

*COVID-19 as a Wicked Problem***13.1 Background**

COVID-19 can be regarded as a wicked problem with long-term consequences we will struggle to cope with for many years to come. After the initial outbreak in Wuhan, China, in December 2019, the virus spread rapidly to other countries and the World Health Organization (WHO) declared it a pandemic in March 2020. The pandemic has led to economic and social instability. Because of the scale and the speed of infections, most countries eventually had to close down their societies, with a range of negative effects that we do not yet fully understand (Alford & Head, 2017; Moon, 2020). A number of systemic factors have had a negative impact such as economic loss, financial insecurity, unemployment, inadequate access to health services, school closures, and lack of social contact (Moreno et al., 2020; Pfefferbaum & North, 2020; Torales, O'Higgins, Castaldelli-Maia, & Ventriglio, 2020). According to projections released by the Congressional Budget Office (CBO), the virus will reduce US economic output by 3 percent through 2030, a loss of \$8 trillion. Unemployment has also increased (Rushe, 2020). In the first outbreak, most European countries decided to shut down the schools, but they largely decided to keep the schools open during the second wave. One important argument is that a shutdown makes young people's futures and education another victim of the disease. Children from poorer backgrounds lose more and need more time to recover. There have been reports about children both losing physical fitness and showing mental distress when schools were closed. Low-income families have suffered more because they lack access to technology and space to work at home. Home confinement has been particularly difficult for vulnerable children. Schools are also important because they allow families to participate in the economy (Reynolds, 2020).

Governments have had to cope with overwhelming policy challenges worldwide. All governments have been tested on how to prepare for, mitigate, and respond to the outbreak. The complexity and lack of knowledge of the problem creates ethical dilemmas (e.g., striking a balance between limiting the loss of lives as much as possible vs. maintaining a healthy economy) (Alford & Head, 2017; Moon, 2020). Previous studies of similar public health emergencies have shown that a large amount of emotional distress is produced in the affected populations, and this appears to be the case now too (Pfefferbaum & North, 2020). Studies point to an increase in additional mental health problems in the population, such as stress, anxiety, depressive symptoms, insomnia, denial, anger. This includes both those with preexisting mental disorders and previously healthy people. Many groups are particularly vulnerable, such as infected patients, their families, elderly, individuals with preexisting medical conditions, and healthcare providers who work directly with sick people (Pfefferbaum & North, 2020; Torales et al., 2020). One reason is the unpredictability and uncertainty of the disease. Another is that lockdown and physical distancing increase social isolation, loss of income, loneliness, inactivity, limited access to basic services, access to food, alcohol, and online gambling; they also result in decreased family and social support (Moreno et al., 2020). Both the fear of being infected and mass home confinement has led to an increase in anxiety and depression. However, we do not yet know how serious the long-term effects will be of this type of isolation (Moreno et al., 2020; Pfefferbaum & North, 2020; Rajkumar, 2020). Another negative effect is the lack of follow-up of long COVID patients (Gallagher, 2020). A recent study finds that half of the individuals who had recovered from acute infection were still experiencing persistent fatigue ten weeks after initial symptoms. A third were still unable to return to work. The fatigue was independent of the severity of initial infection (Townsend et al., 2020).

Furthermore, the outbreak has affected the general healthcare service in a negative way. In June 2020, almost half of US adults had delayed or avoided medical care because of concerns about COVID-19. This avoidance was more prevalent among vulnerable groups, including persons with underlying medical conditions or those with disabilities (Czeisler et al., 2020). Because of an increase in unemployment, people have had more problems paying for medical care (Abelson, 2020). In addition, people are facing longer hospital waits for other diseases in countries such as the UK (Triggle, 2020). In total, all these stressors have increased the risk of suicide (Pfefferbaum & North, 2020), and even “successful” countries like

South Korea report an increase in suicide rates (Ryall, 2020a). Although many international organizations like the WHO advocate stronger support on mental health measures, the economic breakdown has limited response opportunities at a systemic level (Moreno et al., 2020).

