virus needs to be orchestrated as a coherent system of actions taken simultaneously.
    - Data accuracy and standardisation.
    - Learning is critical. Finding the right implementation approach requires the ability to quickly learn from both successes and failures and the willingness to change actions accordingly. Italy learnt the following -
        - Extensive testing of symptomatic and asymptomatic cases early on.

- Proactive tracing of potential positives. If testing kits are unavailable, self-quarantined.
- A strong emphasis on home diagnosis and care. Whenever possible, collect samples directly from a patient's home.
- Specific efforts to monitor and protect health care and other essential workers (eg supermarket cashiers, pharmacists, and protective services staff).

Economic Impact

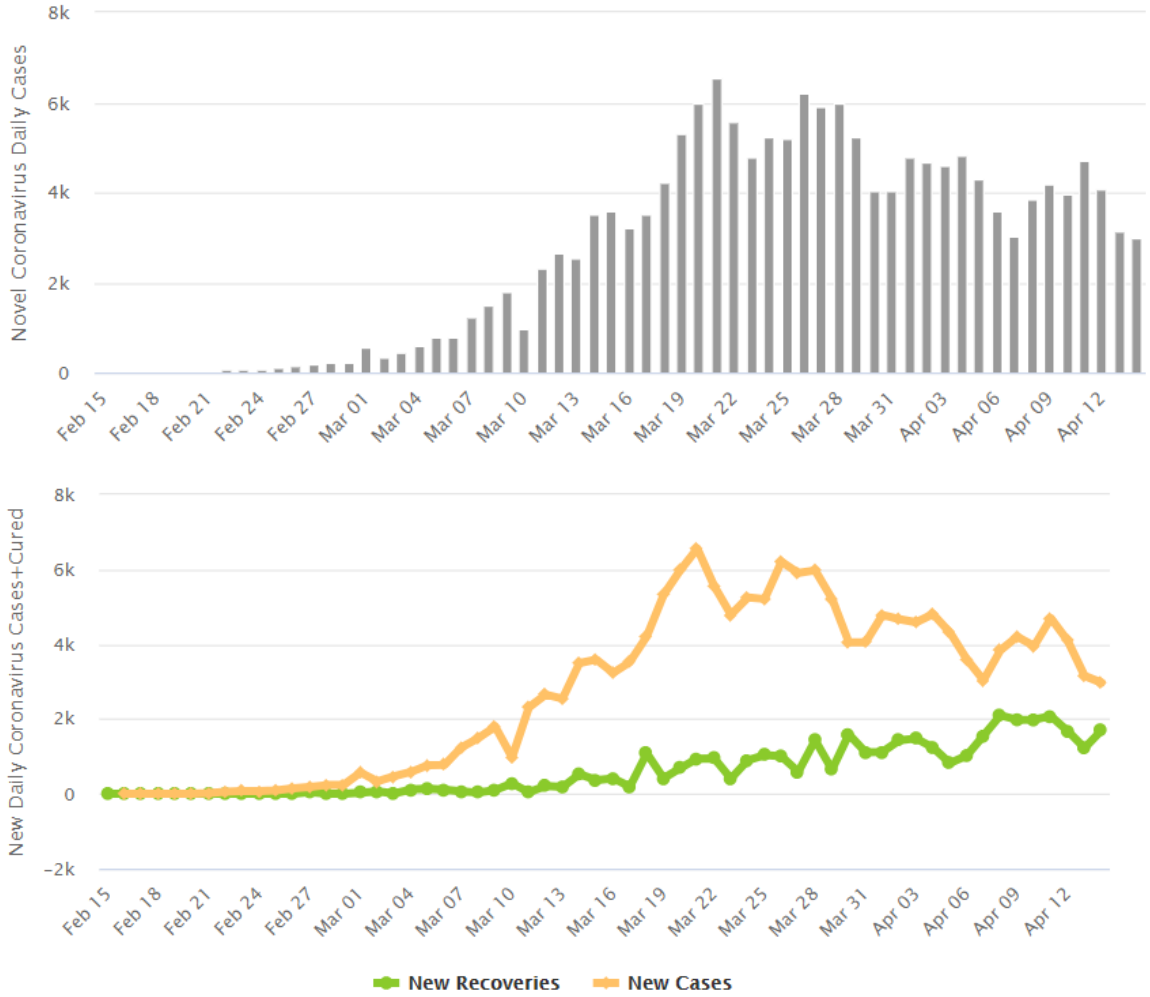
The IMF forecast that Italian gross domestic product would shrink 9.1 per cent in 2020.[171]

The government has passed a 25 billion-euro spending plan to try to counteract some of the economic impacts from the pandemic.[172] The Italian government approved a six-month debt moratorium, working on a guarantee covering 90% of new credit and has pledged to cover a third of the losses banks could face once the debt holiday ends.[173]

Italy announced a €400 billion (US$430 billion) stimulus to help businesses affected by the lockdown. The programme will add to the €340 billion in government-backed loans announced last month.[174]

Impact on the Epidemiological Curve

Cases rose to a peak on March 20, and since then there has been a general decline. As with many countries, testing capacity remains an issue and affects overall data.



Source: Worldometer (2020) [175]

Implemented Measures

Border Controls	31 Jan	Suspension of all flights to and from China
	23 Feb	Strict travel restrictions in and out for the following two weeks
	8 Mar	Avoidance of movement in and out of Northern region except for work
	10 Mar	Restrictions on non-essential movement across the country
Community-Level Isolation and Social Distancing	23 Feb	Suspension of all events, including sporting events, cultural activities (carnivals) and museums, and religious activities (masses)
		Closure of restaurants and commercial activities
		School closures for at least a week (universities already closed)
		Police granted authority to enforce restrictions
	8 Mar	Suspension of all sporting and recreational/cultural events; closure of all ski resorts
		Suspension of schools and exams
		Suspension of civil and religious ceremonies (masses and weddings)
		Restaurants only open from 6am-6pm
		Suspension of all events and shows, including medical congresses and sporting events
		Closure of entertainment and cultural facilities, such as museums and cinema
		Suspension of schools
		Practicing of physical distancing of 1m apart in restaurants and places of worship
	9 Mar	Prohibition of public gatherings
		Suspension of all sporting events
	10 Mar	Suspension of all religious ceremonies, weddings, and funerals
		Closure of restaurants, coffee shops, bars, nightclubs for two weeks
		Hairdressers and beauticians by single-slot appointment only (no overlapping of customers)
	11 Mar	Suspension of good and services retail businesses including markets, gyms, hairdressers and beauticians
		Closure of restaurants, coffee shops, bars, nightclubs (possibly indefinitely)
	24 Mar	Fines increased for leaving home without legitimate reason
Corporate Work Environment Measures	8 Mar	Promotion of working from home
	11 Mar	Recommendations for teleworking and paid leave, suspension of non-essential business activities

Government Level	31 Jan	Declaration of state of emergency
	11 Mar	Ministers given power to suppress inter-regional transport services

Taiwan

Taiwan is only 81 miles from mainland China. The country has 23 million citizens of which 850 000 reside in and 404 000 work in China.[176]

Though Taiwan has close ties to China it has managed to maintain its number of confirmed cases at 50 and reported a single death as of 13 March 2020. This number increased over following days to 67, mainly due to people who had arrived from overseas with COVID-19 infections.[177] Towards the end of March, cases increased to 306 and 5 deaths were reported.[178]

As of April 14, Taiwan reported 393 cases and 6 deaths.[179] On April 14 Taiwan reported no new cases of COVID-19 for the first time in more than a month.[180]

Approach

Although the WHO sent a tweet out on the 14 January stating that the new coronavirus didn't appear to spread via human-to-human transmission. Taiwan's Centre's for Disease Control had concluded the opposite two weeks previously and notified the WHO of their research through the UN agency's International Health Regulations.[181]

Like many countries with previous experience of SARS, Taiwan's government established a public health response mechanism for enabling rapid actions for the next crisis. [182]

Its response to the crisis shows swift action, effective use of technological infrastructure to support screening / surveillance / contact tracing, widespread vigilance, and community acceptance and participation.[183] Taiwan implemented early travel bans from the original affected areas in China and later widened them. Taiwan has also focused on production and distribution of masks.[184]

Taiwan used new technology to improve operational efficiency and speed in border screening. QR code scanning coupled with online reporting of travel history and health symptoms is used to classify persons into risk categories. 'Cleared' travellers are then sent a health declaration border pass via SMS for faster immigration clearance, while those with higher risk are quarantined at home and tracked through their mobile phones to ensure compliance.

It also leveraged on its National Health Insurance system/database to quickly mobilise case identification. It integrated the database with its migration/customs database, which facilitated the generation of real-time alerts during clinical visits based on travel history and clinical symptoms to aid case identification. The database integration was accomplished in one day.

Communication was prioritised, frequent press briefings and public announcements are made by ministers and even the vice president on developments on the outbreak and issues such as mask usage and handwashing. Concurrently, efforts are being made to tackle the propagation of misinformation in social media.[185]

In March, stricter border controls were put in place in view of the increasing number of imported cases.[186]

Implementation Issues

There are high levels of social responsibility in the community with virtually everyone using public transport wearing a mask. Hotels are proactive in offering to spray sanitising fluids on

the hands of entering visitors, and in restaurants and eateries, waiting staff are masked with sharing dishes served with serving utensils.

There have been concerns of fake news being spread and the government acted fast to address this issue.

There has been concern regarding Taiwan – China – WHO relations. Taiwan is prevented from being a member of WHO and there have been concerns that information from Taiwan has not been shared by WHO.[187]

Japan, the US, UK, EU and Australia have called for Taiwan to be given access to the WHO. US, Japan and the European Union have expanded bilateral ties so that they can learn from Taiwan's success. [188]

Economic Impact

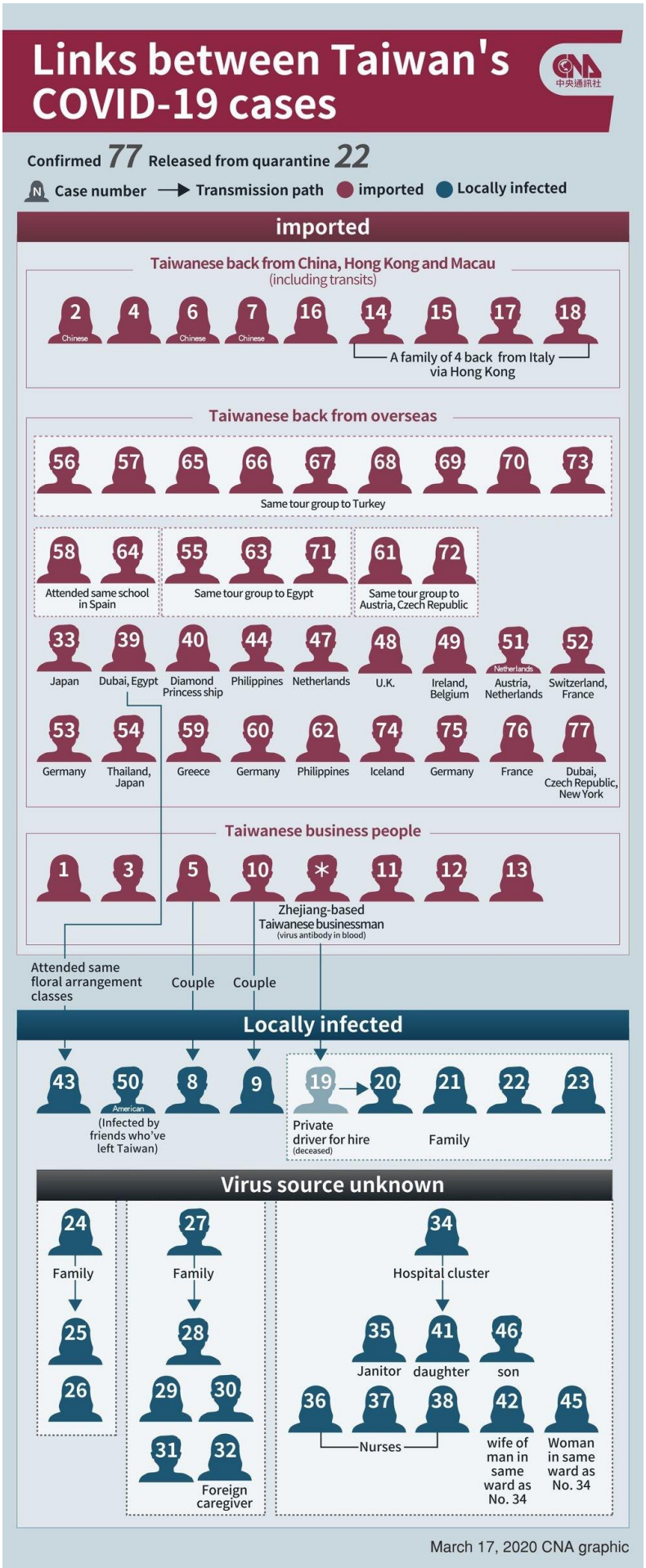
Taiwan has warned of the negative effects of COVID-19 on the economy; tourism and retail sales are already down as consumers stay home; manufacturing is also slowing due to disruptions to international supply chains. The government has committed to a compensation scheme for furloughed workers and tax breaks for affected companies.[189]

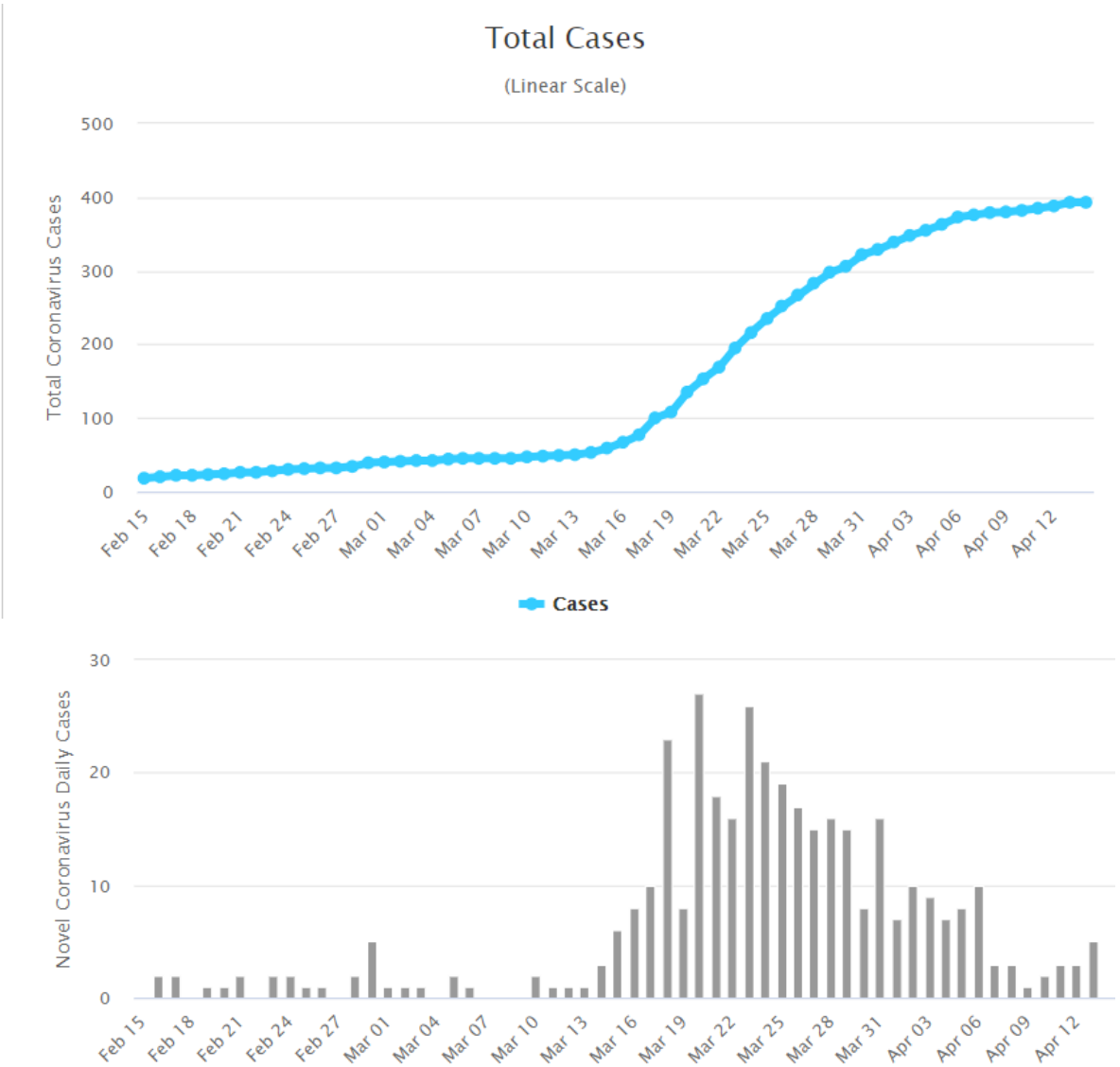
In April, the IMF lowered its projection for Taiwan's economic growth in 2020 to minus 4% from 2% because of the pandemic and forecast that unemployment would go from 3.8% to 4.4%.[190]

Impact on the Epidemiological Curve

As of April 8, Taiwan had confirmed 376 cases of COVID-19 and 5 deaths.

Given the close ties to China it was expected that Taiwan would have experienced a rise in cases from January, and yet there are relatively few cases and clusters. The graphic below is a breakdown of those cases up to March 17. After this time there was an increase in cases linked to travellers from other countries and residents returning from other countries; however, the measures implemented resulted in a fall in cases reported per day.


Links between Taiwan's COVID-19 cases
CNA 中央通訊社
Confirmed 77 Released from quarantine 22
Case number
Transmission path
imported
Locally infected
imported
Taiwanese back from China, Hong Kong and Macau
(including transits)
2 Chinese
4
6 Chinese
7 Chinese
16
14
15
17
18
A family of 4 back from Italy via Hong Kong
Taiwanese back from overseas
56 57 65 66 67 68 69 70 73
Same tour group to Turkey
58 64
Attended same school in Spain
55 63 71
Same tour group to Egypt
61 72
Same tour group to Austria, Czech Republic
33 Japan
39 Dubai, Egypt
40 Diamond Princess ship
44 Philippines
47 Netherlands
48 U.K.
49 Ireland, Belgium
51 Netherlands Austria, Netherlands
52 Switzerland, France
53 Germany
54 Thailand, Japan
59 Greece
60 Germany
62 Philippines
74 Iceland
75 Germany
76 France
77 Dubai, Czech Republic, New York
Taiwanese business people
1 3 5 10 * 11 12 13
Zhejiang-based Taiwanese businessman
(virus antibody in blood)
Attended same floral arrangement classes
Couple
Couple
Locally infected
43
50 American
(Infected by friends who've left Taiwan)
8
9
19 → 20
Private driver for hire
(deceased)
21 22 23
Family
Virus source unknown
24 Family → 25 26
27 Family → 28 29 30 31 32
Foreign caregiver
34 Hospital cluster → 35 Janitor, 41 daughter, 46 son
36 37 38 Nurses
42 wife of man in same ward as No. 34
45 Woman in same ward as No. 34
March 17, 2020 CNA graphic



Source: Worldometer (2020) [191]

Implemented Measures

The following list of measures is taken from the supplementary information from a recent journal article.[192] It has also been supplemented with information from new reports.

