



Variations in COVID strategies: Determinants and lessons

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ABSTRACT

This paper examines the experience of a set of countries that performed relatively well in coping with the COVID-19 crisis. The goal is to garner insights and lessons that can help countries that may experience initial or second-round outbreaks of the pandemic in the future. The paper finds healthcare, social protection, and overall governance systems as the three main determinants of COVID-19 strategies and their success. Though unique country-specific factors played an important role in confronting the pandemic in some countries, their role was generally mediated through one or the other of the above three main determinants. The findings of the paper suggest that establishing universal healthcare and social protection systems and improvement of governance need to be taken up as an immediate task – and not as a distant goal – even by developing countries. In view of the possibility of recurrence of epidemics in the future, this task has become important.

JEL Classification: H12, H51, H53, H55, I18, J65, P50

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1 Introduction

The COVID-19 (henceforth COVID) pandemic created an unprecedented public health crisis for the entire world. It also led to an economic and social crisis. Putting an end to the COVID public health crisis is necessary for switching full attention to recovering from the aftermath of the pandemic, while ensuring that the recovery is compatible with the goal of sustainable development.

The spread of COVID so far has had an uneven character. Many countries have already witnessed full-blown outbreaks, and some of them have brought it under control while others continue to struggle. A large number of countries are yet to experience full-blown outbreaks of the disease, and some face the danger of a second round of outbreaks. This paper offers an analysis of the experience of a select number of countries which proved to be more successful in confronting the disease, at least during its first-round of outbreaks, in order to derive insights and lessons that can be useful for countries that are still grappling with the pandemic and may face large-scale outbreaks in the near future.

To facilitate the comparative analysis, the paper uses a common analytical framework that distinguishes four stages of COVID response, namely (i) identification of risk, (ii) containment, (iii) treatment, and (iv) post-treatment and easing measures. The framework also identifies three broad determinants of COVID performance, namely the (i) healthcare system, (ii) social protection system, and (iii) overall governance system. The study reveals how an individual country's COVID response at each of the four stages was determined by these three determinants. The paper notes that certain unique country-specific factors played an important role in determining the COVID response. However, their role was mediated through the three main determinants mentioned above. The paper shows that whether a country could have an "early start" or not was the key, and it depended on the country's governance system. Similarly, the success of either the lockdown measures or the Trace-Test-Quarantine (TTQ) measures depended crucially on a country's healthcare and social protection system. Countries that had large gaps in their healthcare and social protection systems had to take emergency measures to fill them in order to be successful in dealing with COVID.

The findings of this paper show that establishing universal healthcare and social protection systems and improvement of governance need to be taken up as immediate tasks — and not as distant goals — even by developing countries. It also shows that strengthening the healthcare system of countries, where it is currently weak, is a task not only of these countries alone but of the international community as a whole, because globally the public healthcare system can be only as strong as it is in the weakest country. The insights gathered from this study have two-fold relevance. First, they can be helpful for countries that may witness their first full-blown or second-round outbreak of COVID in near future. Second, they can be useful in dealing with other epidemics and pandemics that are likely to arise in the future.

Some countries of the sample have witnessed second-round outbreaks in recent months, providing additional considerations to judge their overall performance. However, these outbreaks do not negate their initial successes and the lessons they offer.

The discussion of the paper is organized as follows. Section 2 explains the rationale behind the sample of countries chosen and the logical framework used for the analysis. Sections 3-6 analyse variations across the sample countries regarding identification, containment, treatment and post-treatment measures, respectively. Section 7 discusses COVID experiences of Brazil, Italy, and South Africa. Section 8 summarizes the findings, insights and lessons gathered from sections 3-7. Section 9 offers some concluding remarks.

2 Sample of countries and analytical scheme

The study presented in this paper is based on a “purposive sample” and not a random sample. This is because its goal is not to offer statistically significant inferences but to garner insights from in-depth analysis of a select group of countries that have been more successful in dealing with COVID and for that reason are of particular interest to the international community. Such a sample obviously has to include China, where the first outbreak was reported, so that it offers a unique experience. Similarly, it needs to include Viet Nam, which displayed remarkable success in confronting COVID, with zero deaths until the end of July and just a few hundred cases of infections, despite having a long border and significant trade and economic relationships with China. Another Asian country, the Republic of Korea (ROK), is of particular interest because of its effective TTQ-based COVID strategy that was adopted later by many other countries. Among the European countries, Germany is of interest because it has done better in dealing with COVID, as compared with its neighbors, such as France, Italy, Sweden, Switzerland, and the Netherlands. Iceland has been included in the sample, because it represents an island country with a small population that has performed well in responding to the COVID challenge. Of the African countries, the study includes Rwanda, which has been widely regarded as a successful case in dealing with COVID. Similarly, the study includes Uruguay, which is regarded as a successful country in dealing with COVID in Latin America. Thus, the countries selected for in-depth study in this paper are China, Germany, Iceland, ROK, Rwanda, Uruguay, and Viet Nam.