This chapter addresses three important strategies that have been used in the outbreak:

1. The test and trace strategy
2. Effective communication about the pandemic
3. Rule compliance in the population

I will particularly draw to Moon's (2020) analysis of the success factors behind the South Korean response. Although the country experienced a sudden surge of infected cases, it managed to get control over the situation within two months, and the country did not need to go into lockdown. In addition, the successful New Zealand response will be briefly presented. In the final section, the three strategies will be analyzed from a CI perspective.

13.2 The Test and Trace Strategy

After the COVID-19 outbreak, governments chose different measures to suppress transmission. The soft approach used only moderate mitigation measures. One example is the UK strategy, which initially aimed to obtain so-called herd immunity (Colfer, 2020). China chose a hard approach by using aggressive measures such as lockdowns, travel bans, and curfews in the Wuhan area. As conditions worsened, most countries shifted to a hard approach (Moon, 2020). However, the hard lockdown approach has huge negative effects on both the economy and people's mental health when they need to stay at home and social interaction is restricted. By contrast, the soft approach has a less negative impact on the economy, but more people get sick and die of the virus. Recent studies also point to herd immunity as not being a realistic alternative because antibodies fall rapidly after recovering from the disease (Ward et al., 2020).

An interesting third approach is the unique approach that South Korea chose and which many countries are now trying to implement when they are facing the second wave of the outbreak. South Korea experienced a surge in new cases in the middle of February 2020 in two provinces, but by taking a series of actions they were able to get control over the situation relatively quickly (Moon, 2020). Moon describes it as an agile-adaptive

approach, as it is primarily centered on identifying each infected case as fast as possible through massive testing. Infected patients were isolated and digital technology was used to track these people's previous movements. At the beginning of the outbreak, South Korea tested around 4,000 people per million, while Japan only tested less than 100 per million. The massive preventive testing was combined with epidemiological surveys of each infected patient, which gave important information about the contagion speed. Several innovative practices, such as drive-through and walk-through testing stations were quickly adopted, which reduced testing time and enhanced the national testing capacity. Training centers and public institutions' facilities were used to accommodate light-symptom patients. This approach and the alternative solutions were successful in slowing down the contagion speed. Countries like Italy and France that did not increase testing eventually ended up with a hard lockdown approach because of the uncontrollable massive surges. In contrast, the massive testing was able to control the outbreak without extreme intervention measures such as lockdowns (Moon, 2020).

While the South Korean government has demonstrated innovative responses to the COVID-19 outbreak, it was equally ineffective in dealing with the MERS virus in 2015. Despite the surge of infected cases at that time, the government initially did not disclose all information to the public, such as where the patients were hospitalized. They wanted to avoid any unnecessary fear among citizens and potential reputation damage to the hospitals. This nontransparent position caused public outcry and tensions with the local municipality in Seoul that wanted to disclose this information. Eventually, this information was published, allowing citizens to assess if they had could have been exposed to the virus (Moon, 2020).

Later, the MERS white paper was published to document key lessons and policy recommendations from the experience. This led the South Korean government to upgrade the Korean Center for Disease Control and Prevention, which strengthened its autonomy and increased the number of the professional staff. The MERS experience was a failure, but the government used it to learn so they would be better prepared for the next outbreak. New procedural protocols were established to control and prevent new infectious diseases, and these would be helpful when the outbreak of COVID-19 happened (Moon, 2020).