Border Control, Travel Restrictions, and Case Finding	Dec 31	Travellers from Wuhan screened.
	Jan 5	Taiwan CDC to be notified if a traveller from Wuhan has symptoms
	Jan 20	Wuhan: Level 2 travel alert, Central Epidemic Command Center activated
	Jan 21	Wuhan: Level 3 travel alert
	Jan 23	Wuhan residents banned, travellers from China required to make health declaration before entering
	Jan 25	Tours to China suspended until Jan 31, Hubei Province: Level 3 travel alert, rest of China: Level 2 travel alert

Jan 26	Tour groups from Wuhan to depart Taiwan
Jan 27	Tour groups from Hubei province to depart Taiwan, National Health System IT to integrate patients' past 14-day travel history into database
Jan 28	China (except Hong Kong and Macau): Level 3 travel alert
Jan 29	Electronic monitoring of quarantined individuals via government-issued cell phones
Jan 30	Tours to or transiting in China suspended until Feb 29, National Health database expands to cover 14-day travel history for patients from China, Hong Kong, and Macau
Jan 31	Remaining tour groups from China to depart Taiwan
Feb 2	Guangdong Province: Level 2 travel alert
Feb 3	Wenzhou city: Level 2 travel alert
Feb 5	Zhejiang province: Level 2 travel alert, cruise ships with suspected cases in past 28 days are banned, cruise ships with previous dockings in China, Hong Kong, or Macau in past 14 days are banned
Feb 6	Tours to Hong Kong and Macau suspended until Feb 29, Chinese nationals are banned, all international cruise ships are banned, contacts traced for Diamond Princess cruise ship passengers who disembarked in Taiwan on Jan 31
Feb 7	Foreign nationals with travel to China, Hong Kong, or Macau in the past 14-days are banned, foreigners must see an immigration officer and cannot use e-Gate (quick entry), couple fined NT$300,000 (USD $10,000) for breaking 14-day home quarantine rule
Feb 8	128 passengers on SuperStar Aquarius cruise ship tested within one day and all were negative for the coronavirus
Feb 10	Tours to or transiting in China suspended until Apr 30, tours to or transiting in Hong Kong or Macau suspended until March 31, most passenger flights from Taiwan to China suspended from Feb 10-April 29 (except flights to and from Beijing, Shanghai Pudong, Shanghai Hongqiao, Xiamen, and Chengdu airports)
Feb 11	Most residents of Hong Kong and Macau are banned, Hong Kong and Macau: Level 3 travel alert, Singapore: Level 2 travel alert, Thailand: Level 1 travel alert, travelers entering Taiwan must complete an accurate health declaration form or be fined up to NT$150,000 (USD $5,000)
Feb 12	Government declared that violators of home isolation regulations will be fined up to NT$300,000 (USD $10,000); violators of home quarantine regulations will be fined up to NT$150,000 (USD $5,000), Cases of severe influenza that tested negative for influenza since Jan 31 to be retested for COVID-19

Feb 13 Taiwanese nationals from MS Westerdam will return to Taiwan and be quarantined immediately, foreigners on cruise ship MS Westerdam are not allowed to enter or transfer in Taiwan

Feb 14 Taipei City Government tracks down 3 Hong Kong visitors who disappeared for almost a week without undergoing quarantine. Each fined NT$70,000 (USD $2,350) and transferred to specially assigned quarters for medical isolation, Entry Quarantine System launched to fill out health declaration form electronically and allow for faster immigration clearance

Feb 15 Japan: Level 1 travel alert, Taipei City Government publishes names of two Taiwanese women and one man of unclear nationality who could not be found after instructed to undergo home quarantine

Feb 16 National Health database expanded to cover 30-day travel history for travellers from or transited through China, Hong Kong, Macau, Singapore, and Thailand, expanded community-based surveillance measures:

- Individuals with foreign travel history in the past 14-days and had contact with travellers exhibiting fever or respiratory symptoms with suspected cause from COVID-19
- Clusters of cases with fever or respiratory symptoms
- Pneumonia cases with symptoms without improvement after 3 days of antibiotic therapy, cluster of pneumonia cases, or healthcare workers with pneumonia

Feb 17 Travelers arriving with fever or respiratory symptoms will have sample taken

Feb 18 Taiwanese passengers on Diamond Princess cruise ship returning to Taiwan must use charter flight arranged by the CECC and be quarantined, all hospitals, clinics, and pharmacies have access to patients' travel histories

Feb 19 Tours to or transiting through Hong Kong or Macau suspended until April 30

Feb 20 South Korea: Level 1 travel alert

Feb 22 Japan: Level 2 travel alert, South Korea: Level 2 travel alert, 19 Taiwanese nationals from cruise ship Diamond Princess return to Taiwan and were quarantined immediately

Feb 23 Italy, Iran: Level 1 travel alert, healthcare professionals banned from overseas travel

Feb 24 South Korea: Level 3 travel alert, healthcare professionals travel ban amended to level 3 alert locations (China, Hong Kong, and Macau). Approval needed for level 1 and 2 locations, travellers with history of travel to China, Hong Kong, and Macau subject to home quarantine for 14 days from arrival date, travelers arriving from countries with level 1 and 2 travel warnings subject to 14-day self-health management, foreign nationals arriving from

		South Korea subject to 14-day home quarantine starting Feb 25, Taiwanese nationals arriving from South Korea subject to 14-day self-health management starting Feb 26
	Mar 17	Level 3 travel alert to over 99 countries and regions, including those from the European Schengen area. Travellers returning from these regions would have to self-quarantine for 14 days.
	Mar 19	Ban on international arrivals except for people with residence permits, diplomats or carrying out commercial contracts.
	Mar 20	All countries raised to Level 3 travel alert, all inbound travellers are subject to 14-day quarantine.
Resource Allocation	Jan 22	Government allocates masks to retailers and sets quantity per person and price limit, Ministries of Health and Welfare promote quarantine efforts and setup notification mechanism through travel agents and tour guides, Ministry of Economic Affairs lists daily local mask manufacturing capability at 2.44 million units which surpasses the local demand of 1.3 million per day
	Jan 24	Testing of COVID-19 to take place at Taiwan CDC or eight designated hospitals, export ban on disposable surgical masks until Feb 23, outbound travellers can only take up to 250 masks, violation of the ban results in confiscation and a fine of 3 times the masks' value
	Jan 30	4 million masks released daily from local manufacturers, only 1-3 masks are allowed per purchase at convenience stores, local pharmacies, and medical supply stores, mask prices are currently fixed at NT$8 apiece (USD $0.27), Taiwan's High Prosecutors Office starts a nationwide campaign to stop profiteering by raising prices on disease prevention products; penalty is 1-7 years in jail and a fine up to NT$5 million (USD $167,000), 4 million surgical masks produced per day with 1.4 million allotted to hospitals and medical workers with remaining 2.6 million for consumer sales
	Jan 31	Government requisitions surgical masks from Jan 31 to Feb 15
	Feb 1	Mask prices drop to NT$6 apiece (USD $0.20)
	Feb 2	Government facilities (dorms or spare military camps) used for quarantine, soldiers mobilized to production lines at local mask factories, 60 additional surgical mask machines being installed with 10% of capacity reserved for children. Each machine can manufacture 100,000 surgical masks per day. Normally, 60 production lines requires 4-6 months to activate but all will be ready in one month. The daily output will be boosted to 10 million masks a day.
	Feb 3	Further mask measures
	Feb 13	Export ban on face masks extended until April 30, government requisitioning of surgical masks extended until April 30
	Feb 17	Daily testing capacity for COVID-19 is approximately 1,300 samples, daily mask output is 5 million masks; sellers now allotted 400 masks a day

	Mar 5	Increased allowance of masks due to increased production of 8.2 million masks per day on average. Children allowed 3 masks while adults allowed 5 masks per week. Number of locations authorised to sell face masks increased from 400 to 600.
	Mar 12	Trial run of online ordering made available for convenience of office workers and students.
Social distancing and related measures	Feb 2	Government extended school winter break from Feb 15 to Feb 25
	Feb 19	CECC coordinated with the Environmental Protection Administration, the Ministry of Education, and local environmental protection departments to disinfect public spaces around schools and school areas open to the public during winter break, Ministry of Education oversaw commissioning of licensed companies to disinfect universities and colleges, Ministry of Education announced student absences due to fever or respiratory symptoms will not count on students' attendance records, Ministry of Transportation and Communications set cleaning standards for school buses, Taiwan High Speed Rail, Taiwan Railways, tour buses, and taxis
	Feb 21	Ministry of Education guidelines for suspension of classes due to confirmed coronavirus cases: • If 1+ in a class (student or teacher) at the K-9 level diagnosed with COVID-19, class is suspended for 14 days • If 2+ cases in a school, school is closed for 14 days • If one-third of schools in a township, city, or district are shut down, all others are closed • If a student or teacher is diagnosed in a high school, college, or university, all classes they attend or teach is suspended for 14 days • If 2+ cases of COVID-19 in an institution at any level, it will close for 14 days

Hong Kong

Hong Kong, a Special Administrative Region (SAR) of China with 7.4 million people on within 1,110 km2, is one of the world's most densely populated regions with their own governing body.[193]

When the National Health Commission of China announced a cluster of pneumonia of unknown aetiology on 31 Dec, Hong Kong began augmenting infection control measures in its public hospitals.194 The first imported case was confirmed on 23 Jan, and the first suspected local transmission case was reported on 30 Jan.[195]

As of April 15, there were 1,013 cases and 4 deaths.[196]

The first case reported was a 39-year-old Wuhan resident who travelled from Wuhan via high-speed railway with his wife, two sons and mother-in-law (all were well at the time). He had fever upon his arrival and was detained without his family. He was found positive for COVID-19 at Queen Elizabeth Hospital, and was transferred to Hospital Authority Infectious Disease Centre at Princess Margaret Hospital. Patient recovered uneventfully and was discharged.[197]

Hong Kong was still suffering from the aftermath of the months-long protests that started against the proposed extradition bill to mainland China, that escalated to Hong Kong pro-democracy activists seeking judicial independence and a separate political system.[198,199] The disruptions have led to significant impact on the economy and learning in Hong Kong, which had its first recession in 10 years.[200,201]

In the aftermath of the recent political unrest, there was a general mistrust of the government which influenced the populace's reception for the government's initial responses.[202] As of 17 March, 50 out of the 57 first cases had travel history from an affected area, and many healthcare workers called for the borders to be sealed. [203,204] On 12 Feb, the government announced the closure of 10 of 13 border crossings.[205]

Approach

As a Special Administrative Region of China, Hong Kong's initial approach to the coronavirus focused more on suppressing community transmission through educational campaigns and extensive social distancing measures than on stemming the inflow of possibly infected people into the territory.

After the first case was reported, there was a rise in cases over the next nine weeks. As at 19 Mar, there were 192 confirmed cases with 4 fatalities.[206] On 18 Mar, Hong Kong saw the highest surge of cases in a single day of 25 cases of which 22 were imported.[207] Hong Kong was initially effective in containing the spread within the community by augmenting infection control measures in hospitals, public health education and encouraging social distancing.[208]

The number of imported cases increased however and now account for some 70% of new cases as of 19 March, many of whom are non-residents seeking medical treatment in preference to their own countries'.[209] Hong Kong tightened border controls with a mandatory 14-day quarantine for all travellers entering from 19 March for the next 3 months.[210]

However, with the surge in imported cases, Hong Kong has now moved to ban all non-locals.[211]

Arrivals are issued an electronic bracelet which will alert the authorities if they leave their place of isolation.[212] A pilot project has also been launched for travellers to submit their swab specimens for COVID-19 testing.[213]

Implementation Issues

The following implementation issues were identified:

- Major public health policy measures require citizen buy-in. Despite the lack of confidence amid distrust between the local and Hong Kong government during the protest period, residents have generally been compliant to the various social distancing measures implemented, possibly influenced by the SARS outbreak when Hong Kong was one of the hardest hit, which had almost one-third of global deaths.[214,215] "People are quite cautious now when they face a major outbreak of an infection," says David Hui, director of the Stanley Ho Center for Emerging Infectious Diseases at the Chinese University of Hong Kong. The precautions have been so effective, he says, that the city's annual flu season has also been dramatically reduced.[216]
- The social distancing is very costly. Following on the protests, the COVID crisis worsened unemployment rate which is now 3.7%, the highest in more than nine years.[217] Hong Kong has announced its anti-epidemic fund to mitigate the impact.
- Citizens are understandably very supportive of border controls, and have even called for the Kiu Tau checkpoint (one of the few remaining border checkpoints with mainland China) to be closed as well, calling a "huge loophole".[218]

Economic Impact

Hong Kong was still being impacted by protests when the pandemic emerged. It has reported unemployment in March was 3.7% (tourism was at 6.1% and construction 6.8%) with many small and medium-sized businesses experiencing a “cliff-edge” fall in business. Unemployment is forecasted to rise further.

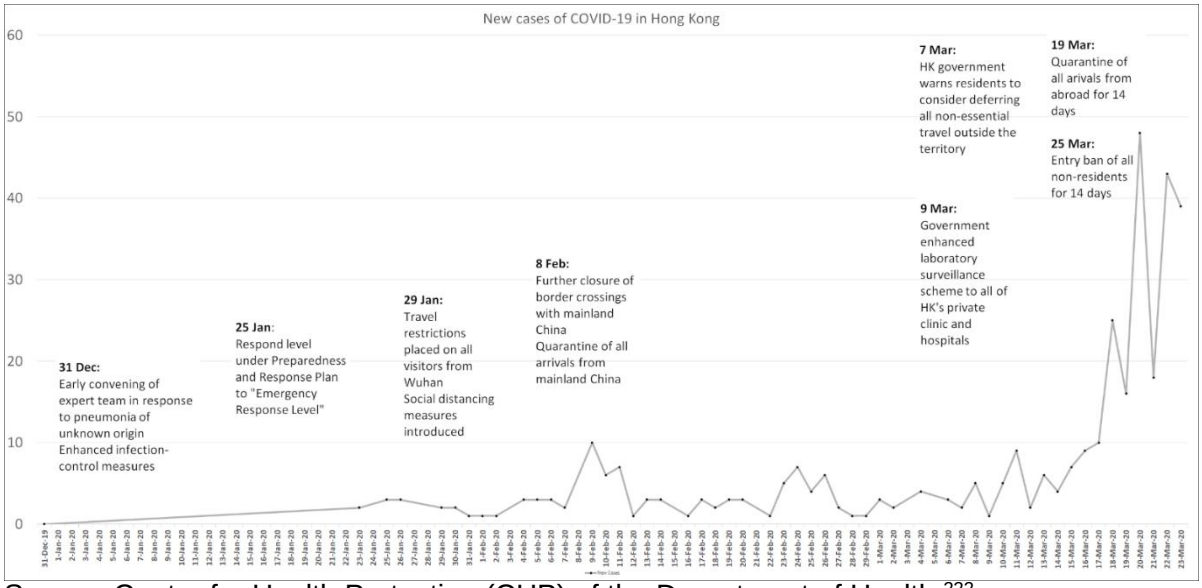
The economy has contracted 1.2% in the first quarter. The government increased national expenditure by approximately 20%, forecasting a budget deficit of HKD 139.1 billion (US$17.9 billion) in 2021, which is about 4.8 percent of Hong Kong’s GDP. Financial relief measures have been put in place; these include rebates and waivers for individuals (eg US$1,289 for each citizen over 18, reduced tax and rent) and businesses (fee waivers, tax reductions, rent and utility fee cuts, and funding for additional employee training).[219]

In April, the IMF lowered its projection for Hong Kong’s economic growth in 2020 to minus 4.8% from minus 1.2% because of the pandemic and forecast that unemployment would go from 3% to 4.5%.[220]

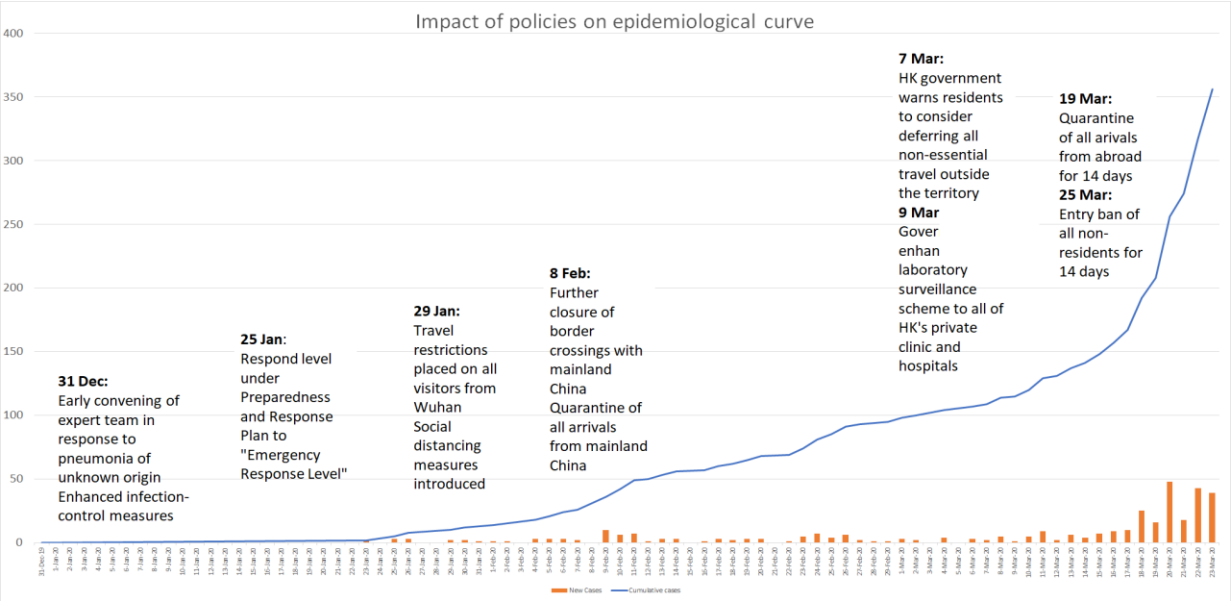
Impact on the Epidemiological Curve

Initially, there was a slow and gradual rise in the number of confirmed Covid-19 cases, in contrast to the rates in other countries. It is likely that early border control measures and extensive social distancing efforts have played a large role. However, there has been a sharp peak in the number of cases prompting stricter border control measures. Current infected persons tend to be Hong Kong citizens returning from abroad.

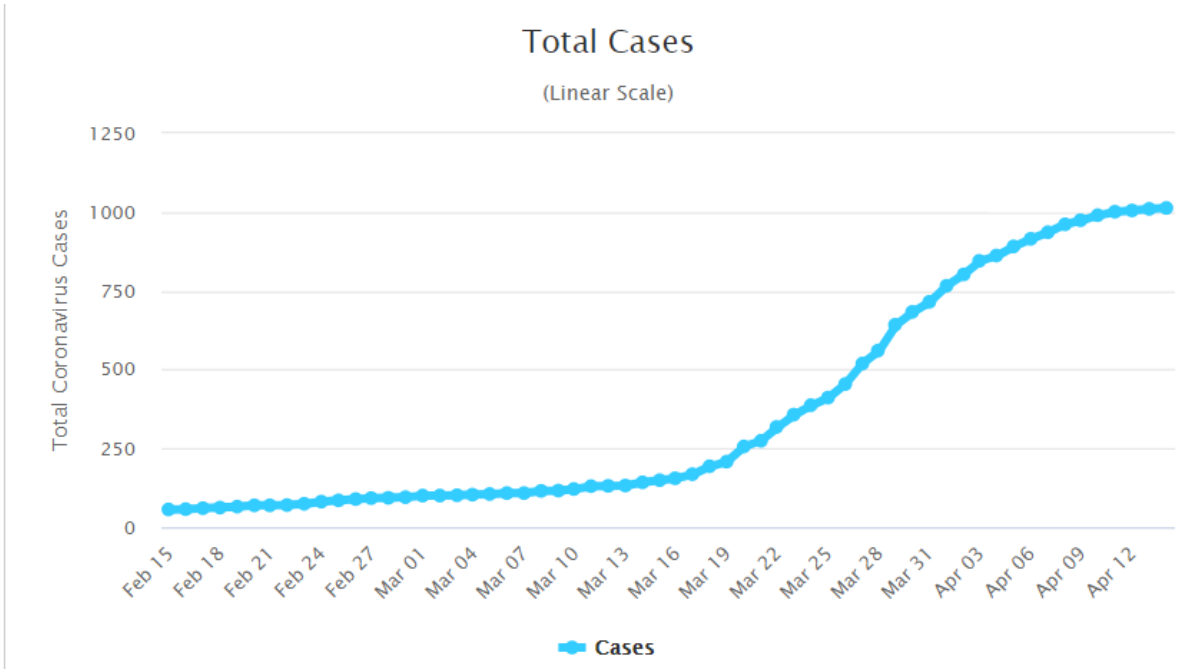
From late March there was a rapid increase in community transmission. [221] As a result of measures, cases continued to fall in early April.