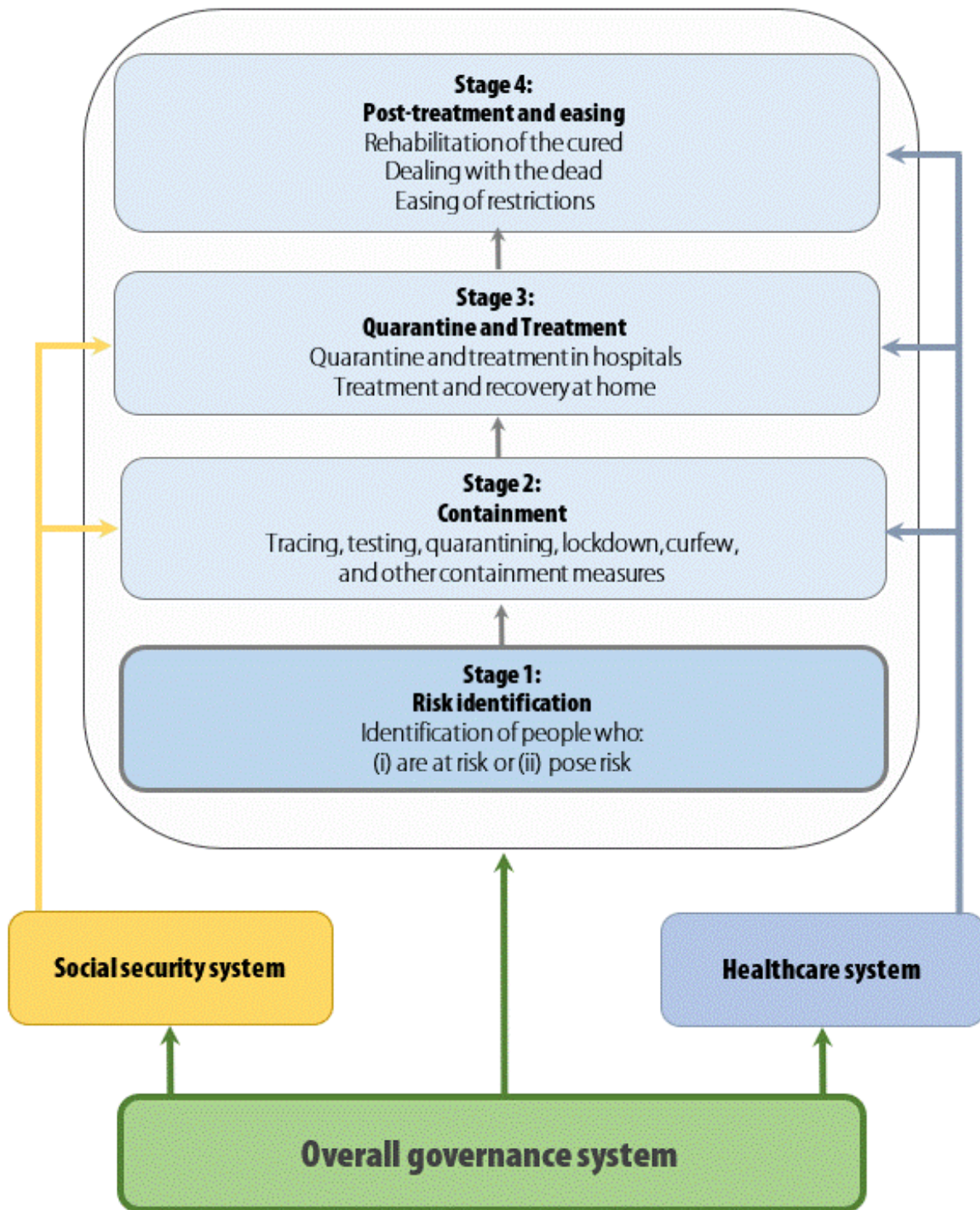
Though small, this sample of countries offers a broad range of experiences. In terms of population, it includes both the largest population as well as one of the smallest countries in the world. It covers both developed and developing countries, as well as countries with the earliest and later outbreaks of COVID. Finally, it includes countries from all continents, except Oceania.

In addition to the above countries, the paper also briefly discusses the experiences of Brazil, Italy, and South Africa. These are some of the countries that have not been that successful in dealing with COVID and hence can serve as comparators from the other end of the spectrum. Of these, Brazil, the largest country in Latin America, now ranks second in terms of the number of deaths from COVID (a total of 155,403, and 742 per million of population, as of October 20, 2020). Similarly, Italy is well-known for suffering from a high COVID death toll and can therefore offer a good comparison for Germany. South Africa, the largest economy of Africa, also has the highest number of COVID deaths on the continent (a total of 18,741 and 324 per million of population, as of October 20). The inclusion of these three countries helps to see more clearly the better performance of some of the countries chosen for in-depth study in this paper.

To facilitate the comparison of country experiences, the study uses a common analytical framework (Figure 1) that distinguishes four stages of COVID response, namely (i) identification, (ii) containment, (iii) treatment, and (iv) post-treatment and easing measures. It also identifies three broad determinants of COVID response, namely the (i) healthcare system, (ii) social protection system and (iii) overall governance system. The study focuses on the ways in which the determinants shape the responses.