Likewise, many governments have learned from the first wave when they are trying to tackle the second wave of the pandemic in the most effective way. Many countries want to avoid a lockdown and have aimed to develop a "test and trace" strategy, prioritizing community testing, case

isolation, contact tracing, and quarantining of contacts of cases (Aleta et al., 2020; Kendall et al., 2020). The UK is one example of a country that has chosen to meet the second wave with a “test and trace” strategy (TTI) in combination with physical and social distancing. Based on evidence from South Korea, researchers recommended that the UK should implement TTI because it would make it possible to keep schools open (Panovska-Griffiths et al., 2020). TTI can be very effective in breaking chains of transmission, if three conditions are satisfied. The first factor is speed; there needs to be a quick turnaround of both case testing and contact tracing. Second, compliance is essential, as most people need to be willing and able to follow the guidelines like isolation and quarantine measures. The third factor is to maximize the coverage, in identifying as many cases as possible through high-precision population surveillance (Initiative, 2020). Because a large number of people show no symptoms when they are positive, testing must also be combined with physical distancing measures. However, a weakness with the testing strategy is that the test sensitivity estimates can be as low as 65 percent. Because of the high false-negative rates, testing must be combined with physical distancing measures. Still, this approach can be effective if the virus is not spreading too fast (R below 1.5) (Davis et al., 2020).

However, in mid-November 2020, the TTI was buckling because the cases were increasing too fast. Only one in four tests were received within the original goal of 24 hours. Only about 60 percent of the contacts of infected people were reached, far below the 80 percent considered necessary to control transmission. The proportion of asymptomatic cases poses a huge challenge, and if the numbers of infected case first begin to surge, a temporary national lockdown becomes the only option. TTI also depends on efficient coordination between national and local government, which may not be present (Neville & Dombey, 2020).

13.3 Effective Communication about the Pandemic

COVID-19 differs from previous pandemics in its mass media coverage. A wide range of news sites, public health sites, and universities (e.g., Johns Hopkins) provide open data, easily readable statistical graphs that inform the public about the current evolution of the pandemic. Anyone can easily access and read the confirmed cases and number of deaths in different areas. Local sites can also provide data on how many are hospitalized or have been tested. The numbers are continuously changing as they are being updated “in real time.” In this sense, the coverage of the pandemic

has to a large extent focused on numerical data, even though the statistics may be highly inaccurate, depending on how many persons have been tested.

Still, these data provide transparency and are important in making tough political decisions more acceptable. A study from South Korea shows that a majority of respondents checked this type of information multiple times a day. When South Korea in 2015 failed with MERS, they did not provide any information. This time the government has provided up-to-date statistics on infected cases and the fatality rate in an attempt to increase citizen engagement in anti-COVID-19 measures (Moon, 2020). If the numbers begin going down, this also provides positive feedback to citizens and will perhaps motivate them to continue to follow behavioral measures. If the numbers are going in the wrong direction, people will know that they have to increase their efforts to stop the virus. Statistics from the whole country may strengthen the feeling of the pandemic as a collective responsibility. During the first outbreak, these numbers were regularly part of the headlines of the online news coverage, and they were also important during the second wave. The statistics on the number of deaths and infected cases are reported daily and provide a continuously updated set of “scores” on the current development. It gives information about how well the crowd are performing. Still, the graphics do not include the rate of mental health problems or the unemployment rate. Although journalists report on these issues too, the pandemic indicators dominate the headlines.

Certainly, the online statistical data do provide an overview of the situation, and it is usually worse not to provide any public information about the development. During a crisis, people will seek out information to better understand what is happening. Fear of the unknown leads to higher anxiety levels in both healthy people and those with preexisting mental health problems. Misleading information via social media can increase stress. Therefore, it is important that public health authorities release updated information regularly (Torales et al., 2020). When there was a sudden surge of confirmed cases in South Korea, citizens were at first very disturbed. Many were disappointed by the poor judgement of the government, and the updated statistics amplified fear and distrust. However, in the long run, these data contributed to reducing fear and increasing public trust in the government. By displaying negative results, the government strengthened their credibility as an objective information provider, which was important in filtering fake news and misinformation around COVID-19 from social media (Moon, 2020).