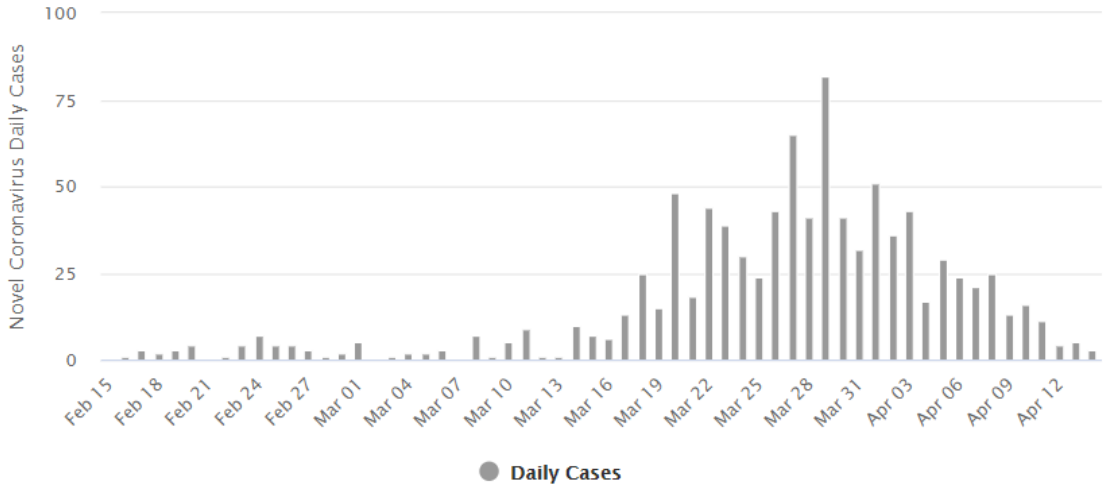


Source: Centre for Health Protection (CHP) of the Department of Health.[222]



Source: Centre for Health Protection (CHP) of the Department of Health.[223]





Source: Worldometer

Implemented Measures

Preliminary measures	31 Dec	Early convening of expert team in response to pneumonia of unknown cause in Wuhan.[224]
	25 Jan	Chief Executive Carrie Lam raises response level under the "Preparedness and Response Plan for Novel Infectious Disease of Public Health Significance" (the Preparedness and Response Plan) to Emergency Response Level.[225] • Enhancing organisational structure to tackle disease (CE chairing the Steering Committee) • Strengthening immigration control • Minimising community spread by cancelling large scale events, closing schools • Enhancing public's personal hygiene (eg increasing mask supply) • Improving anti-epidemic facilities (namely quarantine and port screening facilities) • Allocation of financial resources
Border controls	3 Jan	Expanded temperature screening stations at ports of entry
	7 Jan	Strengthening port health measures at airport and express rail links.[226] • Temperature checking for passengers from Wuhan • Healthcare professionals stationed at port health offices to give advice to those feeling unwell
	29 Jan	Travel restrictions placed on all visitors from Wuhan and other affected areas; closure of 6 of 14 border crossings with mainland China.[227]

	5 Feb	Quarantine of all arrivals from mainland China
	8 Feb	Further closure of 5 border crossings with mainland China.[228]
	7 Mar	Warning to residents to consider deferring all non-essential travel outside of the territory.[229] Red alert (second-highest warning in Hong Kong) placed on travelling to South Korea and several regions of Italy.
	19 Mar	Quarantine of all arrivals from abroad for 14 days.[230]
	25 Mar	Non-residents from abroad were banned from entry for 14 days.[231]
	8 Apr	All asymptomatic inbound travellers arriving at the Hong Kong International Airport have to go for mandatory tests before they undergo their compulsory home quarantine.
Community measures	28 Jan	"Very extensive" social distancing measures • Civil servants asked to work from home • Cancellation/postponement of most large-scale events • Closure of all kindergartens and schools Multiple extensions closure, most recently to at least 20 Apr
	22 Jan	Public education campaign to promote hand hygiene and environmental hygiene.[232]
	7 Mar	Lockdown of public showers frequented by the homeless.[233]
	29 Mar	Temporary closure of non-essential public services and civil servants to work from home.[234]
	Unspecified	Prohibition of sale of alcoholic beverages to all licensed eateries, restaurants and pubs.[235]
	9 Mar 4, 9, 11 Mar	Enhanced laboratory surveillance scheme for all of Hong Kong's private clinics and hospitals. Private GPs and family doctors collect respiratory samples from appropriate patients, based on the doctors' assessment.[236]
	12 Mar	Hong Kong's MTR subway disinfect trains and stations with robots spraying hydrogen peroxide, in addition to regular cleaning by staff.237 Decontamination robots to be deployed to areas where there are confirmed Covid-19 patients.

	16 Mar	Smart technology used to monitor home quarantine, with locally developed electronic wristbands.[238]
	28 Mar	Cinemas, party rooms and gyms ordered to close. Karaoke lounges and restaurants remain open and must ensure at least 1.5 metres distance between tables and limiting tables to four people.[239] This was later extended to include mahjong parlours, karaoke lounges and nightclubs.
	8 Apr	Beauty salons and massage parlours shut Gatherings of more than four people prohibited
Food resources	20 Feb	Government's HK$30 billion relief package to aid struggling industries such as the food and beverages industry.[240]
Treatment and Healthcare	31 Dec	Enhanced infection-control measures.[241] • Active surveillance and enhanced laboratory surveillance for early recognition of disease, allowing rapid diagnosis • Prompt isolation of suspect and confirmed cases in airborne infection isolation room • Application of contact, droplet and airborne precautions for all suspect and confirmed cases • N95 respirators for all aerosol-generating procedures • Universal masking of all healthcare workers, patients and visitors • Timely infection prevention and control (IPAC) education and PPE training for staff • Tracing of exposed patients and HCWs • Quarantine of exposed patients, followed by medical surveillance of an additional 14 days
	23 Jan	Immediate quarantine of first suspect case at a quarantine centre set up at Lady MacLehose Holiday Village in Sai Kung.[242]
	8 Mar	Recruitment of volunteers at a temporary hotline centre in the Department of Health's Public Health Laboratory to trace people put under compulsory quarantine.[243]
	9 Mar	Extension of enhanced laboratory surveillance scheme to all of Hong Kong's private clinics and hospitals, allowing private GPs and family doctors to send respiratory samples for testing.[244]

13 Mar	Public hospitals to conduct clinical trials on remdesivir, a drug originally developed to treat Ebola245 COVID19 patients are currently treated with Kaletra (drug originally for HIV/ AIDS), Ribavirin (a drug for Hepatitis C) and interferon.
16 Mar	Daily fee for stay in temporary quarantine facilities (to “combat abuse of facilities and reserve places for people with genuine need”, does not apply for those under compulsory quarantine).[246]
28 Mar	The government looking to convert sports and entertainment stadiums into isolation areas for stable patients and free up hospital beds. Also looking to shorten the quarantine period to 10 days if the person tests negative and has no symptoms.

Japan

Japan reported its first case on January 14, 2020, a traveller who had arrived from Wuhan, China. As at April 15, Japan reported 7,885 cases and 146 deaths (excluding the cruise ship that was quarantines in a Japanese port).[247] Japan has one of the largest population groups over the age of 65 years, about 29%.

February 5 saw the cruise ship Diamond Princess being placed under quarantine in Yokohama. The experience of the cruise ship drew international media scrutiny. Comment on the cruise ship is not provided in this short case summary.

Late March saw a spike in cases, mainly linked to imports from areas that had not contained early cases.

Approach

Japan, with an estimated population of 126 million people, has tested around 27,000 individuals as at 27 March.[248] Given the characteristics of COVID, creating more severe illness in older people, Japan could face a substantial impact on the healthcare system if the infection spreads widely.

Japan’s initial response was one of containment. Japan has a nationwide network of investigators in the National Institute of Infectious Diseases. Doctors in Japan are legally required to report all cases of infectious diseases to NIID; this gives each case a number and triggers the network of investigators to trace (and usually test) all contacts. Data is online. Clusters are identified and transmission points shut and sterilised. However, at the end of March unlinked cases were emerging.[249]

In February there was relatively low levels of testing on medical basis with narrow parameters (eg fever longer than 4 days and 2 days in older people). Japan had the capacity to conduct about 4,000 tests a day, but often carried out half that number. Only a limited number of centers were authorised to undertake COVID testing and these were sent to one of the five approved companies to analyse.[250] National Institute of Infectious Diseases stated the strict testing criteria were to preserve limited medical resources for those in need of urgent care.[251]

Rush-hour traffic in Tokyo is down just 10%. Over half of large companies have put in place remote working arrangements, but a culture of working in the office remains. Cinema takings are down just 50%.[252] However, mask wearing and personal hygiene measures are strong in the Japanese culture. Japanese people also rarely shake hands or hug when greeting. [253]

Source: Charly Triballeau/Agence France-Presse — Getty Images (NYT 2020) [254]

The rise in cases in Tokyo has raised speculation that the prime minister may declare a state of emergency, which brings with its specific measures (outlined below).[255]

Implementation Issues

The following implementation issues were identified:

- Personal hygiene and mask wearing may have affected the epidemiological curve.
- Japan didn't see a widespread local outbreak during the SARS and MERS epidemics, which was a focus of learning for many Asian countries.[256]
- Compliance with government requests around social distancing is based on asking for public cooperation, rather than sanctioned measures.
- Japan tested based on a narrow set of parameters, which has led to some public criticism.[257]
- Japan lacks a center for disease control, which has led to different approaches and standards adopted by some cities and areas. [258]
- There has been some erosion of public trust, based on the lack of testing and relaxed approach. [259]

Economic Impact

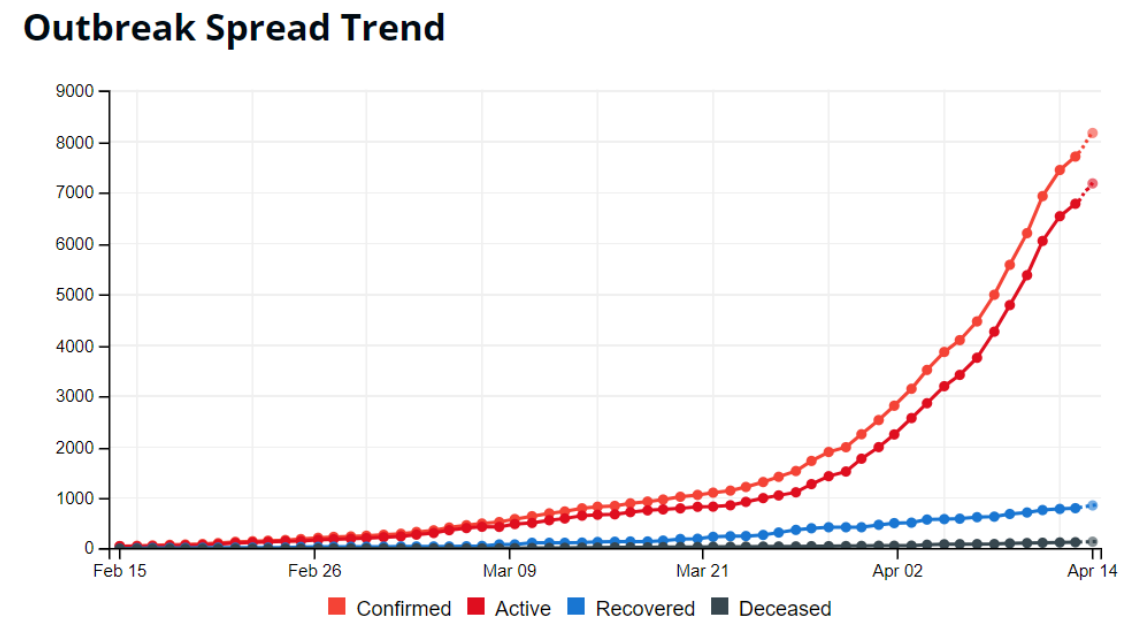
Japan has reported that the economic impact is on a level with that seen after the 2011 earthquake and tsunami and the 2008 global financial crisis. The government has announced a 108 trillion yen ($990 billion) financial package to mitigate the impact. This includes fiscal stimulus, tax breaks, borrowing available at zero interest from private financial institutions and cash payouts to households and companies in need.[260, 261,262]

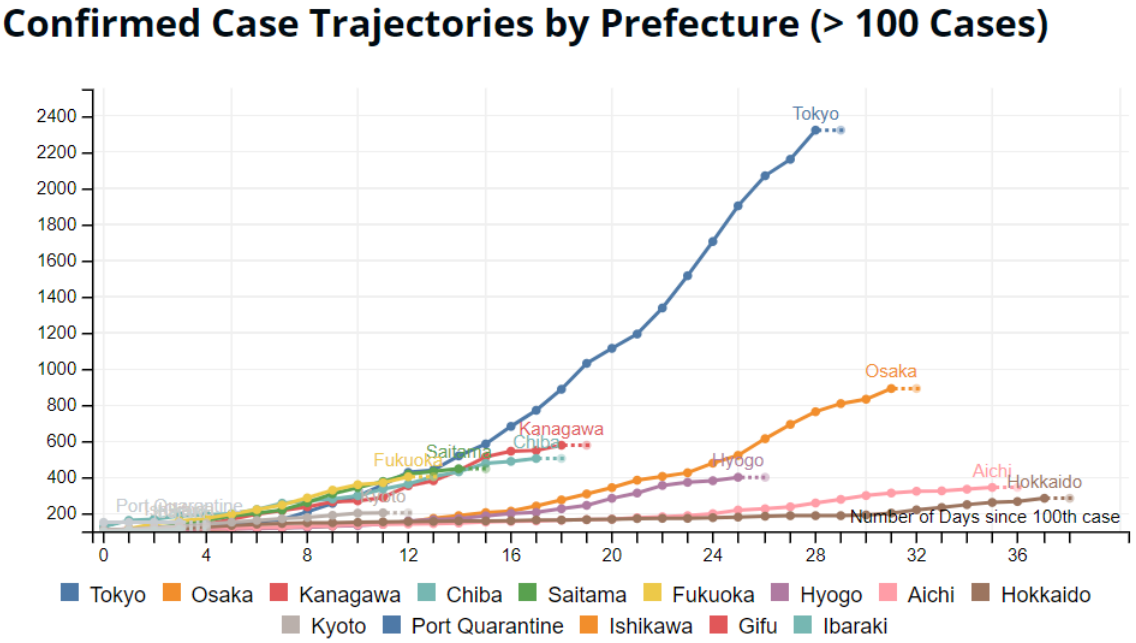
Japan and the International Olympic Committee decided to postpone the July 2020 Tokyo games for a year.[263]

In April, the IMF lowered its projection for Japan's economic growth in 2020 to minus 5.2% from 0.7% because of the pandemic and forecast that unemployment would go from 2.4% to 3%.[264]

Impact on the Epidemiological Curve

From the first case to early March the reported cases followed a relatively flat line, since the first week in March reported cases have risen sharply and are in a growth phase, particularly for Tokyo.





Source: Japan COVID-19 Coronavirus Tracker[265]

Implemented Measures

Feb 3 No one from to from Hubei Province allowed to enter Japan.

Non-Japanese travellers required to fill out health declaration questionnaires related to travel to Hubei.

Feb 12 Japan announced entry restrictions for anyone who had travelled to and from Zhejiang.

Feb 25 Basic Policies for Novel Coronavirus Control launched.[266] These included:

Information sharing.

Encouraging employees to take days off if unwell, promoting teleworking and staggered office hours.

Reconsidering events.

Temporary school closures.

Preparing health services.

Border control measures.

Ramp up production and ensure smooth supply of masks, disinfectants, etc.

Mar 5 Quarantine restrictions for all visitors coming from China and South Korea.

Mar 16 Entry restrictions to foreigners from areas in Spain, Italy, Switzerland and Iceland.

Mar 26 Japan asked arrivals from Southeast Asia and Middle East to self-quarantine for at least two weeks. [267] Residents in specific areas requested to stay home at weekend and night.

Mar 28 Tokyo and surrounding regions asked to avoid non-essential, non-urgent outings. Osaka area also asked to stay at home. [268]

Military deployed to Tokyo's Narita and Haneda airports to assist in virus screenings and the transport of people placed in quarantine. [269]

Some department stores, movie theatres, museums and parks closed, but many supermarkets and convenience stores were open as usual. [270]

Mar 30 Japan had already imposed an entry ban on arrivals from affected areas of China and South Korea, as well as more than 20 countries. Japan expanded its entry ban to include people travelling from the US and most of Europe.[271]

Japanese citizens and foreigners who have travelled abroad are asked to self-quarantine for 14 days and watch for symptoms. [272]

Apr 7 State of Emergency declared for a month in Tokyo and six other prefectures (covering 44% of the population).[273] This triggered the following measures: [274]

- Requesting people to refrain from going out.
- Requesting and issuing an order to restrict the use of facilities including schools.
- Requesting and issuing an order to restrict the holding of events.
- Emergency permission for the use of temporary medical facilities.
- Requesting and issuing an order to transport emergency supplies.
- Requesting the sales and the seizure of specified goods.
- Extending the expiration date of drivers' licenses.
- Provision of loans by public financial institutions

Apr 16 State of emergency expanded to include the entire country

Sweden

Sweden's first case of COVID-19 was confirmed on January 31, 2020, when a traveller returning from Wuhan tested positive. As at April 15, Sweden had recorded 11,927 cases and 1,203 deaths.[275]

Approach

Sweden is an outlier in terms of its strategy to manage COVID-19, as it has not gone for a lockdown. The strategy is to slow the spread of infection so that the health services are not overwhelmed and the population gradually acquires immunity.

The hypothesis is there will not be significantly more Swedes dead at the end of the pandemic than if the country had initiated stricter distancing protocols, but the looser approach will keep the number of cases from spiking when lockdowns are lifted. There is also the view that this approach may prevent the negative outcomes of a long economic pause.[276]

The approach may be influenced by demographics; more than 50% of households are single-person and Sweden has a relatively low population density of about 25 people per square kilometre (compared to 205 in Italy and 259 in UK).[277]

The Public Health Agency of Sweden is responsible for providing recommendations based on evidence and expert opinions.[278] Based on these recommendations the government has advised working from home when possible, avoiding crowded places and for people above 70 to stay at home. As of April 15, it has not implemented a lockdown. The government drafted legislation to enable them to put in place measures if decided upon.

A key aspect of the strategy is personal responsibility and trust; for example, people with symptoms are asked to self-isolate and there is no checking or surveillance.