Furthermore, there are examples of educational material being shared in effective ways during the pandemic. In one case, an infographic presenting intubation guidelines for use in operating theatres was published openly through an official website and social media. Because the material was open access, the use of the infographic spread very rapidly, resulting in 12 translations to other languages within a ten-day period. Some chose to adjust some of the content, and a large number of other health organizations also began to use the resource. One important reason why the dissemination was so successful was because an institution with a good reputation made the infographic, and the imagery was of high quality (Chan, Nickson, Rudolph, Lee, & Joynt, 2020).

Unfortunately, there is large amount of misinformation about COVID-19, particularly on social media (Pennycook, McPhetres, Zhang, Lu, & Rand, 2020). One study analyzed 25 million tweets over ten days to show that disinformation regarding the coronavirus was spread 7,000 times from 6,000 accounts. Almost all political activity was performed by right-wing governments or parties, one prominent example being the coordinated spreading of the China bioweapon conspiracy theory, which has made over 5 million impressions on Twitter users (T. Graham, Bruns, Zhu, & Campbell, 2020). In a recent shared statement, the WHO, UN and others claim that social media is currently amplifying an infodemic that undermines the global response to control the pandemic. There are deliberate attempts to disseminate misleading information to advance alternative agendas of groups or individuals. It can increase stigmatization and be harmful to people's physical and mental health. Misinformation is polarizing public debate on topics related to COVID-19, and amplifying hate speech. Instead, countries are encouraged to strengthen the support for science-based data to the public (WHO, 2020).

One recent study finds that, rather than being completely fabricated, much of the misinformation about COVID-19 involved various forms of reconfiguration, where existing and often true information is spun, twisted, recontextualized, or reworked. This reconfigured content has higher engagement on social media. There was less evidence of misinformation that was completely fabricated, and there were very few examples of "deepfakes." Misleading or false claims about the actions or policies of public authorities were most common (Brennen et al., 2020)

Moreover, the study finds that top-down misinformation from politicians, celebrities, and other prominent public figures is what creates the largest social engagement. To counter this, it is important that news media also publicize falsehoods and lies from prominent politicians which have

been published in social media, in order to hold them accountable. Misinformation on social media that come from ordinary people generate far less engagement. Although independent fact-checkers have increased their work, it is not possible to check all problematic content because of the large volume. However, social media platforms are doing more work in targeting prominent figures, like when Twitter, Facebook, and YouTube in late March removed posts shared by Brazilian President Jair Bolsonaro because they included coronavirus misinformation. Still, a significant percentage of posts on Twitter, YouTube, and Facebook remain on the sites without warning labels. Independent media and fact-checkers play an important role in sorting false from true material. Since much of the misinformation is directed towards public authorities, it is more difficult for those institutions to address it directly (Brennen et al., 2020).

Still, social media play an important role in being a supportive public environment. One example is the COVID Symptom Study app, developed by Tim Spector at King's College London, which is the largest community monitoring of COVID in the world. Over 4 million individuals have voluntarily shared personal information and answered questions related to any underlying chronic condition. The app has been important in identify the problems of long COVID, which is now being increasingly acknowledged by public health authorities as a major health challenge (Ennals, 2020).

13.4 Rule Compliance

Rule compliance in the population is critical in the effective management of any infectious diseases, whether it is influenza or COVID-19. For instance, social distancing and individual sanitization are considered the best ways to prevent the spread of a virus. All countries depend on people actually following the behavioral rules, like physical distancing, hand washing, quarantine, and wearing masks. Even South Korea, which uses advanced surveillance technology, is reliant on voluntary engagement and cooperation. Therefore, public information campaigns about behavioral rules are essential (Moon, 2020). The major challenge is typically non-compliance with public health directives when people contract the disease, or that the general population ignore social distancing measures. The measures infringe personal freedoms, and can lead to financial losses, so they can easily trigger anger and opposition in the population (Pfefferbaum & North, 2020).

Regarding rule compliance, New Zealand stands out as an interesting example. The country experienced one of the lowest rates of infected cases and mortality among higher-income countries in the first wave of COVID-19. The government decided to try to stop the virus by enforcing border restrictions even before the first local case was confirmed. When infected cases were detected, they moved very quickly into national lockdown, within just a month. This strategy was combined with rigorous case detection, isolation, contact tracing, and quarantine measures. As a result, New Zealand could move out of lockdown earlier than other countries. Nor were high-risk workers and indigenous Māori people disproportionately affected in the first wave (Jefferies et al., 2020).

This early, intense response could have easily created anger in the population, which was a worry in many countries who used slower lockdown implementation such as Australia, the UK, and Italy. The decisive national leadership would not have been possible without rule compliance and cooperation from the population (Jefferies et al., 2020). The government communicated simple, clear health messages with kindness, and the population cooperated and followed the measures even when New Zealand were one of the first countries to implement lockdown. A research study shows that compliance with basic hygiene practices and trust in authorities was at nearly 100 percent. The population correctly understood important facts about the coronavirus and how the disease spread, indicating that the population was well educated. Nine out of ten practiced social distancing. They were aware of symptoms and the possibility of asymptomatic transmission. Nor did they believe some of the most common myths of misinformation, like for example that only elderly people were infected. Despite the country's success, there were economic tolls, with nearly one in five reporting economic difficulties, and the indigenous population being disproportionately affected (Thaker & Menon, 2020).

Rule compliance with respect to the wearing of facemasks has been an issue during the pandemic. The South Korean people quickly adopted the advice of medical professionals, and very few objected to wearing a mask. A majority of people even began wearing masks before the government recommended it. It was experienced as a sensible precaution, since Koreans were concerned about others not getting ill too. This is very different from some Western countries, where some parts of the population have not followed government rules (Ryall, 2020c). In the US, the wearing of facemasks even became a political issue. One study identified significant differences between Republicans and Democrats on coronavirus-related restrictions and safety measures. Thirty-

one percent of Democrats expressed concern about other people not wearing masks, while only 5 percent of Republicans agreed. Democrats are much more concerned about getting COVID-19 and are more likely to say that people in their community should always wear a mask (Van Kessel & Quinn, 2020). Part of the challenge in some US states is that the mask mandate debate has been left to local authorities to decide because there has been no state mandate (Diamond, 2020).

A supplementary strategy to voluntary rule compliance is the use of digital surveillance tools. In South Korea, the government collected GPS data from individual mobile phones, which provided detailed information about the movement path of each infected patient prior to being quarantined. An app was developed that showed the places infected patients had visited (e.g., Corona Map). This included data mining of CCTV footage and credit card use (Moon, 2020). The track and trace system is widely credited with limiting the spread of the illness. The highly automated system effectively traced the routes and interactions of people infected with the virus and who they had been in contact with. The system was able to reduce tracking time from 48 hours to four hours. All crowded places the infected person had visited, like a gym or bar, were closed and disinfected (Ryall, 2020c). Those in quarantine use the app to report their symptoms and provide status updates to officials. A local government case officer checks in twice a day, and by using electronic wristbands, the government ensures that people are not able to break their quarantine (M. S. Kim, 2020; Moon, 2020). In contrast, preliminary data on England's test and trace programme showed that only half of those who were asked to self-isolate said they had complied with the rules (BBC, 2020).

Surveillance tools can be effective in enforcing rule compliance, but even though the app data are published anonymously, there are serious concerns about infringement on the privacy of infected patients. Governments face a trade-off between privacy and public safety in this emergency. What is interesting with South Korea is that a national survey found that a large majority of people (84 percent) support the surveillance strategy, apparently because people trust the system will be used to ensure their well-being (Moon, 2020). In many Western countries, this surveillance technology has been met with much more skepticism.