Implementation Issues

- In early April the population remained largely supportive of the approach of personal responsibility, reporting that the hospitals were coping and the peak was nearing.[279]

- As at April 15, Sweden had a COVID-19 death rate of 118 per million inhabitants, compared with their neighbours of Denmark at 55 and Finland at 15 (both had lockdowns start in mid-March). This has led to criticism from neighbouring countries and some academics.[280]

  "Partly that we are on different places on the exposition curve, partly that we in Sweden, unfortunately, have had a large spread of contagion in elderly homes, something you have not seen in the other Nordic countries. And this we, of course, continue to analyse, why Swedish elderly homes have been exposed so much compared to other countries. But if we compare Sweden with Belgium, the US and a number of other countries our death rates are rather low." Anders Tegnell, Sweden's Chief Epidemiologist.[281]

  At the end of March 2,300 academics and scientists signed an open letter to the Swedish government, calling for tougher measures to protect the health system.[282]

- Social distancing measures are mainly based on personal responsibility and not legally enforceable. In April, about half of the workforce was working, public transport use fell 50% and there was a 70% reduction in transport in the capital.[283]

- The government was criticised for not closing schools and only children who are ill themselves stay home. Some students have been kept home by anxious parents.[284]

Economic Impact

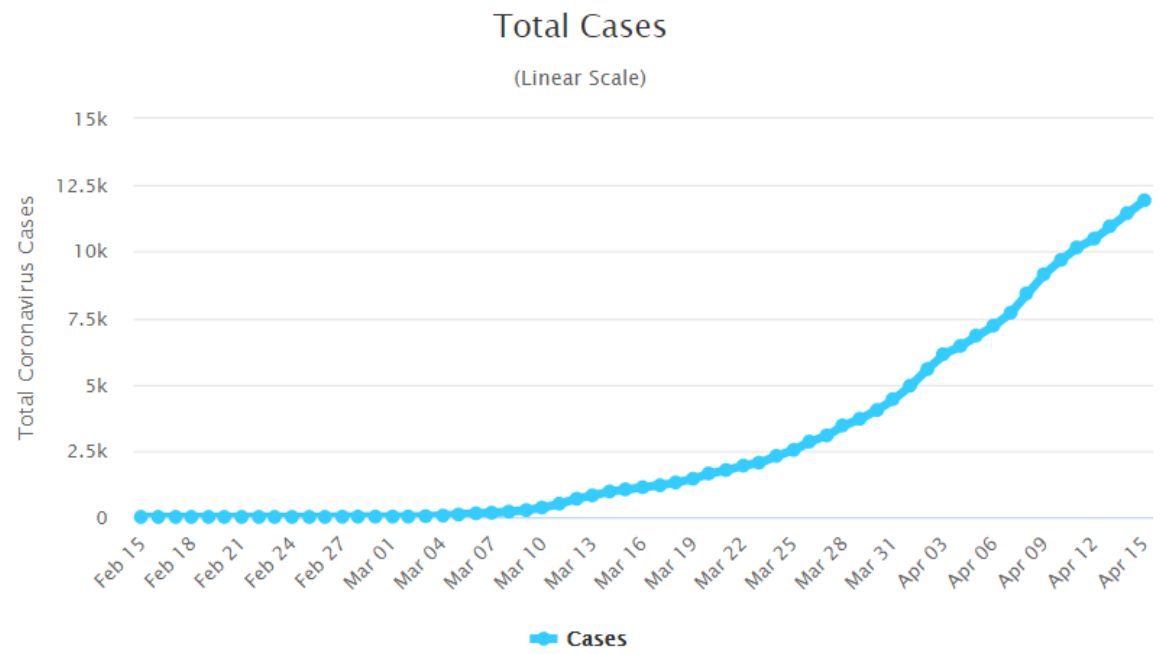
In April, the IMF lowered its projection for Sweden's economic growth in 2020 to minus 6.8% from 1.2% because of the pandemic and forecast that unemployment would go from 6.8% to 10.1%.[285]

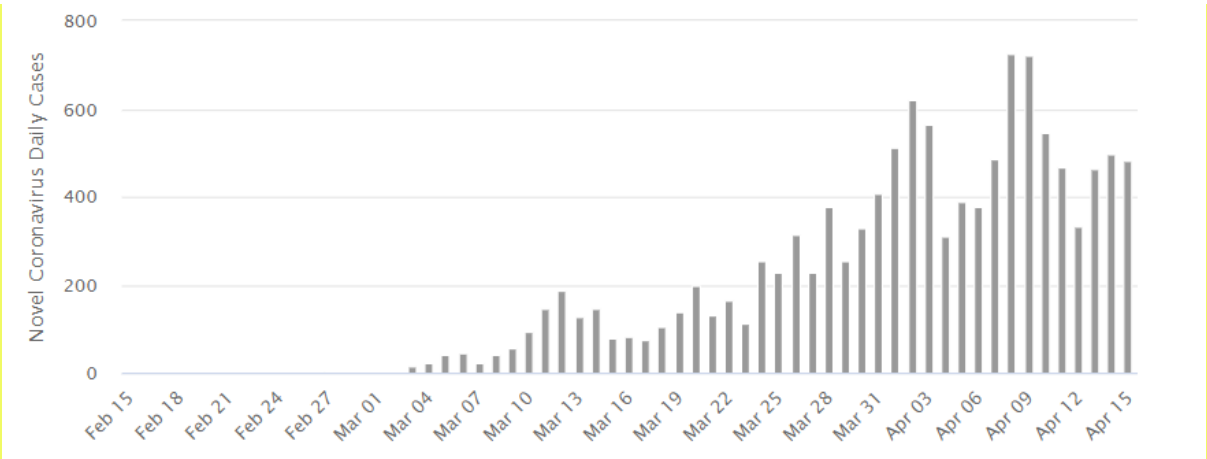
Swedish government emergency budget of up to 300 billion kronor, which includes subsidies for workers, loans to businesses and tax deferrals.[286]

The Government, the Centre Party and the Liberal Party have developed a crisis package for jobs and transition, in the expectation that more people will become unemployed. This includes adapting the unemployment insurance to reduce the wait and to increase the amount. In addition, job flexibility and grants for the creation of "green jobs" to enable subsidised employment, primarily in the area of nature and forest conservation. Funding for distance learning at higher education institutions expanded - anyone who is made unemployed will be able to use these courses.[287]

Impact on the Epidemiological Curve

Cases increased to around April 9, and declined over the following days.





Worldometer (2020)

Implemented Measures

Mar 10	People with symptoms asked to self-isolate Staff working with risk groups, including nursing homes, asked not work if they have any symptoms of respiratory infection Asked people to avoid unnecessary visits at hospitals and in facilities for elderly, and never visit if they have respiratory symptoms
Mar 11	Ban on gatherings larger than 500 people Unpaid first day of sick leave temporarily discontinued to encourage people to stay home if unwell
Mar 13	Temporarily removed the requirement for medical certificate for people staying home from work due to illness
Mar 16	Asked people over 70 to limit close contact with other people Employers asked to recommend their employees work from home
Mar 17	Secondary schools and universities (covering over 16 years) recommended to use distance learning, schools for younger children remain open
Mar 24	Requirement of bars and restaurants to only have table service and to increase the space between the tables
Mar 27	Swedish government announced that gatherings of more than 50 people were banned
Apr 1	All visits to nursing homes banned
Apr 7	Advised against all non-essential travel abroad until 15 June (building on previous travel advisories)

New Zealand

As at April 15, New Zealand had 1,401 cases and 9 deaths. The first case was reported on February 28, 2020, a New Zealand citizen who had recently visited Iran, returning via Bali.

Approach

New Zealand has adopted an elimination strategy based on an alert level system.[288] From March 26, level four of the alert system was enacted, a nationwide lockdown. People were only allowed to leave their homes for essential activities and only allowed to socialise with people in the same house. Borders were effectively shut to all but New Zealand nationals and they had to undergo 14-day quarantine.

Implementation Issues

- The lack of initial testing may have contributed to the national lockdown. [289]
- The economic impacts of full lockdown are emerging, with small and medium sized businesses particularly affected. [290]
- Critique that elimination may not be a long-term viable strategy and lack of alternative strategy.[291]
- Critique on the lack of scrutiny of government and lack of transparent decision making.[292]

Economic Impact

Based on different scenarios, it was reported in April that New Zealand unemployment rate may go from 4-5% to about 13%, but up to 25% if the alert level 4 was maintained longer.[293]

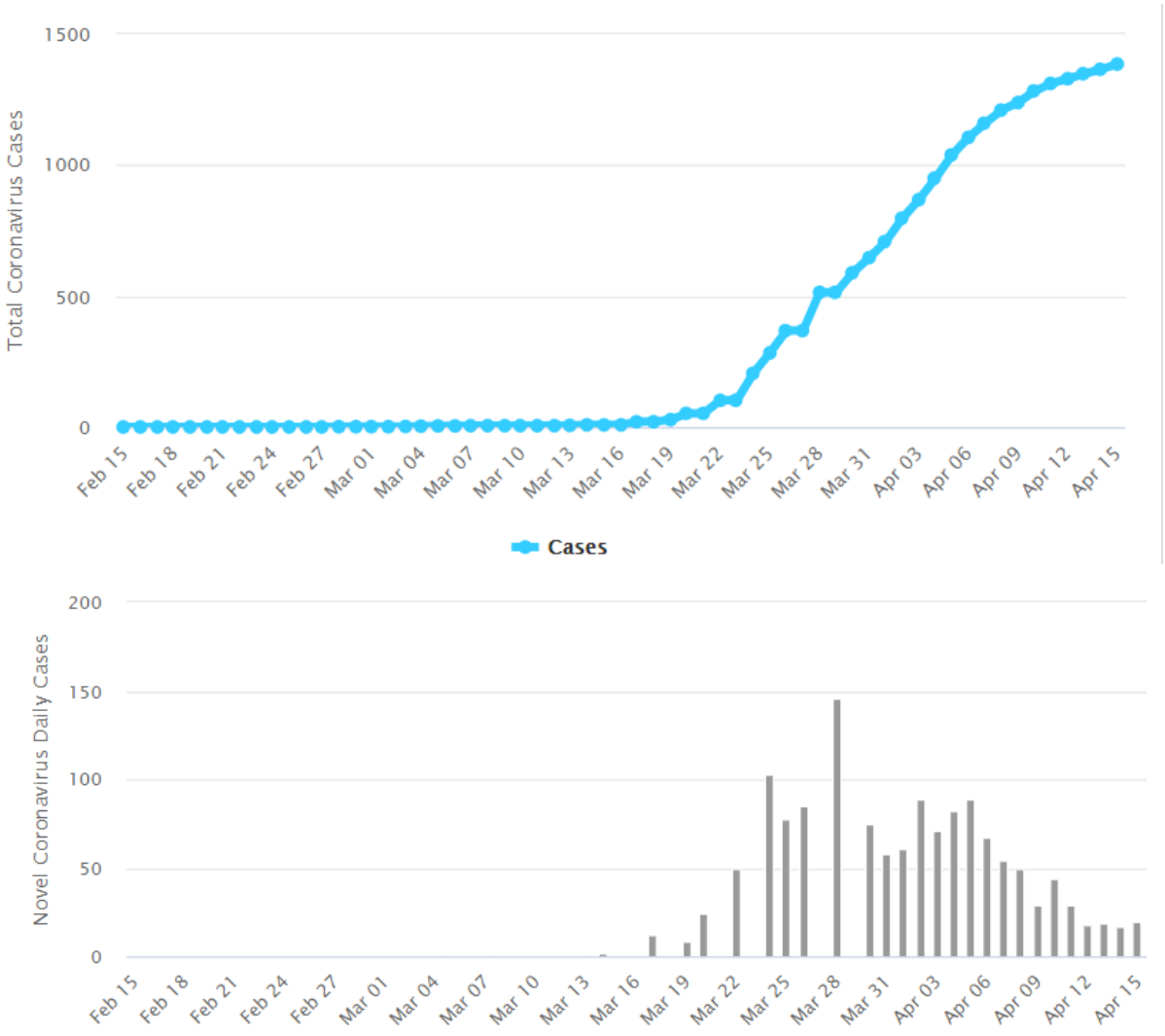
The Reserve Bank of New Zealand has announced a NZ$30 billion monetary stimulus and provided additional liquidity to the business sector that gives banks the ability to access term funding.[294]

Some services are particularly affected; for example, the closing of borders essentially grounded Air New Zealand, in April it announced it was laying off 3,500 employees.[295]

In April, the IMF lowered its projection for New Zealand's economic growth in 2020 to minus 7.2% from 2.2% because of the pandemic and forecast that unemployment would go from 4.1% to 9.2%.[296]

Impact on the Epidemiological Curve

Cases peaked on March 28 and declined subsequently.



Worldometer (2020)

Implemented Measures

Feb 3	Foreign travellers who left from China would be denied entry to New Zealand, with only New Zealand citizens and permanent residents and their family being allowed to enter
Feb 28	Travellers from Iran banned from entry
Mar 26	National lockdown – alert level 4

	• 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
Apr 9	Every traveller arriving into New Zealand must go into one of two facilities for a minimum of 14 days
Apr 14	Only New Zealand residents and citizens (and their children and partners) are permitted to enter New Zealand. There will only be exceptions on a case by case basis

New York

New York is included as an example of a high-density, globally-conncted city. It is the densest metropolitan area in the US, with a population of nearly 20 million. New York is a highly connected city, with over 65 million tourists a year.[297]

New York's first reported case was on March 1, 2020, a healthcare worker returning from Iran. Within a month over 10,000 cases had been reported.[298] By April, New York had more cases and more COVID-19 related deaths per capita than any other state.

Approach

Cases were widespread when a state of emergency was announced on 7 March and restrictions on movement were implemented to minimise the spread. [299] The "New York State on PAUSE" executive order went into effect on 22 March, restricting the operations of all non-essential businesses.[300] It was announced on 16 April that this measure would be extended to 15 May.[301]

Measures were put in place to prepare for the increasing surge in demand for healthcare facilities and medical equipment. There was a coordinated effort to ensure that healthcare staff and equipment were shared and equally distributed using a central inventory system, and temporary medical facilities were set up. There was a call for healthcare volunteers to step up on a voluntary basis, which has been successful, with over 40,000 individuals signing up.[302] Several initiatives used 3D printing technology to produce medical equipment in low supply. [303,304] The state also began producing their own hand sanitiser to meet the rising demand, by employing prison inmates.[305]

Although slow to start testing, in mid-March the state ramped up diagnostic testing, through starting mobile testing centres, and 28 public and private labs, resulting in testing more people per capita than China and Korea. [306,307.308] The governor stated that widespread testing of antibodies will be the key to opening up the economy again. The presence of antibodies prove that the individual is no longer at risk of transmitting the virus, and is likely immune. A new finger-prick antibody test, which can test up to 100,000 individuals in a day, is being expedited for approval.[309]

Implementation Issues

The following implementation issues were identified:

- New York has a very high population density, being the most populated city in US. [310] This likely made it easier for community transmission to occur.[311]

- The stay-home order, or “shelter-in-place” order, came into effect on 22 March, after a week of debate between the New York mayor and governor; this was viewed as delayed.[312]
- Testing levels were low in January and February, resulting in knowledge gaps on the likely level of community spread.[313]

Economic Impact

The economy has been affected by the lockdown. The fall in total retail sales in March was the largest seen in almost three decades.[314] In April, there was a record number of people registering as unemployed.[315] Economic packages such as the Paycheck Protection Program have been launched to help small businesses survive, but there were initial problems with the application of these grants and loans and the sheer number applying reaching the allocated level early on.[316,317]

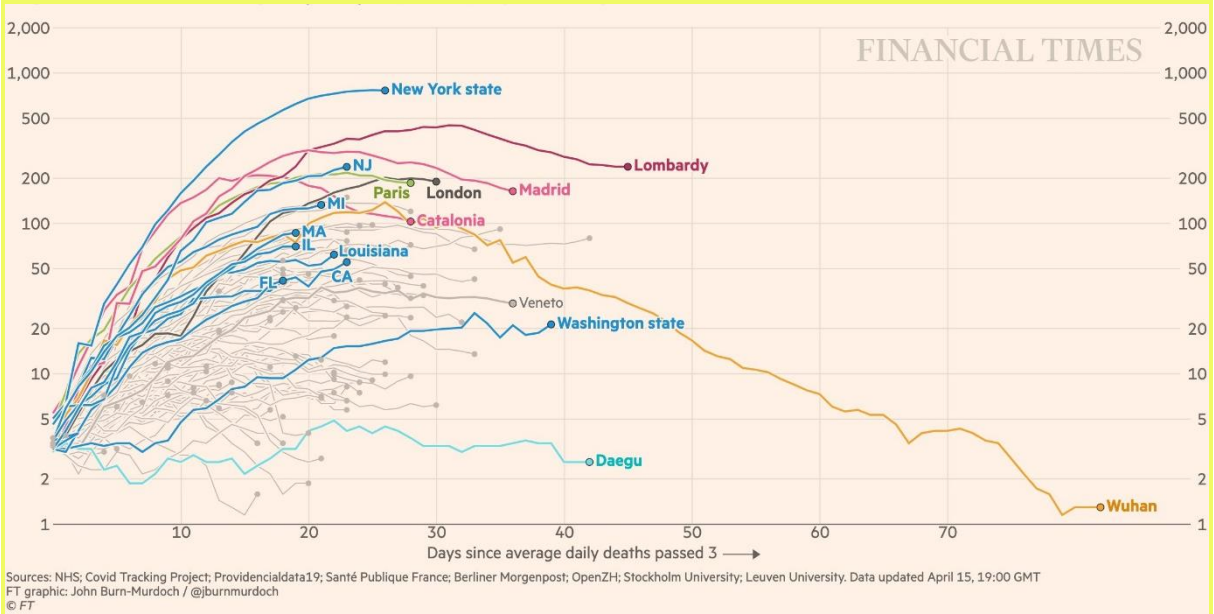
To tackle these issues, the Governor put into place several measures including aid for schools affected by closure and the waiver of waiting period for health insurance claims.[318]

New York will also be receiving at least $40 billion from the COVID-19 relief package from the US Senate.[319]

Impact on the Epidemiological Curve

By the third week of April, the US reported the greatest number of coronavirus deaths in the world, with New York leading the numbers.[320] However, there has been a flattening of the curve based on data from hospitals state-wide, with all numbers declining from mid-April.[321]

On 14 April 2020, the Governor announced that the number of deaths were slowing down.[322]



Implemented Measures

Mar 7	State of emergency announced
Mar 15	Schools closed
Mar 22	New York State PAUSE executive order put in place - full closure of non-essential services
Mar 25	$2 trillion stimulus package passed[323]
Mar 29	PAUSE extended for two weeks through April 15

Apr 6	PAUSE extended for two weeks through April 29
Apr 10	Ramp up on antibody testing and to bring mass-testing to scale
Apr 12	Executive order on employers requiring them to provide masks for employees having public interaction
Apr 13	Executive order on financial measures to help relieve negative economic impact[324]
Apr 16	PAUSE extended for two weeks through May 15
Apr 17	Compulsory wearing of masks or face coverings in public

Search Methodology

The review was a high-level time limited scan of online publications. PubMed was searched - “pandemic” or “Spanish flu” or “1918 influenza” and “lockdown” / “social distance”. Resources from the CDC, WHO were reviewed. Media story searches were undertaken for the case study examples.