13.5 COVID-19 in a CI Perspective

This final section will more closely examine how the three governmental strategies mentioned in this chapter resemble different aspects of CI.

13.5.1 Transparent Information

First, this chapter has shown the importance of many different types of transparent information flow. Arguably the most effective governmental strategy that both contains the virus and simultaneously minimizes the “damage,” is a strategy that resembles environmental sensing in its attempt to maximize information about the spread of the virus. The South Korean “test and trace” strategy illustrates an adaptive type of collective problem solving that made it possible to react quickly when infected cases were reported. The country managed to contain the spread of COVID-19 without a lockdown, while other countries were eventually forced to implement a hard lockdown with many negative effects. In addition, South Korea used mobile technologies to map the spread of the virus and inform citizens when necessary. A number of apps and QR-tracing at different hotspots made it possible to keep an overview of individual movements in the population. When infected cases were identified, close contacts could be easily identified, and people could move more quickly into quarantine. The constant testing and tracking of people who had been in contact with those who had been infected made it possible to contain the virus without shutting down society.

From a CI perspective, this approach resembles environmental sensing and human swarm problem solving in the attempt to maximize environmental information. When accurate information about the current situation is continuously updated, the government can be more flexible in their choice of strategy, depending on the spread of the virus. The disadvantage is the heavy surveillance of the public, for example, the highly effective quarantine rules, which still violate privacy.

Another aspect of transparent information flows is the sharing of all types of knowledge about the pandemic through the Internet. Most of the big news sites in all countries have provided citizens with updated statistics on the spread of the virus. From one perspective, these numbers provide feedback to the citizens on how well they are succeeding in following different behavioral rules. As the case of South Korea shows, it is likely that this type of transparent information increases citizen’s understanding of the seriousness of the problem. From a CI perspective, this is an example of stigmergic problem solving. The constantly changing statistical indicators resemble how solutions can be “reestimated.” A decrease in number of infected cases informs the crowd population that they are moving closer to the optimal solution. If the number of cases increase, people will know that they have to be better at following behavioral rules, such as social distancing measures.

There are also several other interesting examples of open online knowledge sharing during the pandemic. This includes preprints of scientific research papers and even online platforms that allow anyone to upload data about their health condition to a database, like the COVID Symptom Study. Such research-based initiatives provide important data about the pandemic, both regarding geographical differences in infected cases and in providing more information about how sick people are. This type of knowledge sharing can be interpreted as a type of stigmergic problem solving. However, the problem with misinformation during the pandemic, the so-called infodemic, illustrates how biased information can attract a lot of attention on the Internet. When people like or share information, they also sometimes look for information that is sensational or entertaining, but not necessarily truthful, with the risk of amplifying misinformation.

13.5.2 Citizen Responsibility

Second, citizen responsibility has been an important issue, since citizens have had to comply with behavioral rules enforced by the government. All governments are dependent on citizens' cooperation concerning some of these behaviors, such as social distancing measures and voluntary quarantines. The New Zealand approach was reliant on citizens actually trusting government's strategies. Most citizens report that they followed the behavioral rules. The challenge of getting people to follow behavioral rules is an example of human swarm problem solving, but the aim is to achieve homogeneous social interaction, whereby everyone complies with the same rules.

Governments have also regularly had to change their advice because the number of infected cases have changed. Clear messaging has been important, but this has been more difficult when there is a mix of mandatory requirements and recommendations. To maximize trust, many governments have chosen to let both politicians and health experts inform the public together. However, there have been tensions between politicians of different political parties and researchers. One example is the lack of clear recommendations on facemasks in the US, which created confusion among the citizens and reduced motivation to use a mask. Educating citizens is part of the process and if different advice is given, it can easily lead to more resistance.