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References

[1] Washington Post (2020) First, China. Then, Italy. What the U.S. can learn from extreme coronavirus lockdowns. March 12, 2020. Available at: https://www.washingtonpost.com/world/asia_pacific/first-china-then-italy-what-the-us-can-learn-from-extreme-coronavirus-lockdowns/2020/03/11/1cfaa07c-630e-11ea-912d-d98032ec8e25_story.html (accessed 15.3.2020)
[2] Time (2020) China's Draconian Lockdown Is Getting Credit for Slowing Coronavirus. Would It Work Anywhere Else? Available at: https://time.com/5796425/china-coronavirus-lockdown/ (Accessed 15.3.2020)
[3] Guardian (2020) outbreak 'Do not let this fire burn': WHO warns Europe over Covid-19. Available at: https://www.theguardian.com/world/2020/mar/13/european-countries-take-radical-steps-to-combat-coronavirus (Accessed 15.3.2020)
[4] Changi Airport (2020) Available at: https://www.changiairport.com/corporate/our-expertise/air-hub/traffic-statistics.html (accessed 31.3.2020)
[5] SCMP (2020) 5 million left Wuhan before lockdown, 1,000 new coronavirus cases expected in city. January 26, 2020. Available at: https://www.scmp.com/news/china/society/article/3047720/chinese-premier-li-keqiang-head-coronavirus-crisis-team-outbreak (accessed 31.3.2020)
[6] Asia One (2020) Thousands left Wuhan for Singapore, Hong Kong, Bangkok, Tokyo. January 28, 2020. Available at: https://www.asiaone.com/asia/thousands-left-wuhan-singapore-hong-kong-bangkok-tokyo (accessed 31.3.2020)
[7] YouTube (2020) PM Lee Hsien Loong on the COVID-19 situation in Singapore on 8 February 2020. Available at: https://www.youtube.com/watch?v=oNw1pyksKHo (accessed 31.3.2020)
[8] Straits Times (2020) WHO praises Singapore's response to coronavirus outbreak. February 19, 2020. Available at: https://www.straitstimes.com/world/europe/coronavirus-who-reports-92-cases-of-human-to-human-spread-outside-china (accessed 31.3.2020)
[9] BBC (2020) Coronavirus: Should the world worry about Singapore's virus surge? April 10, 2020. Available at: https://www.bbc.com/news/world-asia-52232147 (accessed 15.4.2020)
[10] Straits Times (2020) MAS eases Singdollar policy in measured move as economy braces for recession. March 30, 2020. Available at: https://www.straitstimes.com/business/economy/mas-sets-zero-appreciation-path-for-singdollar-at-lower-level-in-easing-move (accessed 31.3.2020)
[11] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[12] Wong L (2020) Facebook Post. April 13 2020. Available at: https://www.facebook.com/LawrenceWongST/photos/a.194878853886799/3650197798354870/?type=3&theater (accessed 15.4.2020)
[13] MOH (2020) Circuit breaker to minimise further spread of COVID-19. April 3, 2020. Available at: https://www.moh.gov.sg/news-highlights/details/circuit-breaker-to-minimise-further-spread-of-covid-19 (Accessed 8.4.2020)
[14] Straits Times (2020) Over 7,000 written advisories issued to those who breached Covid-19 safe distancing measures. April 7, 2020. Available at: https://www.straitstimes.com/singapore/day-1-of-shutdown-more-than-7000-written-advisories-issued-to-those-who-breached-safe (accessed 8.4.2020)
[15] Straits Times (2020) Coronavirus: Inter-agency taskforce to provide support to foreign workers, dormitory operators. April 7, 2020. Available at: https://www.straitstimes.com/singapore/manpower/coronavirus-inter-agency-taskforce-to-provide-support-to-foreign-workers (accessed 8.4.2020)
[16] Straits Times (2020) About 5,000 foreign workers to be tested for Covid-19 in next few days, even those who are well but are contacts of confirmed cases. April 14, 2020. Available at: https://www.straitstimes.com/singapore/health/about-5000-foreign-workers-to-be-tested-for-covid-19-in-the-next-few-days-even (accessed 15.4.2020)
[17] Straits Times (2020) Coronavirus: Mandatory for all in Singapore to wear mask when out, except for kids under 2 and those doing strenuous exercise. April 14, 2020. Available at: https://www.straitstimes.com/singapore/coronavirus-mandatory-for-all-to-wear-a-mask-when-out-with-exceptions-for-kids-under-2-and (accessed 15.4.2020)
[18] Straits Times (2020) Coronavirus testing blitz appears to keep South Korea death rate low
[19] Time (2020) China's Draconian Lockdown Is Getting Credit for Slowing Coronavirus. Would It Work Anywhere Else? Available at: https://time.com/5796425/china-coronavirus-lockdown/ (Accessed 15.3.2020)
[20] Reuters (2020) Italian businesses count heavy cost of coronavirus lockdown. Available at: https://www.reuters.com/article/us-health-coronavirus-italy-business/italian-businesses-count-heavy-cost-of-coronavirus-lockdown-idUSKBN20Z1CM (Accessed 15.3.2020)

[21] Ferguson NM et al (2020) Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. March 16, 2020 Imperial College COVID-19 Response Team. Available at: https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf (accessed 17.3.2020)
[22] Koo JR et al (2020) Interventions to mitigate early spread of SARS-CoV-2 in Singapore: a modelling study. Lancet Infect Dis 2020. S1473-3099(20)30162-6 Available at: https://doi.org/10.1016/S1473-3099(20)30162-6 (accessed 25.4.2020)
[23] Time (2020) 'You Call This a Lockdown?' Coronavirus Tests Italians' Commitment to the Common Good. March 10, 2020. Available at: https://time.com/5800605/coronavirus-lockdown-covid-19-italy/(accessed 15.3.2020)
[24] Kucharski AJ et al (2020) Early dynamics of transmission and control of COVID-19: a mathematical modelling study. Lancet Infect Dis [Internet]. 2020;3099(20):2020.01.31.20019901. Available at: http://medrxiv.org/content/early/2020/02/18/2020.01.31.20019901.abstract (accessed 17.3.2020)
[25] Kylie E C Ainslie KEC et al (2020) Report 11: Evidence of initial success for China exiting COVID-19 social distancing policy after achieving containment. 24 March 2020 Imperial College COVID-19 Response Team Available at: https://doi.org/10.25561/77646 (accessed 26.3.2020)
[26] WorldoMeters (2020) Available at: https://www.worldometers.info/coronavirus/coronavirus-death-rate/ (accessed 15.3.2020)
[27] Webinar: American Hospital Association. Best Guess Epidemiology.Leaked to Business Insider
[28] Ferguson NM et al (2020) Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. March 16, 2020 Imperial College COVID-19 Response Team. Available at: https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf (accessed 17.3.2020)
[29] JAMA (2020) Published online March 17, 2020. doi:10.1001/jama.2020.4344
[30] Straight (2020) Stanford University epidemiologist John Ioannidis calls out media for panicking the public over COVID-19. April 10, 2020. Available at: https://www.straight.com/covid-19-pandemic/stanford-university-researcher-john-ioannidis-relies-on-data-to-puncture-some-of-myths-about (accessed 17.4.2020)
[31] WHO (2020) About pandemic phases. Available at: http://www.euro.who.int/en/health-topics/communicable-diseases/influenza/data-and-statistics/pandemic-influenza/about-pandemic-phases (accessed 26.3.2020)
[32] FT (2020) UK's chief scientific adviser defends 'herd immunity' strategy for coronavirus. March 14, 2020. Available at: https://www.ft.com/content/38a81588-6508-11ea-b3f3-fe4680ea68b5 (accessed 19.3.2020)
[33] BBC (2020) Coronavirus: UK schools, colleges and nurseries to close from Friday. March 19, 2020. Available at: https://www.bbc.com/news/uk-51952314 (accessed 19.3.2020)
[34] Ferguson NM et al (2020) Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. March 16, 2020 Imperial College COVID-19 Response Team. Available at: https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf (accessed 17.3.2020)
[35] BBC (2020) Coronavirus: UK schools, colleges and nurseries to close from Friday. March 19, 2020. Available at: https://www.bbc.com/news/uk-51952314 (accessed 19.3.2020)
[36] Guardian (2020) Coronavirus: UK over-70s to be asked to stay home 'within weeks', Hancock says. March 15, 2020 Available at: https://www.theguardian.com/world/2020/mar/15/coronavirus-uk-over-70s-to-be-asked-to-self-isolate-within-weeks-hancock-says (accessed 18.3.2020)
[37] People who have received an organ transplant and remain on ongoing immunosuppression medication, people with cancer who are undergoing active chemotherapy or radiotherapy, people with cancers of the blood or bone marrow such as leukaemia who are at any stage of treatment, people with severe chest conditions such as cystic fibrosis or severe asthma (requiring hospital admissions or courses of steroid tablets), people with severe diseases of body systems, such as severe kidney disease (dialysis).
[38] UK Government (2020) Coronavirus outbreak I'm an epidemiologist. When I heard about Britain's 'herd immunity' coronavirus plan, I thought it was satire. Guidance on social distancing for everyone in the UK and protecting older people and vulnerable adults. March 16, 2020. Available at: https://www.gov.uk/government/publications/covid-19-guidance-on-social-distancing-and-for-vulnerable-people/guidance-on-social-distancing-for-everyone-in-the-uk-and-protecting-older-people-and-vulnerable-adults (accessed 18.3.2020)
[39] UNCTAD (2020) Coronavirus: Can policymakers avert a trillion-dollar crisis. March 9, 2020. Available at: https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2300 (accessed 25.3.2020)

[40] UNCTAD (2020) Coronavirus: Can policymakers avert a trillion-dollar crisis. March 9, 2020. Available at: https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2300 (accessed 25.3.2020)
[41] IMF (2020) The Great Lockdown: Worst Economic Downturn Since the Great Depression. April 14, 2020. Available at: https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/ (accessed 17.4.2020)
[42] MOM (2019) Foreign workforce numbers. Singapore Available at: https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers (accessed 16.3.2020)
[43] WHO Pandemic Phases. Available at: https://www.who.int/influenza/resources/documents/pandemic_phase_descriptions_and_actions.pdf (accessed 14.3.2020)
[44] CDC Available at: https://www.cdc.gov/flu/pandemic-resources/1918-pandemic-h1n1.html (accessed 14.3.2020)
[45] CDC Available at: https://www.cdc.gov/flu/pandemic-resources/1918-pandemic-h1n1.html (accessed 14.3.2020)
[46] Tomes N (2010) "Destroyer and teacher": Managing the masses during the 1918-1919 influenza pandemic. Public Health Rep. 2010 Apr;125 Suppl 3:48-62. DOI: 10.1177/00333549101250S308
[47] Liu Y et al (2020) The Contribution of Pre-symptomatic Transmission to the COVID-19 Outbreak. PrePrint. Available at: https://cmmid.github.io/topics/covid19/control-measures/pre-symptomatic-transmission.html (accessed 14.3.2020)
[48] Markel (2006) A Historical Assessment of Nonpharmaceutical Disease Containment Strategies Employed by Selected U.S. Communities During the Second Wave of the 1918-1920 Influenza Pandemic. For Defense Threat Reduction Agency. Prepared by The University of Michigan. DTRA01-03-D-0017. Available at: http://chm.med.umich.edu/wp-content/uploads/sites/20/2015/01/DTRA-Final-Influenza-Report.pdf (Accessed 14.3.2020)
[49] Markel H et al (2007) Nonpharmaceutical Interventions Implemented by US Cities During the 1918-1919 Influenza Pandemic. JAMA. 2007;298(6):644-654. doi:10.1001/jama.298.6.644
[50] Del Rio C, Hernandez-Avila M (2009) Lessons from previous influenza pandemics and from the Mexican response to the current influenza pandemic. Arch Med Res. 2009 Nov;40(8):677-80. doi: 10.1016/j.arcmed.2009.12.005
[51] Markel (2006) A Historical Assessment of Nonpharmaceutical Disease Containment Strategies Employed by Selected U.S. Communities During the Second Wave of the 1918-1920 Influenza Pandemic. For Defense Threat Reduction Agency. Prepared by The University of Michigan. DTRA01-03-D-0017. Available at: http://chm.med.umich.edu/wp-content/uploads/sites/20/2015/01/DTRA-Final-Influenza-Report.pdf (Accessed 14.3.2020)
[52] CDC 1918 Pandemic Influenza Historic Timeline. Available at: https://www.cdc.gov/flu/pandemic-resources/1918-commemoration/pandemic-timeline-1918.htm (accessed 18.4.2020)
[53] Markel (2006) A Historical Assessment of Nonpharmaceutical Disease Containment Strategies Employed by Selected U.S. Communities During the Second Wave of the 1918-1920 Influenza Pandemic. For Defense Threat Reduction Agency. Prepared by The University of Michigan. DTRA01-03-D-0017. Available at: http://chm.med.umich.edu/wp-content/uploads/sites/20/2015/01/DTRA-Final-Influenza-Report.pdf (Accessed 14.3.2020)
[54] BBC (2018) In places like Alaska, the Spanish flu exacted a terrible toll. But while some communities suffered many deaths, others nearby escaped the carnage. How? Available at: https://www.bbc.com/future/article/20181023-the-places-that-escaped-the-spanish-flu (accessed 14.3.2020)
[55] Tomes N (2010) "Destroyer and teacher": Managing the masses during the 1918-1919 influenza pandemic. Public Health Rep. 2010 Apr;125 Suppl 3:48-62. DOI: 10.1177/00333549101250S308
[56] Tomes N (2010) "Destroyer and teacher": Managing the masses during the 1918-1919 influenza pandemic. Public Health Rep. 2010 Apr;125 Suppl 3:48-62. DOI: 10.1177/00333549101250S308
[57] Tomes N (2010) "Destroyer and teacher": Managing the masses during the 1918-1919 influenza pandemic. Public Health Rep. 2010 Apr;125 Suppl 3:48-62. DOI: 10.1177/00333549101250S308
[58] Bangkok Post (2020) Vietnam locks down 10,000 people over coronavirus. February 13, 2020. Available at: https://www.bangkokpost.com/learning/easy/1856904/vietnam-locks-down-10-000-people-over-coronavirus (accessed 14.3.2020)
[59] SCMP (2020) Coronavirus: China's first confirmed Covid-19 case traced back to November 17. March 13, 2020. Available at: https://www.scmp.com/news/china/society/article/3074991/coronavirus-chinas-first-confirmed-covid-19-case-traced-back (Accessed 8.4.2020)
[60] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 15.4.2020)

[61] The Economist (2020) China's data reveal a puzzling link between covid-19 cases and political events. April 7, 2020. Available at: https://www.economist.com/graphic-detail/2020/04/07/chinas-data-reveal-a-puzzling-link-between-covid-19-cases-and-political-events (accessed 8.4.2020)
[62] Chinazzi M et al (2020) The effect of travel restrictions on the spread of the 2019 novel coronavirus (2019-nCoV) outbreak," medRxiv (preprint), 2020. [Online]. Available at https://www.medrxiv.org/content/10.1101/2020.02.09.20021261v1 (accessed 20.2.2020)
[63] Tian H et al (20209 Early evaluation of Wuhan City travel restrictions in response to the 2019 novel coronavirus outbreak," medRxiv preprint, 2020. [Online]. Available at: https://www.medrxiv.org/content/10.1101/2020.01.30.20019844v2.full.pdf (accessed 20.2.2020)
[64] Zhao X et al (2020) Tracking the spread of novel coronavirus (2019-nCoV) based on big data. medRxiv. Available at: https://www.medrxiv.org/content/10.1101/2020.02.07.20021196v1.full.pdf (accessed 15.3.2020)
[65] Yang K et al (2020) Analysis of epidemiological characteristics of coronavirus 2019 infection and preventive measures in Shenzhen China—a heavy population city. medRxiv (preprint) , 2020. [Online]. Available: https://doi.org/10.1101/2020.02.28.20028555 (accessed 15.3.2020)
[66] C Wang et al (2020) Evolving Epidemiology and Impact of Non-pharmaceutical Interventions on the Outbreak of Coronavirus Disease 2019 in Wuhan, China, medRxiv (prepring), 2020. [Online]. Available: https://doi.org/10.1101/2020.03.03.20030593 (accessed 15.3.2020)
[67] D Li et al (2020) Estimating the Efficacy of Traffic Blockage and Quarantine for the Epidemic Caused by 2019-nCoV (COVID-19) medRxiv (preprint), p. Available at: https://doi.org/10.1101/2020.02.14.20022913 (accessed 15.3.2020)
[68] Zhu et al (2020) Spatially Explicit Modeling of 2019-nCoV Epidemic Trend based on Mobile Phone Data in Mainland China," medRxiv (preprint), p. Available at: https://doi.org/10.1101/2020.02.09.20021360 (accessed 15.3.2020)
[69] Zhao S, Chen H (20200 Modeling the Epidemic Dynamics and Control of COVID-19 Outbreak in China. medRxiv (preprint), 2020. [Online]. Available: https://doi.org/10.1101/2020.02.27.20028639 (accessed15.3.2020)
[70] Kraemer MUG et al (2020) The effect of human mobility and control measures on the COVID-19 epidemic in China," medRxiv (preprint) , 2020. [Online]. Available: https://doi.org/10.1101/2020.03.02.20026708 (accessed 15.3.2020)
[71] Zhang Y et al (2020) The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China : A data-driven SEIQR model study. medRxiv (preprint) Available at: https://doi.org/10.1101/2020.03.04.20031187 (accessed 15.3.2020)
[72] Sanche S et al (2020) High Contagiousness and Rapid Spread of Severe Acute Respiratory Syndrome Coronavirus 2. CDC. Available at: https://wwwnc.cdc.gov/eid/article/26/7/20-0282_article?deliveryName=USCDC_333-DM25287 (accessed 8.4.2020)
[73] Zhang Y et al (2020) The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China : A data-driven SEIQR model study. medRxiv (preprint) Available at: https://doi.org/10.1101/2020.03.04.20031187 (accessed 15.3.2020)
[74] WHO (2020) Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Available at: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf (accessed 15.3.2020)
[75] Zhu et al (2020) Spatially Explicit Modeling of 2019-nCoV Epidemic Trend based on Mobile Phone Data in Mainland China," medRxiv (preprint), p. Available at: https://doi.org/10.1101/2020.02.09.20021360 (accessed 15.3.2020)
[76] See – COVID-19 Containment Measure Report for references
[77] Kylie E C Ainslie KEC et al (2020) Report 11: Evidence of initial success for China exiting COVID-19 social distancing policy after achieving containment. 24 March 2020 Imperial College COVID-19 Response Team Available at: https://doi.org/10.25561/77646 (accessed 26.3.2020)
[78] Tian H et al (2020) An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China DOI: 10.1126/science.abb6105. Available at: https://science.sciencemag.org/content/early/2020/03/30/science.abb6105 (accessed 2.4.2020)
[79] Zhang Y et al (2020) The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China : A data-driven SEIQR model study. medRxiv (preprint) Available at: https://doi.org/10.1101/2020.03.04.20031187 (accessed 15.3.2020)
[80] Lai et al (2020) Effect of non-pharmaceutical interventions for containing the COVID-19 outbreak: an observational and modelling study," medRxiv (preprint) 2020. [Online]. Available at: https://doi.org/10.1101/2020.03.03.20029843 (accessed 15.3.2020)
[81] Zhang Y et al (2020) The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China : A data-driven SEIQR model study. medRxiv (preprint) Available at: https://doi.org/10.1101/2020.03.04.20031187 (accessed 15.3.2020)