In trust-based strategies, social norms among different groups in the population will be important. Solidarity during the pandemic is centered

on all citizens following the same behavioral rules. One example is the expected solidarity across generations, in requiring young people to be careful to protect elders and other vulnerable groups. From a bottom-up perspective, the behavioral rules are more than just rules; there is a degree of sacrifice when everyone must restrict their own social life through physical and social distancing.

The paradox in a pandemic is that you also want less individual free choice and more conformity towards the correct behavior. Social conformity and pressure can be effective if the majority already follow the required behavioral rules. People who do not follow rules will quickly observe that they are a small minority. If people comment on others breaking the rule, this will create a peer pressure to comply. However, the effect can also be opposite if the majority in a group don't follow the rules. Rules on social distancing, like limiting the number of people who can meet at informal social gatherings, can be considered as "invasions" into people's private lives. These activities cannot be controlled and are dependent on citizens being willing to follow them. Peer pressure will be the most important mechanism against rule-breakers. If a group of people follow physical distancing rules, it will be quite difficult to break these rules, because if a person comes too close others will just move further away.

In an emergency, conformity is an advantage. This has been less of a problem in totalitarian countries, like China, where the population are used to following mandatory requirements. The South Korean government was also reliant on people using the health apps and actually seeking health services when they became sick. The citizen acceptance of surveillance technology to collect geodata has made it easier to contain the spread. Under normal circumstances, this technology would have created much more concern regarding privacy infringement. However, these behavioral rules will inevitably have many negative side effects. Even relatively "successful" countries like South Korea have seen a rise in the number of suicides in the last half-year (Ryall, 2020b).

13.5.3 *Collective Learning*

Third, collective learning at a system level has been important in dealing with the pandemic. South Korea learned a lot from the Middle East Virus (MERS) in 2015 a couple of years before the COVID-19 outbreak. Most decisions on how to tackle the outbreak were based on science instead of

political decisions. Key initial disinfection decisions were primarily based on scientific evidence and standard operating procedures established after MERS (Moon, 2020). Their past failure in coping with that outbreak made them much better prepared than other countries.

Other countries that have struggled during the first wave of the outbreak have also tried to adjust their strategies in meeting the second wave. Many have adopted a test and trace strategy. However, the disadvantage is that if too many people are infected, the number of cases lead to information overload, which chokes the testing system. When this recently happened in Slovakia, they invented a new strategy by choosing to mass test most of the people in the country. This makes it possible to reduce the spread of the virus because most of the infected individuals are set in quarantine. It is then possible to regain control over the number of infected individuals. Public health authorities will get more accurate information on how and where the virus is spreading, making it possible to continue to trace the virus without going into a full lockdown. Other countries, like Austria, are adopting a similar strategy, which illustrates how countries are learning from each other at a rapid pace during the pandemic.

Concerning the vaccine development, it has not been possible to treat vaccines as global public goods. International actors like the WHO have tried to build an inclusive global distribution network, but the process has instead been dominated by “vaccine nationalism” and bilateral contractual mechanisms. Therefore, there is a risk that the vaccine distribution process will accentuate the economic and social divide between higher and lower income countries (Santos Rutschman, 2020). The vaccine race has largely been organized as an innovation contest with many different vaccine candidates. At present, nine candidates are in late-stage trials, while many more are in the earlier stages. A large variety of different types of vaccines are being developed, with teams working independent of each other. As with other types of human swarm problem solving, this approach increases the likelihood of identifying one candidate that is effective. Currently, a number of the vaccines show very promising results.

In addition, the pandemic has led to new policies that might have potentially positive consequences in the long term. In Spain, the economic crisis and poverty that followed the lockdown triggered the government to implement a guaranteed minimum income to all citizens. The European

Council has recommended that other member countries do the same to combat poverty and social inclusion. Although home schooling has been less of a success, people have realized that some of their work can be done at home and in this way, they can save travel time. This may also reduce pollution. It remains to be seen if these working habits will change permanently, but several big companies now say that workers can choose if they want to work from home.