[82] Lai et al (2020) Effect of non-pharmaceutical interventions for containing the COVID-19 outbreak: an observational and modelling study," medRxiv (preprint) 2020. [Online]. Available at: https://doi.org/10.1101/2020.03.03.20029843 (accessed 15.3.2020)
[83] Zhu et al (2020) Spatially Explicit Modeling of 2019-nCoV Epidemic Trend based on Mobile Phone Data in Mainland China," medRxiv (preprint), p. Available at: https://doi.org/10.1101/2020.02.09.20021360 (accessed 15.3.2020)
[84] Wan et al (2020) Risk estimation and prediction by modeling the transmission of the novel coronavirus (COVID-19) in mainland China excluding Hubei province. medRxiv (preprint0 , 2020. [Online]. Available: https://doi.org/10.1101/2020.03.01.20029629 (accessed 15.3.2020)
[85] Zhang Y et al (2020) The impact of social distancing and epicenter lockdown on the COVID-19 epidemic in mainland China : A data-driven SEIQR model study. medRxiv (preprint) Available at: https://doi.org/10.1101/2020.03.04.20031187 (accessed 15.3.2020)
[86] Guardian (2020) China to lift travel restrictions in Hubei after months of coronavirus lockdown. March 24, 2020. Available at: https://www.theguardian.com/world/2020/mar/24/china-to-lift-travel-restrictions-in-hubei-after-months-of-coronavirus-lockdown (accessed 25.3.2020)
[87] The Star (2020) People in China need a green light from Alibaba app to move around country. March 23, 2020. Available at: https://www.thestar.com.my/tech/tech-news/2020/03/23/people-in-china-need-a-green-light-from-alibaba-app-to-move-around-country (accessed 25.3.2020)
[88] BBC (2020) Coronavirus: Wuhan to ease lockdown as world battles pandemic. available at: https://www.bbc.com/news/world-asia-china-52016139 (accessed 25.3.2020)
[89] BBC (2020) Coronavirus: Wuhan to ease lockdown as world battles pandemic. available at: https://www.bbc.com/news/world-asia-china-52016139 (accessed 25.3.2020)
[90] Guardian (2020) Japan and South Korea tighten borders as US faces up to 200,000 Covid-19 deaths. March 30, 2020. Available at: https://www.theguardian.com/world/2020/mar/30/japan-and-south-korea-tighten-borders-as-us-faces-up-to-200000-covid-19-deaths (accessed 31.3.2020)
[91] Bloomberg (2020) China Reveals 1,541 Symptom-Free Virus Cases Under Pressure. March 31, 2020. Available at: https://www.bloomberg.com/news/articles/2020-03-31/china-reveals-1-541-symptom-free-virus-cases-under-pressure (accessed 1.4.2020)
[92] Aljazeera (2020) China approves two coronavirus vaccines for human trials Experimental COVID-19 treatments to go ahead in China as it grapples with imported cases from neighbouring Russia. Available at: https://www.aljazeera.com/news/2020/04/china-approves-coronavirus-vaccines-human-trials-200414083310079.html (accessed 15.4.2020)
[93] WHO (2020) Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Available at: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf (accessed 15.3.2020)
[94] The Economist (2020) The virus is coming The Economist, 27 Feb 2020.
[95] Chinazzi M et al (2020) The effect of travel restrictions on the spread of the 2019 novel coronavirus (2019-nCoV) outbreak," medRxiv (preprint), 2020. [Online]. Available at https://www.medrxiv.org/content/10.1101/2020.02.09.20021261v1 (accessed 20.2.2020)
[96] Reuters (2020) https://www.reuters.com/article/us-china-economy-business/virus-had-eye-popping-impact-on-chinas-economy-beige-book-idUSKBN21A3R9 (accessed 25.3.2020)
[97] CAN (2020) China's Q1 GDP posts first decline on record as COVID-19 shuts down economy. April 17, 2020. Available at: https://www.channelnewsasia.com/news/business/china-gdp-covid-19-economy-decline-coronavirus-12651092 (accessed 18.4.2020)
[98] SCMP (2020) Coronavirus: China's 2020 growth forecast slashed in surprise move by prominent bank CICC. Available at: https://www.scmp.com/economy/china-economy/article/3076745/coronavirus-chinas-2020-growth-forecast-slashed-surprise-move (accessed 25.3.2020)
[99] China Briefing (2020) Virus had 'eye-popping' impact on China's economy: Beige Book. March 24, 2020. China's Support Policies for Businesses Under COVID-19: A Comprehensive List. March 20, 2020. https://www.china-briefing.com/news/china-covid-19-policy-tracker-benefiting-business-enterprises-comprehensive-updated-list/#hebeiprovinceHeader (accessed 24.3.2020)
[100] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[101] BBC (2020) Coronavirus: China outbreak city Wuhan raises death toll by 50%. April 18, 2020. Available at: https://www.bbc.com/news/world-asia-china-52321529 (accessed 18.4.2020)
[102] Pueyo T. Analysis over chart from the Journal of the American Medical Association, based on raw case data from the Chinese Center for Disease Control and Prevention. Cited in Ibid Medium (2020)
[103] Yang Qian (2020) China's Confirmed and Suspected Cases. March 16, 2020. Saw Swee Hock School of Public Health.
[104] Yang (2020) Analysis of epidemiological characteristics of coronavirus 2019 infection

and preventive measures in Shenzhen China—a heavy population city. PrePrint. Available at: : https://doi.org/10.1101/2020.02.28.20028555 (accessed 16.3.2020)
[105] Yang (2020) Analysis of epidemiological characteristics of coronavirus 2019 infection and preventive measures in Shenzhen China—a heavy population city. PrePrint. Available at: : https://doi.org/10.1101/2020.02.28.20028555 (accessed 16.3.2020)
[106] Gong F et al (2020) China's local governments are combating COVID-19 with unprecedented responses - from a Wenzhou governance perspective. Available at: https://link.springer.com/article/10.1007%2Fs11684-020-0755-z (Accessed 25.3.2020)
[107] Tian H et al (2020) An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China DOI: 10.1126/science.abb6105. Available at: https://science.sciencemag.org/content/early/2020/03/30/science.abb6105 (accessed 2.4.2020)
[108] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 15.4.2020)
[109] Jeremy Konyndyk, Senior Policy Fellow, Center for Global Development in Washington. Cited in Ibid Reuters (2020)
[110] Straits Times (2020) Mapping coronavirus: South Koreans turn to online tracking as cases surge. February 24. 2020.
[111] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 15.4.2020)
[112] BBC (2020) Coronavirus in South Korea: How 'trace, test and treat' may be saving lives By Bicker L. BBC News, Seoul. March 12, 2020. Available at: https://www.bbc.com/news/world-asia-51836898 (accessed 14.3.2020)
[113] Asia Times (2020) South Korea turns to tech to take on Covid-19. March 12, 2020. Available at: https://asiatimes.com/2020/03/south-korea-turns-to-tech-to-take-on-covid-19/ (Accessed 15.3.2020)
[114] BBC (2020) Coronavirus in South Korea: How 'trace, test and treat' may be saving lives By Bicker L. BBC News, Seoul. March 12, 2020. Available at: https://www.bbc.com/news/world-asia-51836898 (accessed 14.3.2020)
[115] KCDC (2020) The updates on COVID-19 in Korea as of 22 March. March 23, 2020. Available at https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030&act=view&list_no=366621&tag=&nPage=1 (accessed 23.3.2020)
[116] KCDC (2020) Available at: http://ncov.mohw.go.kr/en/ (accessed 8.4.2020)
[117] Reuters (2020) Special Report: Italy and South Korea virus outbreaks reveal disparity in deaths and tactics. March 12, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-response-specialre/italy-and-south-korea-virus-outbreaks-reveal-disparity-in-deaths-and-tactics-idUSKBN20Z27P (accessed 14.3.2020)
[118] Times (2020) How South Korea stopped coronavirus in its tracks. March 24, 2020. available at: https://www.thetimes.co.uk/article/how-south-korea-stopped-coronavirus-in-its-tracks-jxbnvxw9q (accessed 25.3.2020)
[119] KCDC (2020) Available at: http://ncov.mohw.go.kr/en/ (accessed 8.4.2020)
[120] BBC (2020) Coronavirus in South Korea: How 'trace, test and treat' may be saving lives By Bicker L. BBC News, Seoul. March 12, 2020. Available at: https://www.bbc.com/news/world-asia-51836898 (accessed 14.3.2020)
[121] KCDC (2020) The updates on COVID-19 in Korea as of 22 March. March 23, 2020. Available at https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030&act=view&list_no=366621&tag=&nPage=1 (accessed 23.3.2020)
[122] Reuters (2020) Special Report: Italy and South Korea virus outbreaks reveal disparity in deaths and tactics. March 12, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-response-specialre/italy-and-south-korea-virus-outbreaks-reveal-disparity-in-deaths-and-tactics-idUSKBN20Z27P (accessed 14.3.2020)
[123] Sung-sun K et al (2020) Physicians work out treatment guidelines for coronavirus. Korean Biomedical Review Available at: http://www.koreabiomed.com/news/articleView.html?idxno=7428 (Accessed 11.3.2020)
[124] Yonhap via Reuters (2020) Available at: https://www.theatlantic.com/photo/2020/03/photos-large-scale-disinfection-efforts-against-coronavirus/607810/ (accessed 14.3.2020)
[125] Reuters (2020) Special Report: Italy and South Korea virus outbreaks reveal disparity in deaths and tactics. March 12, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-response-specialre/italy-and-south-korea-virus-outbreaks-reveal-disparity-in-deaths-and-tactics-idUSKBN20Z27P (accessed 14.3.2020)
[126] BBC (2020) Coronavirus in South Korea: How 'trace, test and treat' may be saving lives By Bicker L. BBC News, Seoul. March 12, 2020. Available at: https://www.bbc.com/news/world-asia-51836898 (accessed 14.3.2020)

[127] Reuters (2020) South Korea advises facilities suspension, experts warn of 'long battle' against coronavirus. March 21, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-southkorea/south-korea-advises-facilities-suspension-experts-warn-of-long-battle-against-coronavirus-idUSKBN218029 (accessed 25.3.2020)
[128] The Korea Herald (2020) Moon against discussing permanent change in academic calendar, Cheong Wa Dae says. March 23, 2020. Available at: http://www.koreaherald.com/view.php?ud=20200323000912&ACE_SEARCH=1 (accessed 24.3.2020)
[129] Fendos J (2020) Lessons From South Korea's COVID-19 Outbreak: The Good, Bad, and Ugly. The Diplomat. March 10, 2020. Available at: https://thediplomat.com/2020/03/lessons-from-south-koreas-covid-19-outbreak-the-good-bad-and-ugly/ (accessed 14.3.2020)
[130] Fendos J (2020) Lessons From South Korea's COVID-19 Outbreak: The Good, Bad, and Ugly. The Diplomat. March 10, 2020. Available at: https://thediplomat.com/2020/03/lessons-from-south-koreas-covid-19-outbreak-the-good-bad-and-ugly/ (accessed 14.3.2020)
[131] Fendos J (2020) Lessons From South Korea's COVID-19 Outbreak: The Good, Bad, and Ugly. The Diplomat. March 10, 2020. Available at: https://thediplomat.com/2020/03/lessons-from-south-koreas-covid-19-outbreak-the-good-bad-and-ugly/ (accessed 14.3.2020)
[132] Fendos J (2020) Lessons From South Korea's COVID-19 Outbreak: The Good, Bad, and Ugly. The Diplomat. March 10, 2020. Available at: https://thediplomat.com/2020/03/lessons-from-south-koreas-covid-19-outbreak-the-good-bad-and-ugly/ (accessed 14.3.2020)
[133] Straits Times (2020) Coronavirus: Panic buying in Seoul as cases grow. February 25, 2020
[134] Straits Times (2020) Coronavirus: Questions raised in South Korea about the culture of going to work sick. By Chang May Choon, South Korea Correspondent. March 14, 2020. Available at: https://www.straitstimes.com/asia/east-asia/covid-19-questions-raised-about-the-culture-of-going-to-work-sick-in-south-korea-as (accessed 14.3.2020)
[135] KCDC (2020) Updates on COVID-19 in Republic of Korea. 20 March, 2020. Available at: https://www.cdc.go.kr/board/board.es?mid=a30402000000&bid=0030 (accessed 24.3.2020)
[136] Business Korea (2020) South Korean Economy on the Verge of Recession. March 23, 2020. http://www.businesskorea.co.kr/news/articleView.html?idxno=43060 (accessed 25.3.2020)
[137] Business Times (2020) S Korea doubles coronavirus rescue package to 100t won. March 25, 2020. Available at: https://www.businesstimes.com.sg/banking-finance/s-korea-doubles-coronavirus-rescue-package-to-100t-won (accessed 25.3.2020)
[138] CAN (2020) South Korea to pay cash to families, bring in extra budget relief. March 30, 2020. Available at: https://www.channelnewsasia.com/news/asia/coronavirus-covid-19-south-korea-cases-12588524 (accessed 31.3.2020)
[139] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[140] KCDC (2020) Available at: http://ncov.mohw.go.kr/en/ (accessed 8.4.2020)
[141] KCDC (2020) Available at: http://ncov.mohw.go.kr/en/ (accessed 8.4.2020)
[142] KCDC (2020) Available at: http://ncov.mohw.go.kr/en/ (accessed 8.4.2020)
[143] Worldometers (2020) Available at: https://www.worldometers.info/coronavirus/#countries (accessed 25.3.2020)
[144] SCMP (2020) Italy, reeling from coronavirus outbreak, discovers what it's like for Chinese. February 26, 2020. Available at: https://www.scmp.com/news/world/europe/article/3052450/italy-reeling-coronavirus-outbreak-discovers-what-its-be-chinese(accessed 15.3.2020)
[145] De Spiegel (2020) Why Are There So Many Cases in Italy? March 12, 2020. Available at: https://www.spiegel.de/international/world/coronavirus-why-are-there-so-many-cases-in-italy-a-00459ce0-bea7-482e-8a77-efe618f3b06b (accessed 15.3.2020)
[146] Washington Post (2020) Coronavirus curve shows much of Europe could face Italy-like surge within weeks. https://www.washingtonpost.com/world/europe/flatten-the-curve-coronavirus/2020/03/12/a648883c-6460-11ea-8a8e-5c5336b32760_story.html (accessed 15.3.2020)
[147] Reuters (2020) Two first coronavirus cases confirmed in Italy - prime minister. January 31, 2020. Available at: https://www.reuters.com/article/china-health-italy/two-first-coronavirus-cases-confirmed-in-italy-prime-minister-idUKL8N29Z8LZ (accessed 15.3.2020)
[148] WHO (2020) Novel Coronavirus(2019-nCoV) Situation Report – 11. January 31, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4(accessed 15.3.2020)
[149] WHO (2020) Coronavirus disease 2019 (COVID-19) Situation Report – 34. February 23, 2020. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200223-sitrep-34-covid-19.pdf?sfvrsn=44ff8fd3_2 (accessed 15.3.2020)
[150] WHO (2020) Coronavirus disease 2019 (COVID-19) Situation Report – 48. March 8, 2020.

https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200308-sitrep-48-covid-19.pdf?sfvrsn=16f7ccef_4 (accessed 15.3.2020)
[151] WHO (2020) Coronavirus disease 2019 (COVID-19) Situation Report – 50. March 10, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200310-sitrep-50-covid-19.pdf?sfvrsn=55e904fb_2 (accessed 15.3.2020)
[152] NPR (2020) With Italy's Coronavirus Cases Rising Fast, Rome's Streets Go Quiet . March 6, 2020. https://www.npr.org/2020/03/06/812904540/with-italys-coronavirus-cases-rising-fast-rome-s-streets-go-quiet (accessed 15.3.2020)
[153] Reuters (2020) Italian businesses count heavy cost of coronavirus lockdown. Available at: https://www.reuters.com/article/us-health-coronavirus-italy-business/italian-businesses-count-heavy-cost-of-coronavirus-lockdown-idUSKBN20Z1CM (Accessed 15.3.2020)
[154] Time (2020) 'You Call This a Lockdown?' Coronavirus Tests Italians' Commitment to the Common Good. March 10, 2020. Available at: https://time.com/5800605/coronavirus-lockdown-covid-19-italy/(accessed 15.3.2020)
[155] Guardian (2020) Italians sing patriotic songs from their balconies during coronavirus lockdown. March 14, 2020. Available at: https://www.theguardian.com/world/2020/mar/14/italians-sing-patriotic-songs-from-their-balconies-during-coronavirus-lockdown (accessed 15.3.2020)
[156] BBC News (2020) Coronavirus: Italy says 1,000 have died but lockdown can work. March 12, 2020. Available at: https://www.bbc.com/news/world-europe-51852320 (accessed 15.3.2020)
[157] De Spiegel (2020) Why Are There So Many Cases in Italy? March 12, 2020. Available at: https://www.spiegel.de/international/world/coronavirus-why-are-there-so-many-cases-in-italy-a-00459ce0-bea7-482e-8a77-efe618f3b06b (accessed 15.3.2020)
[158] Time (2020) 'You Call This a Lockdown?' Coronavirus Tests Italians' Commitment to the Common Good. March 10, 2020. Available at: https://time.com/5800605/coronavirus-lockdown-covid-19-italy/ (accessed 15.3.2020)
[159] Bloomberg (2020) Italy May Set Heavier Fines for Coronavirus Lockdown Violations. March 24, 2020. Available at: https://www.bloomberg.com/news/articles/2020-03-24/italy-may-set-heavier-fines-for-coronavirus-lockdown-violations (accessed 25.3.2020)
[160] CAN (2020) Italy expected to maintain lockdown as it awaits steady COVID-19 decline. March 30, 2020. Available at: https://www.channelnewsasia.com/news/world/italy-expected-to-maintain-lockdown-as-it-awaits-steady-covid-19-12590860 (accessed 31.3.2020)
[161] Reuters (2020) Impossible dilemma? World watches Italy as businesses plead to return to work. April 7, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-italy-industry-ins/impossible-dilemma-world-watches-italy-as-businesses-plead-to-return-to-work-idUSKBN21P27C (accessed 8.4.2020)
[162] Reuters (2020) Impossible dilemma? World watches Italy as businesses plead to return to work. April 7, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-italy-industry-ins/impossible-dilemma-world-watches-italy-as-businesses-plead-to-return-to-work-idUSKBN21P27C (accessed 8.4.2020)
[163] Straits Times (2020) Coronavirus: Italy extends lockdown despite business pressure. April 12, 2020. Available at: https://www.straitstimes.com/world/europe/italy-extends-lockdown-despite-business-pressure (accessed 14.4.2020)
[164] FP (2020) Italy's Politicians Are Making the Coronavirus Crisis Worse. March 9, 2020. https://foreignpolicy.com/2020/03/09/italy-covid19-coronavirus-conte-salvini-epidemic-politicians-are-making-crisis-worse/ (accessed 15.3.2020)
[165] AA (2020) Italy extends COVID-19 measures amid deadly outbreak. March 9, 2020. Available at: https://www.aa.com.tr/en/europe/italy-extends-covid-19-measures-amid-deadly-outbreak/1760229 (accessed 15.3.2020)
[166] MWE (2020) COVID-19 – Recent legal developments in Italy and practical Implications. Available at: https://www.mwe.com/insights/covid-19-recent-legal-developments-in-italy-and-practical-implications/ (accessed 15.3.2020)
[167] Democracy Now (2020) Italy's "Darkest Hour": Life Grinds to a Halt Amid COVID-19 Lockdown, as Death Toll Spikes. March 12, 2020. Available at: Available at: https://www.democracynow.org/2020/3/12/italy_coronavirus_lockdown (accessed 15.3.2020)
[168] CNN (2020) All of Italy is in lockdown as coronavirus cases rise. March 13, 2020. Available at: https://edition.cnn.com/2020/03/09/europe/coronavirus-italy-lockdown-intl/index.html (accessed 15.3.2020)
[169] CAN (2020) Commentary: Italy's 'darkest hour': How a country-wide lockdown is generating divisions. March 10, 2020. Available at: https://www.channelnewsasia.com/news/commentary/covid-19-coronavirus-italy-quarantine-government-travel-restrict-12521592 (accessed 15.3.2020)

[170] Pisano GP et al (2020) Lessons from Italy's Response to Coronavirus. March 27, 2020. Harvard Business Review. Available at: https://hbr.org/2020/03/lessons-from-italys-response-to-coronavirus (accessed 15.4.2020)
[171] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[172] Bloomberg (2020) Italy Economy Starts to Switch Off, Literally, to Stop Virus. March 19, 2020. Available at: https://www.bloomberg.com/news/articles/2020-03-19/italy-s-economy-starts-to-switch-off-literally-to-stop-virus (accessed 25.3.2020)
[173] Reuters (2020) UPDATE 1-Italian banks ready new measures as economy stops, but debt goes on. March 24, 2020. Available at: https://www.reuters.com/article/health-coronavirus-italy-lending/update-1-italian-banks-ready-new-measures-as-economy-stops-but-debt-goes-on-idUSL8N2BG78O (accessed 25.3.2020)
[174] CAN (2020) Italy's daily COVID-19 cases fall sharply, some regions test for signs of immunity. April 7, 2020. Available at: https://www.channelnewsasia.com/news/world/italy-covid-19-cases-immunity-regions-12615600 (accessed 8.4.2020)
[175] Worldometers (2020) Available at: https://www.worldometers.info/coronavirus/#countries (accessed 25.3.2020)
[176] Wang JC et al (2020) Response to COVID-19 in Taiwan: Big Data Analytics, New Technology, and Proactive Testing. JAMA doi:10.1001/jama.2020.3151 Available at: https://jamanetwork.com/journals/jama/fullarticle/2762689 (accessed 17.3.2020)
[177] CAN (2020) Taiwan reports 8 new COVID-19 cases, widens travel warning. March 16, 2020. Available at: https://www.channelnewsasia.com/news/asia/coronavirus-covid19-taiwan-new-cases-travel-warning-12543160 (accessed 17.3.2020)
[178] Straits Times (2020) Taiwan reports third coronavirus death, total cases near 300. March 30, 2020. Available at: https://www.straitstimes.com/asia/east-asia/taiwan-reports-third-coronavirus-death-total-cases-near-300 (accessed 31.3.2020)
[179] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 15.4.2020)
[180] CAN (2020) Taiwan reports no new COVID-19 cases for first time in a month. April 15, 2020. Available at: https://www.channelnewsasia.com/news/asia/taiwan-reports-no-new-covid-19-cases-first-time-month-12640186 (accessed 15.4.2020)
[181] Bloomberg (2020) Taiwan's Viral Success Makes It Harder to Ignore. April 6, 2020. Available at: https://www.bloomberg.com/opinion/articles/2020-04-05/taiwan-s-advance-on-who-in-covid-19-shows-its-place-in-world (accessed 8.4.2020)
[182] Wang JC et al (2020) Response to COVID-19 in Taiwan: Big Data Analytics, New Technology, and Proactive Testing. JAMA doi:10.1001/jama.2020.3151 Available at: https://jamanetwork.com/journals/jama/fullarticle/2762689 (accessed 17.3.2020)
[183] Isaac S (2020) Taiwan has only 50 coronavirus cases. Its response to the crisis shows that swift action and widespread healthcare can prevent an outbreak. *Business Insider.*
[184] Bloomberg (2020) Taiwan's Viral Success Makes It Harder to Ignore. April 6, 2020. Available at: https://www.bloomberg.com/opinion/articles/2020-04-05/taiwan-s-advance-on-who-in-covid-19-shows-its-place-in-world (accessed 8.4.2020)
[185] Wang JC et al (2020) Response to COVID-19 in Taiwan: Big Data Analytics, New Technology, and Proactive Testing. JAMA doi:10.1001/jama.2020.3151 Available at: https://jamanetwork.com/journals/jama/fullarticle/2762689 (accessed 17.3.2020)
[186] Channel News Asia (2020) Taiwan COVID-19 cases jump again, second death reported. March 20, 2020. Available at: https://www.channelnewsasia.com/news/asia/taiwan-covid-19-coronavirus-cases-jump-second-death-reported-12560682 (accessed 24.03.2020)
[187] Reuters (2020) Taiwan says WHO not sharing coronavirus information it provides, pressing complaints. March 30, 2020. Available at: https://www.reuters.com/article/us-health-coronavirus-taiwan-who/taiwan-says-who-not-sharing-coronavirus-information-it-provides-pressing-complaints-idUSKBN21H1AU (accessed 31.3.2020)
[188] Bloomberg (2020) Taiwan's Viral Success Makes It Harder to Ignore. April 6, 2020. Available at: https://www.bloomberg.com/opinion/articles/2020-04-05/taiwan-s-advance-on-who-in-covid-19-shows-its-place-in-world (accessed 8.4.2020)
[189] Kyodo News (2020) Taiwan beating the odds on COVID-19. March 10, 2020. Available at: https://english.kyodonews.net/news/2020/03/1e7864b88592-focus-taiwan-beating-the-odds-on-covid-19.html (accessed 25.3.2020)
[190] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[191] Worldometers (2020) Available at: https://www.worldometers.info/coronavirus/#countries (accessed 25.3.2020)

[192] Wang JC et al (2020) Response to COVID-19 in Taiwan: Big Data Analytics, New Technology, and Proactive Testing. JAMA doi:10.1001/jama.2020.3151 Available at: https://jamanetwork.com/journals/jama/fullarticle/2762689 (accessed 17.3.2020)
[193] World Population Review (2020) Hong Kong Population 2020. March, 2020. Available at: https://worldpopulationreview.com/countries/hong-kong-population/ (accessed 19.3.2020)
[194] Cambridge Coronavirus Collection (2020) Escalating infection control response to the rapidly evolving epidemiology of the Coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. March 05, 2020. Available at: 10.1017/ice.2020.58. (accessed 19.03.2020)
[195] Centre for Health Protection, Department of Health (2020) Latest situation of cases of COVID-19. March 17, 2020. Available at: https://www.chp.gov.hk/files/pdf/local_situation_covid19_en.pdf (accessed 17.3.2020).
[196] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/#countries (accessed 1.4.2020)
[197] South China Morning Post (2020) China coronavirus: death toll almost doubles in one day as Hong Kong reports its first two cases. March 22, 2020. Available at https://www.scmp.com/news/hong-kong/health-environment/article/3047193/china-coronavirus-first-case-confirmed-hong-kong (accessed 19.3.2020)
[198] Cable News Network (2019) Hong Kong Protests. June, 2019. Available at: https://edition.cnn.com/specials/asia/hong-kong-protests-intl-hnk (accessed 19.03.2020)
[199] British Broadcasting Corporation (2019) The Hong Kong protests explained in 100 and 500 words. November, 2019. Available at: https://www.bbc.com/news/world-asia-china-49317695 (accessed 19.03.2020)
[200] British Broadcasting Corporation (2019) Hong Kong to close all schools amid escalating protests. November 2019. Available at: https://www.bbc.com/news/world-asia-china-50400338 (accessed 19.03.2020)
[201] Consumer News and Business Channel (2019) 5 charts show how protests in Hong Kong have affected the city's economy and stock market. December 2019. Available at: https://www.cnbc.com/2019/12/26/hong-kong-protests-impact-on-economy-stock-market-in-five-charts.html (accessed 19.03.2020)
[202] The Lancet (2020) Are high performing health systems resilient against the COVID-19 pandemic? March 06, 2020. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30551-1/fulltext. (accessed 19.03.2020)
[203] Channel News Asia (CNA) (2020) Arrivals in Hong Kong to be subject to 14-day quarantine. March 17, 2020. Available at: https://www.channelnewsasia.com/news/asia/coronavirus-covid-19-hong-kong-quarantine-travel-12545598. (accessed 19.03.2020)
[204] Channel News Asia (CNA) (2020) Hong Kong medical staff strike for third day as locally transmitted coronavirus cases rise. February 05, 2020. Available at: https://www.channelnewsasia.com/news/hong-kong-medical-staff-strike-wuhan-coronavirus-rise-cases-12395288 (accessed 19.03.2020)
[205] Channel News Asia (CNA) (2002) Novel coronavirus: Hong Kong leader Carrie Lam announces suspension of 10 border crossings with mainland China. February 05, 2020. Available at: https://www.channelnewsasia.com/news/asia/wuhan-virus-hong-kong-carrie-lam-suspension-border-crossings-12386054 (accessed 25.04.2020)
[206] The Straits Times (2020) Coronavirus: Hong Kong reports 25 new cases, most are travellers from abroad. March 18, 2020. Available at**:** https://www.straitstimes.com/asia/east-asia/coronavirus-hong-kong-reports-14-new-cases-most-are-travellers-from-abroad. (accessed 19.03.2020)
[207] News.gov.hk (2020) 25 COVID-19 cases confirmed. March 19, 2020. Available at: https://www.news.gov.hk/eng/2020/03/20200319/20200319_101104_079.html?type=category&name=covid19. (accessed 19.03.2020)
[208] Cable News Network (CNN) (2020) Hong Kong and Tokyo airports are handling coronavirus very differently. Which one has it right? March 19, 2020. Available at: https://edition.cnn.com/2020/03/18/asia/japan-coronavirus-intl-hnk/index.html. (accessed 19.03.2020)
[209] South China Morning Post (SCMP) (2020) Coronavirus: Hong Kong and Singapore seen as safe harbours by US, South Asian travellers. March 18, 2020. Available at: https://www.scmp.com/week-asia/health-environment/article/3075816/coronavirus-hong-kong-and-singapore-seen-safe-harbours. (accessed 19.03.2020)
[210] South China Morning Post (SCMP) (2020) Coronavirus: imported cases threaten Hong Kong's efforts to contain disease as 25 infections confirmed in one day. March 18, 2020. Available at: https://www.scmp.com/news/hong-kong/health-environment/article/3075731/coronavirus-imported-cases-surge-eight-more-test. (accessed 19.03.2020)
[211] The Straits Times (2020) Coronavirus: HK to ban entry of most non-residents and sale of alcoholic drinks at F&B outlets. March 23, 2020. Available at: https://www.straitstimes.com/asia/east-

asia/coronavirus-hong-kong-to-ban-all-tourist-arrivals-weighs-suspension-of-alcohol-sales (accessed 23.03.2020)
[212] News.gov.hk (2020) Wristbands pose no privacy issues. March 18, 2020. Available at: https://www.news.gov.hk/eng/2020/03/20200318/20200318_232832_530.html. (accessed 19.03.2020)
[213] News.gov.hk (2020) Travellers to submit specimens. March 18, 2020. Available at: https://www.news.gov.hk/eng/2020/03/20200318/20200318_170920_186.html?type=category&name=health. (accessed 19.03.2020)
[214] CNBC (2020) Hong Kong residents are least optimistic in 25 years, poll shows. March 20, 2019. Available at https://www.cnbc.com/2019/03/20/hong-kong-residents-are-least-optimistic-in-25-years-poll-shows.html (accessed 19.3.2020)
[215] Time (2020):What We Can Learn From Singapore, Taiwan and Hong Kong About Handling Coronavirus. Available at https://time.com/5802293/coronavirus-covid19-singapore-hong-kong-taiwan/ (accessed 19.3.2020)
[216] The Straits Times (2020): Coronavirus: Singaporeans out in force over the weekend despite social distancing measures. March 14, 2020. Available at https://www.straitstimes.com/singapore/health/coronavirus-singaporeans-out-in-force-over-the-weekend-despite-social-distancing (accessed 19.3.2020)
[217] Hong Kong Government News (2020) Unemployment rises to 3.7%. March 17, 2020. Available at https://www.news.gov.hk/eng/2020/03/20200317/20200317_165130_315.html?type=category&name=wuhan&tl=t (accessed 18.3.2020)
[218] South China Morning Post (2020) Coronavirus: historic Hong Kong border checkpoint sparks fears of quarantine loophole March 3, 2020. Available at https://www.scmp.com/news/hong-kong/health-environment/article/3064720/coronavirus-historic-hong-kong-border-checkpoint (accessed 19.3.2020)
[219] China Briefing (2020) Hong Kong Budget 2020-2021: Rebooting the Economy. March 23, 2020. Available at: https://www.china-briefing.com/news/hong-kong-budget-2020-2021-rebooting-economy/ (accessed 25.3.2020)
[220] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[221] SCMP (2020) Coronavirus: Hong Kong may shorten stays at quarantine centres to free up rooms as health care system comes under strain. March 31, 2020. Available at: https://www.scmp.com/news/hong-kong/health-environment/article/3077756/coronavirus-hong-kong-confirms-32-new-covid-19 (accessed 1.4.2020)
[222]Centre for Health Protection (CHP) (2020): Latest situation of cases of COVID-19. March 18, 2020. Available at https://www.chp.gov.hk/files/pdf/local_situation_covid19_en.pdf (accessed 19.3.2020)
[223] Centre for Health Protection (CHP) (2020): Latest situation of cases of COVID-19. March 18, 2020. Available at https://www.chp.gov.hk/files/pdf/local_situation_covid19_en.pdf (accessed 19.3.2020)
[224] The Straits Times (2020) Q&A with HK microbiologist Yuen Kwok-yung who helped confirm coronavirus' human spread. March 10, 2020. Available at https://www.straitstimes.com/asia/east-asia/exclusive-qa-with-hong-kong-microbiologist-yuen-kwok-yung-who-helped-confirm (accessed 18.3.2020)
[225] Hong Kong Government Press Release (2020): CE announces activation of Emergency Response Level in relation to novel coronavirus infection. January 26, 2020. Available at https://www.info.gov.hk/gia/general/202001/26/P2020012600087.htm (accessed 19.3.2020)
[226] Hong Kong Government News (2020) Port health measures boosted. January 7, 2020. Available at https://www.news.gov.hk/eng/2020/01/20200107/20200107_202556_564.html?type=category&name=wuhan&tl=t (accessed 18.3.2020)
[227] Hong Kong Government Press Release (2020) HKSAR Government announces enhanced measures for disease prevention and control. Jan 29, 2020. Available at https://www.info.gov.hk/gia/general/202001/29/P2020012900006.htm (accessed 18.3.2020)
[228] South China Morning Post (2020) Coronavirus: historic Hong Kong border checkpoint sparks fears of quarantine loophole. March 3, 2020. Available at https://www.scmp.com/news/hong-kong/health-environment/article/3064720/coronavirus-historic-hong-kong-border-checkpoint (accessed on 18.3.2020)
[229]COVID-19 (2020) Hong Kong asks residents to defer non-urgent travel. Available at: https://www.channelnewsasia.com/news/asia/coronavirus-covid-19-hong-kong-residents-travel-defer-12512188 (accessed 18.3. 2020)
[230] BBC (2020) Coronavirus: Hong Kong to quarantine all arrivals from abroad. March 17, 2020. Available at: https://www.bbc.com/news/world-asia-china-51921515 (accessed 18.3.2020)
[231] The Straits Times (2020) Coronavirus: HK to ban entry of most non-residents and sale of alcoholic drinks at F&B outlets. March 23, 2020. Available at: https://www.straitstimes.com/asia/east-

asia/coronavirus-hong-kong-to-ban-all-tourist-arrivals-weighs-suspension-of-alcohol-sales (accessed 23.03.2020)

[232] Centre for Health Protection (2020) Proper Hand Hygiene. 22 Jan 2020. Available at: https://www.chp.gov.hk/en/healthtopics/content/460/19728.html (accessed 18.3.2020)

[233] SCMP (2020) Coronavirus: lockdown of public showers leaves Hong Kong's homeless struggling to stay clean amid Covid-19 pandemic. March 18. 2020. Available at: https://www.scmp.com/news/hong-kong/society/article/3075614/coronavirus-lockdown-public-showers-leaves-hong-kongs (accessed 18.3.2020)

[234] Hong Kong Government News (2020) Public services to be adjusted. March 23, 2020. Available at: https://www.news.gov.hk/eng/2020/03/20200321/20200321_195107_148.html?type=category&name=covid19 (accessed 23.03.2020)

[235] The Straits Times (2020) Coronavirus: HK to ban entry of most non-residents and sale of alcoholic drinks at F&B outlets. March 23, 2020. Available at: https://www.straitstimes.com/asia/east-asia/coronavirus-hong-kong-to-ban-all-tourist-arrivals-weighs-suspension-of-alcohol-sales (accessed 23.03.2020)

[236] SCMP (2020) Coronavirus: Hong Kong's private clinics set to launch Covid-19 testing, but infection risks, potential stigma has many in sector wary. March 9. 2020. Available at https://www.scmp.com/news/hong-kong/health-environment/article/3074315/coronavirus-hong-kongs-private-clinics-now-able (accessed 18.3.2020)

[237] Railway Gazette (2020) Metro operator deploys cleaning robot to fight the coronavirus. March 11, 2020. Available at https://www.railwaygazette.com/technology-data-and-business/metro-operator-deploys-cleaning-robot-to-fight-the-coronavirus/55995.article (accessed 18.3.2020)

[238] Hong Kong Government News (2020) Tech approach to home quarantine. March 16, 2020. Available at https://www.news.gov.hk/eng/2020/03/20200316/20200316_202554_111.html?type=category&name=wuhan&tl=t (accessed 18.3.2020)

[239] SCMP (2020) Coronavirus: Hong Kong may shorten stays at quarantine centres to free up rooms as health care system comes under strain. March 31, 2020. Available at: https://www.scmp.com/news/hong-kong/health-environment/article/3077756/coronavirus-hong-kong-confirms-32-new-covid-19 (accessed 1.4.2020)

[240] SCMP (2020) Coronavirus: massive HK$30 billion relief package revealed as Hong Kong government plans to bail out struggling industries and fund the fight against deadly bug. February 20 2020. Available at https://www.scmp.com/news/hong-kong/politics/article/3051475/coronavirus-massive-hk30-billion-relief-package-revealed (accessed 18.3.2020)

[241] Cheng VCC et al (2020) Escalating infection control response to the rapidly evolving epidemiology of the Coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong. March 5 2020. Available at https://www.unboundmedicine.com/medline/citation/32131908/Escalating_infection_control_response_to_the_rapidly_evolving_epidemiology_of_the_Coronavirus_disease_2019__COVID_19__due_to_SARS_CoV_2_in_Hong_Kong_ DOI: https://dx.doi.org/10.1017/ice.2020.58 (accessed 18.3.2020)

[242] RTHK (2020) Visitor becomes first to be quarantined over virus. January 23. 2020. Available at https://news.rthk.hk/rthk/en/component/k2/1504443-20200123.htm (accessed 18.3.2020)

[243]SCMP (2020) South China Morning Post: Coronavirus: Hong Kong doctors, nurses treating Covid-19 patients surprised with 2,000 flowers on International Women's Day. March 8, 2020. Available at https://www.scmp.com/news/hong-kong/society/article/3074158/coronavirus-hong-kong-doctors-nurses-treating-covid-19 (accessed 18.3.2020)

[244]SCMP (2020) South China Morning Post: Coronavirus: Hong Kong's private clinics set to launch Covid-19 testing, but infection risks, potential stigma has many in sector wary. March 9 2020. Available at https://www.scmp.com/news/hong-kong/health-environment/article/3074315/coronavirus-hong-kongs-private-clinics-now-able (accessed 18.3.2020)

[245] South China Morning Post (2020) Available at Coronavirus: some recovered patients may have reduced lung function and are left gasping for air while walking briskly, Hong Kong doctors find. March 13 2020. Available at: https://www.scmp.com/news/hong-kong/health-environment/article/3074988/coronavirus-some-recovered-patients-may-have (accessed 18.3.2020)

[246] CNA (2020) COVID-19: Hong Kong to charge daily fee to stay in quarantine facility. March 16 2020. Available at: https://www.channelnewsasia.com/news/asia/covid-19-hong-kong-charge-fee-quarantine-facility-coronavirus-12542786 (accessed 18.3.2020)

[247] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 30.3.2020)

[248] Japan Data (2020) About Coronavirus Disease 2019 (COVID-19) Accessed 30.3.2020. https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/newpage_00032.html (accessed 30.3.2020)

[249] Asia Times (2020) Covid-19: US vs Japanese response. March 29, 2020. https://asiatimes.com/2020/03/covid-19-us-vs-japanese-response/ (accessed 30.3.2020)
[250] NYT (2020) In Graying Japan, Many Are Vulnerable but Few Are Being Tested. February 29, 2020. Available at: https://www.nytimes.com/2020/02/29/world/asia/japan-elderly-coronavirus.html (accessed 30.3.2020)
[251] Vox (2020) "This may be the tip of the iceberg": Why Japan's coronavirus crisis may be just beginning. March 28, 2020. Available at: https://www.vox.com/covid-19-coronavirus-explainers/2020/3/28/21196382/japan-coronavirus-cases-covid-19-deaths-quarantine (accessed 30.3.2020)
[252] Vox (2020) "This may be the tip of the iceberg": Why Japan's coronavirus crisis may be just beginning. March 28, 2020. Available at: https://www.vox.com/covid-19-coronavirus-explainers/2020/3/28/21196382/japan-coronavirus-cases-covid-19-deaths-quarantine (accessed 30.3.2020)
[253] Vox (2020) "This may be the tip of the iceberg": Why Japan's coronavirus crisis may be just beginning. March 28, 2020. Available at: https://www.vox.com/covid-19-coronavirus-explainers/2020/3/28/21196382/japan-coronavirus-cases-covid-19-deaths-quarantine (accessed 30.3.2020)
[254] NYT (2020) In Graying Japan, Many Are Vulnerable but Few Are Being Tested. February 29, 2020. Available at: https://www.nytimes.com/2020/02/29/world/asia/japan-elderly-coronavirus.html (accessed 30.3.2020)
[255] Guardian (2020) Japan and South Korea tighten borders as US faces up to 200,000 Covid-19 deaths. March 30, 2020. Available at: https://www.theguardian.com/world/2020/mar/30/japan-and-south-korea-tighten-borders-as-us-faces-up-to-200000-covid-19-deaths (accessed 31.3.2020)
[256] Japan Times (2020) Limited virus testing in Japan masks true scale of infection. March 2, 2020. https://www.japantimes.co.jp/news/2020/03/02/national/limited-virus-testing-japan/#.XoGYyMJMQ2w (accessed 30.3.2020)
[257] NIKKEI (2020) Coronavirus: Why Japan tested so few people. March 12, 2020. Available at: https://asia.nikkei.com/Spotlight/Coronavirus/Coronavirus-Why-Japan-tested-so-few-people (accessed 30.3.2020)
[258] Japan Times (2020) Limited virus testing in Japan masks true scale of infection. March 2, 2020. https://www.japantimes.co.jp/news/2020/03/02/national/limited-virus-testing-japan/#.XoGYyMJMQ2w (accessed 30.3.2020)
[259] Japan Times (2020) Limited virus testing in Japan masks true scale of infection. March 2, 2020. https://www.japantimes.co.jp/news/2020/03/02/national/limited-virus-testing-japan/#.XoGYyMJMQ2w (accessed 30.3.2020)
[260] Japan Times (2020) Japan's economy in 'severe situation' due to COVID-19, government states in monthly report. March 27, 2020. Available at: https://www.japantimes.co.jp/news/2020/03/27/business/economy-business/economy-coronavirus-impact/#.XoFhBMJMQ2w (accessed 30.3.2020)
[261] CAN (2020) Japan's Abe vows unprecedented stimulus as Tokyo COVID-19 cases rise. March 28, 2020. Available at: https://www.channelnewsasia.com/news/asia/japan-abe-vows-unprecedented-stimulus-covid-19-coronavirus-12585972 (accessed 30.3.2020)
[262] CAN (2020) Japan declares COVID-19 state of emergency, prepares nearly US$1 trillion stimulus. April 7, 2020. Available at: https://www.channelnewsasia.com/news/asia/covid-19-japan-emergency-tokyo-osaka-shinzo-abe-stimulus-12617816 (accessed 8.4.2020)
[263] AA (2020) COVID-19: Japanese capital sees spike in new cases. March 26, 2020. Available at: https://www.aa.com.tr/en/asia-pacific/covid-19-japanese-capital-sees-spike-in-new-cases/1780561 (accessed 30.3.2020)
[264] Taiwan Focus (2020) IMF adjusts Taiwan's economic growth down to minus 4% in 2020. Available at: https://focustaiwan.tw/business/202004140025 (accessed 17.4.2020)
[265] Japan COVID-19 Coronavirus Tracker. Available at: https://covid19japan.com/ (accessed 30.3.2020)
[266] MHLW (2020) Basic Policies for Novel Coronavirus Disease Control. Available at: https://www.mhlw.go.jp/content/10200000/000603611.pdf (accessed 30.3.2020)
[267] AA (2020) COVID-19: Japanese capital sees spike in new cases. March 26, 2020. Available at: https://www.aa.com.tr/en/asia-pacific/covid-19-japanese-capital-sees-spike-in-new-cases/1780561 (accessed 30.3.2020)
[268] CAN (2020) Japan's Abe vows unprecedented stimulus as Tokyo COVID-19 cases rise. March 28, 2020. Available at: https://www.channelnewsasia.com/news/asia/japan-abe-vows-unprecedented-stimulus-covid-19-coronavirus-12585972 (accessed 30.3.2020)

[269] CAN (2020) Japan's Abe vows unprecedented stimulus as Tokyo COVID-19 cases rise. March 28, 2020. Available at: https://www.channelnewsasia.com/news/asia/japan-abe-vows-unprecedented-stimulus-covid-19-coronavirus-12585972 (accessed 30.3.2020)
[270] CAN (2020) Japan's Abe vows unprecedented stimulus as Tokyo COVID-19 cases rise. March 28, 2020. Available at: https://www.channelnewsasia.com/news/asia/japan-abe-vows-unprecedented-stimulus-covid-19-coronavirus-12585972 (accessed 30.3.2020)
[271] Guardian (2020) Japan and South Korea tighten borders as US faces up to 200,000 Covid-19 deaths. March 30, 2020. Available at: https://www.theguardian.com/world/2020/mar/30/japan-and-south-korea-tighten-borders-as-us-faces-up-to-200000-covid-19-deaths (accessed 31.3.2020)
[272] Guardian (2020) Japan and South Korea tighten borders as US faces up to 200,000 Covid-19 deaths. March 30, 2020. Available at: https://www.theguardian.com/world/2020/mar/30/japan-and-south-korea-tighten-borders-as-us-faces-up-to-200000-covid-19-deaths (accessed 31.3.2020)
[273] CAN (2020) Japan declares COVID-19 state of emergency, prepares nearly US$1 trillion stimulus. April 7, 2020. Available at: https://www.channelnewsasia.com/news/asia/covid-19-japan-emergency-tokyo-osaka-shinzo-abe-stimulus-12617816 (accessed 8.4.2020)
[274] MHW (2020) Overview of the Act on Special Measures for Pandemic Influenza and New Infectious Diseases Preparedness and Response . Available at: https://www.mhlw.go.jp/content/10900000/000606693.pdf (accessed 30.3.2020)
[275] Worldometer (2020) Available at: https://www.worldometers.info/coronavirus/ (accessed 16.4.2020)
[276] Medicine Net (2020) Coronavirus COVID-19 (SARS-CoV-2): The Latest News, Updates and Information. April 14, 2020. Available at: https://www.medicinenet.com/coronavirus_covid-19_sars_cov_2_news_updates/article.htm (accessed 16.4.2020)
[277] The Guardian (2020) Critics question Swedish approach as coronavirus death toll reaches 1,000. April 15, 2020. Available at: https://www.theguardian.com/world/2020/apr/15/sweden-coronavirus-death-toll-reaches-1000 (accessed 16.4.2020)
[278] Public Health Agency of Sweden (2020) Available at: https://www.folkhalsomyndigheten.se/the-public-health-agency-of-sweden/communicable-disease-control/covid-19/ (accessed 16.4.2020)
[279] The Guardian (2020) Critics question Swedish approach as coronavirus death toll reaches 1,000. April 15, 2020. Available at: https://www.theguardian.com/world/2020/apr/15/sweden-coronavirus-death-toll-reaches-1000 (accessed 16.4.2020)
[280] Euronews (2020) Is Sweden's COVID-19 strategy working? April 13, 2020 Available at: https://www.euronews.com/2020/04/12/is-sweden-s-covid-19-strategy-working (accessed 16.4.2020)
[281] RTE (2020) Is Sweden's lenient approach to Covid-19 working? April 14, 2020 Available at: https://www.rte.ie/news/2020/0414/1130498-sweden-approach-coronavirus/ (accessed 16.4.2020)
[282] RTE (2020) Is Sweden's lenient approach to Covid-19 working? April 14, 2020 Available at: https://www.rte.ie/news/2020/0414/1130498-sweden-approach-coronavirus/ (accessed 16.4.2020)
[283] The Guardian (2020) Critics question Swedish approach as coronavirus death toll reaches 1,000. April 15, 2020. Available at: https://www.theguardian.com/world/2020/apr/15/sweden-coronavirus-death-toll-reaches-1000 (accessed 16.4.2020)
[284] The Guardian (2020) Critics question Swedish approach as coronavirus death toll reaches 1,000. April 15, 2020. Available at: https://www.theguardian.com/world/2020/apr/15/sweden-coronavirus-death-toll-reaches-1000 (accessed 16.4.2020)
[285] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)
[286] The Local (2020) What does the coronavirus mean for the Swedish economy? March 17, 2020. Available at: https://www.thelocal.se/20200317/what-does-the-coronavirus-mean-for-swedish-economy (accessed 16.4.2020)
[287] Government Offices of Sweden (2020) Press release from Ministry of Education and Research, Ministry of Employment, Ministry of Finance. Crisis package for jobs and transition. March 30, 2020. Available at: https://www.government.se/press-releases/2020/03/crisis-package-for-jobs-and-transition/ (Accessed 16.4.2020)
[288] New Zealand COVID-19 Alert Levels Summary. Available at: https://covid19.govt.nz/assets/resources/tables/COVID-19-alert-levels-summary.pdf (accessed 16.4.2020)
[289] NZ Herald (2020) Covid 19 coronavirus: Eliminating virus in NZ is 'pie in the sky' fantasy, former finance minister. April 16, 2020. Available at: https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12325133 (accessed 16.4.2020)
[290] NZ Herald (2020) Covid 19 coronavirus: Eliminating virus in NZ is 'pie in the sky' fantasy, former finance minister. April 16, 2020. Available at:

https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12325133 (accessed 16.4.2020)

[291] NZ Herald (2020) Covid 19 coronavirus: Eliminating virus in NZ is 'pie in the sky' fantasy, former finance minister. April 16, 2020. Available at: https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12325133 (accessed 16.4.2020)

[292] Guardian (2020) New Zealand's Covid-19 strategy looks successful, but we must safeguard democracy. April 15, 2020. Available at: https://www.theguardian.com/commentisfree/2020/apr/16/new-zealands-fight-against-covid-19-looks-successful-but-democracy-is-under-threat (accessed 16.4.2020)

[293] The Spin Off (2020) How Covid-19 will damage the economy, according to Treasury. April 14, 2020. Available at: https://thespinoff.co.nz/business/14-04-2020/how-covid-19-will-damage-the-economy-according-to-treasury/ (accessed 16.4.2020)

[294] NZ Treasury (2020) Monthly Economic Indicators March 2020. April 9, 2020. Available at: https://treasury.govt.nz/publications/mei/monthly-economic-indicators-march-2020-html (accessed 16.4.2020)

[295] Times (2020) New Zealand lockdown on track to kill off coronavirus outbreak. April 10, 2020. https://www.thetimes.co.uk/article/new-zealand-lockdown-on-track-to-kill-off-coronavirus-outbreak-gw7bxtl8b (accessed 16.4.2020)

[296] IMF (2020) World Economic Outlook, April 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020 (accessed 17.4.2020)

[297] New York Times (2020) N.Y. Draws a Record 65 Million Tourists. Available at: https://www.nytimes.com/2019/01/16/nyregion/nyc-tourism-record.html (accessed 17.4.2020)

[298] Business Insider (2020) 'In search of the apex and the other side of the mountain': The coronavirus has killed more than 4,100 New Yorkers in just over a month, and the worst is still to come. Available at: https://www.businessinsider.sg/new-york-coronavirus-crisis-1-month-cases-surge-apex-2020-4?r=US&IR=T(accessed 17.4.2020)

[299] Business Insider (2020) 'In search of the apex and the other side of the mountain': The coronavirus has killed more than 4,100 New Yorkers in just over a month, and the worst is still to come. Available at: https://www.businessinsider.sg/new-york-coronavirus-crisis-1-month-cases-surge-apex-2020-4?r=US&IR=T(accessed 17.4.2020)

[300] Governor (2020) Governor Cuomo Issues Guidance on Essential Services Under The 'New York State on PAUSE' Executive Order. Available at: https://www.governor.ny.gov/news/governor-cuomo-issues-guidance-essential-services-under-new-york-state-pause-executive-order(accessed 17.4.2020)

[301] The New York Times (2020) Cuomo Extends Coronavirus Shutdown Order to May 15. Available at: https://www.nytimes.com/2020/04/16/nyregion/coronavirus-new-york-update.html(accessed 17.4.2020)

[302] Governor (2020) Amid Ongoing COVID-19 Pandemic, Governor Cuomo Announces 40,000 Health Professionals Have Signed up to Volunteer as Part of the State's Surge Healthcare Force. Available at: https://www.governor.ny.gov/news/amid-ongoing-covid-19-pandemic-governor-cuomo-announces-40000-health-professionals-have-signed(accessed 17.4.2020)

[303] NBC New York (2020) NY High School Student Spearheads 3D-Printing Initiative to Get PPE to Hospitals. Available at: https://www.nbcnewyork.com/news/coronavirus/ny-high-school-student-spearheads-3d-printing-initiative-to-get-ppe-to-hospitals/2357930/ (accessed 17.4.2020)

[304] Crunchbase News (2020) From Making 3D Printers To Manufacturing COVID-19 Test Swabs, A Startup Pivots. Available at: https://news.crunchbase.com/news/from-making-3d-printers-to-manufacturing-covid-19-test-swabs-a-startup-pivots/ (accessed 17.4.2020)

[305] CNN (2020) New York is producing its own hand sanitizer due to shortages caused by the coronavirus outbreak. Available at: https://edition.cnn.com/2020/03/09/health/coronavirus-ny-hand-sanitizer-trnd/index.html (accessed 17.4.2020)

[306] Governor (2020) Governor Cuomo Opens the State's First Drive-through COVID-19 Mobile Testing Center in New Rochelle. Available at: https://www.governor.ny.gov/news/governor-cuomo-opens-states-first-drive-through-covid-19-mobile-testing-center-new-rochelle-0 (accessed 17.4.2020)

[307] Business Insider (2020) Available at: https://www.businessinsider.sg/new-york-state-coronavirus-testing-compared-to-other-countries-2020-3?_ga=2.248150286.845734617.1587028863-2011665559.1586137815&r=US&IR=T (accessed 17.4.2020)

[308] Governor (2020) After Weeks of Demanding Approval, Governor Cuomo Announces FDA Gives New York State Authority to Conduct All COVID-19 Testing at Public and Private Labs. Available at: https://www.governor.ny.gov/news/after-weeks-demanding-approval-governor-cuomo-announces-fda-gives-new-york-state-authority (accessed 17.4.2020)

[309] MarketWatch (2020) Wheels are in motion for widespread coronavirus antibody testing in New York. Available at: https://www.marketwatch.com/story/wheels-are-in-motion-for-widespread-coronavirus-antibody-testing-in-new-york-2020-04-15 (accessed 17.4.2020)
[310] NYC Planning (2020) Population - New York City Population. Available at: https://www1.nyc.gov/site/planning/planning-level/nyc-population/population-facts.page (accessed 17.4.2020)
[311] Time (2020) Here's How Quickly Coronavirus Is Spreading in Your State. Available at: https://time.com/5814139/coronavirus-state-data-tracker/ (accessed 17.4.2020)
[312] CNN (2020) New York governor dismisses possibility of shelter in place order after mayor urged New Yorkers to prepare for it. Available at: https://edition.cnn.com/2020/03/17/politics/bill-de-blasio-andrew-cuomo-new-york-shelter-in-place-coronavirus-cnntv/index.html (accessed 17.4.2020)
[313] The New York Times (2020) The Lost Month: How a Failure to Test Blinded the U.S. to Covid-19. Available at: https://www.nytimes.com/2020/03/28/us/testing-coronavirus-pandemic.html (accessed 17.4.2020)
[314] U.S Census Bureau (2020) ADVANCE MONTHLY SALES FOR RETAIL AND FOOD SERVICES, MARCH 2020. Available at: https://www.census.gov/retail/marts/www/marts_current.pdf (accessed 17.4.2020)
[315] USA Today (2020) Record 22 million Americans file for unemployment benefits over past month as layoffs continue. Available at: https://www.usatoday.com/story/money/2020/04/16/coronavirus-more-workers-filed-jobless-claims-layoffs/5136911002/ (accessed 17.4.2020)
[316] The New York Times (2020) 'Pretty Catastrophic' Month for Retailers, and Now a Race to Survive. Available at: https://www.nytimes.com/2020/04/15/business/economy/coronavirus-retail-sales.html (accessed 17.4.2020)
[317] Forbes (2020) The Paycheck Protection Program Ran Out Of Funding. What's Next For Small Business Owners? Available at: https://www.forbes.com/sites/advisor/2020/04/16/the-paycheck-protection-program-ran-out-of-funding-whats-next-for-small-business-owners/#730211317440 (accessed 17.4.2020)
[318] Governor (2020) After Weeks of Demanding Approval, Governor Cuomo Announces FDA Gives New York State Authority to Conduct All COVID-19 Testing at Public and Private Labs. Available at: https://www.governor.ny.gov/news/after-weeks-demanding-approval-governor-cuomo-announces-fda-gives-new-york-state-authority (accessed 17.4.2020)
[319] The Daily Gazette (2020) State to get COVID-19 aid package with up to $100B. Available at: https://dailygazette.com/article/2020/03/25/cuomo-fumes-at-covid-19-aid-package-with-up-to-100b-for-new-york (accessed 17.4.2020)
[320] USA Today (2020) Heartbreak, prayer and mourning: US leads world in coronavirus deaths after deadliest week. Available at: https://www.usatoday.com/in-depth/news/nation/2020/04/15/coronavirus-deaths-how-new-york-chicago-seattle-faced-record-week/5132066002/ (accessed 17.4.2020)
[321] NBC New York (2020) COVID-19 Hospitalizations Flatten in NY Amid Deadliest Week Yet. Available at: https://www.nbcnewyork.com/news/local/covid-19-hospitalizations-flatten-in-ny-amid-deadliest-week-yet/2370527/ (accessed 17.4.2020)
[322] CNBC (2020) New York coronavirus deaths are slowing but at a 'devastating level of pain and grief,' Gov. Cuomo says. Available at: https://www.cnbc.com/2020/04/14/new-york-coronavirus-deaths-are-leveling-off-but-at-a-devastating-level-of-pain-and-grief-gov-cuomo-says.html (accessed 17.4.2020)
[323] The New York Times (2020) F.A.Q. on Stimulus Checks, Unemployment and the Coronavirus Plan. Available at: https://www.nytimes.com/article/coronavirus-stimulus-package-questions-answers.html (accessed 17.4.2020)
[324] New York State (2020) After Weeks of Demanding Approval, Governor Cuomo Announces FDA Gives New York State Authority to Conduct All COVID-19 Testing at Public and Private Labs. Available at: https://www.governor.ny.gov/news/after-weeks-demanding-approval-governor-cuomo-announces-fda-gives-new-york-state-authority (accessed 17.4.2020)