Two qualifications are in order regarding this framework. First, in reality there are more determinants than the ones mentioned above. In fact, the paper will highlight the role of some *unique*, country-specific determinants. However, the paper shows that the role of these unique determinants is ultimately mediated through the above three determinants that are *common* to all countries. Second, there may be more channels — than those shown in Figure 1 — through which the three determinants exert their influence on the COVID response at the four stages. Furthermore, even the channels of influence shown in Figure 1 may involve feedback effects. The goal of the schema in Figure 1 is therefore not to be exhaustive in showing the possible channels but to capture what are considered to be the essential ones.

Figure 1
Analytical framework for studying COVID experience



Source: UN DESA.

3 Variation in identification of risk and their determinants across countries

Stage 1 signifies the beginning of the process when a country needs to identify the population groups that either pose the risk of spreading COVID or appear to be vulnerable to the pandemic. There was an obvious distinction in this regard between China and the rest of the world. For China, both the population posing risk and the population vulnerable to risk were initially internal. China identified the inhabitants of Hubei province and Wuhan city, in particular, as posing risk and the rest of its population as being vulnerable.

For other countries, the population posing the risk was initially external, and it was possible to narrow down the external source to more concrete places or regions. For example, Viet Nam, which shares a long border with China, identified the latter as the direct source of its COVID risk. The ROK, because of its close geographical proximity to — though not sharing a border with — China, also did the same. Germany and Iceland, on the other hand, being located on another continent, were more at risk from secondary sources. Indeed, both these countries discovered that skiers returning from the Alps in Austria and Italy were important sources of infection for them. COVID was initially an external risk for countries of Africa and Latin America too, and these countries therefore had the opportunity of blocking the disease at the border.

Variation in risk identification across countries

The performance of countries in the identification of COVID risks varies. The important distinction was between being pro-active (responding early to the pandemic) or mostly reactive (getting off to a late start).

China

For China, as noted above, the task of identifying both the population at risk and posing a risk was not difficult. However, there are questions whether China took more time than was necessary to recognize the threat and take necessary actions, and whether efforts to suppress information led to a delay. Reflecting dissatisfaction with initial responses, the central authorities of China deposed party secretaries of both Wuhan city and Hubei province on 13 February 2020 and installed new leaders in their places (Myers, 2020). Chinese officials and researchers have now recognized some suppression of factual information at the initial stage of the pandemic (O'Connor, 2020). Finally, the Chinese authorities felt it was necessary to adjust upward by about 50 per cent the total number of deaths caused by COVID (Qin, 2020). However, the authorities soon seemed to have overcome these initial hesitations and taken necessary steps to identify the population segments posing the highest risk to others, as well as those most likely to be affected by the pandemic.

Germany

Germany initially considered COVID to be somewhat distant and not a major threat, and accordingly took no pro-active measures to identify the risks and to stop the disease at the border.¹ The country did make some effort in that direction at the end of February. Thus, international border controls were tightened with new health security measures put in place on 28 February, requiring all travellers from China, Iran, Italy, Japan and the ROK to be screened. On 14 March, international borders were closed to all except European Union citizens, commuters and commercial traffic. Since these measures were late in coming, the situation in Germany changed rapidly during February. By the end of that month, Germany reported the second-highest number of cases in Europe, after Italy. It was clear that large-scale local transmission was already a reality in Germany and across Europe at this stage. By 10 March, infections were confirmed in all of Germany's 16 states, some as a result of returning vacationers and many as a result of local transmission (Reisinger, 2020).

Iceland

Iceland, being geographically far removed from China, was primarily threatened by secondary sources of risk. However, unlike that of Germany, the Government of Iceland mobilized its resources early to stop the disease at the border. Being an island country with a single international airport, border control was easier for Iceland. By 24 January, passengers arriving at the Keflavik International Airport with signs of respiratory infections or having been in Wuhan in the previous 14 days were medically assessed. The Directorate of Health declared three days later a state of uncertainty because of COVID, and on 3 February both Northern Italy and Tyrol of Austria were designated as high-risk areas, much earlier than by other countries. The first confirmed case of COVID in Iceland was identified on 28 February. All the early cases were linked to skiing trips to Italy and Austria, and travellers to those areas were subjected to a 14-day quarantine. Following the first confirmed COVID-related death in Iceland on 17 March, the high-risk designation was extended to all countries, with travel abroad strongly discouraged and those outside the country advised to return. All Icelandic citizens and residents arriving from high-risk areas were quarantined.

Republic of Korea

The ROK identified China as its primary source of risk because of physical proximity. The first case of COVID in the ROK, confirmed on 20 January, was indeed brought from China. With 41 reported cases in China by 11 January 2020, the ROK already started distributing test kits despite insufficient information about the specific strain of the new coronavirus underlying the outbreak in Wuhan, China. Most of the ROK's early local infections were transmitted from people who had recently arrived from abroad. On 4 February, the ROK barred entry of non-Korean travellers having visited or transited through Hubei province in China, or holding a passport issued in Hubei. Also, restrictions on visas of travellers from other countries were imposed — for example, non-Koreans were required to present a coronavirus test certificate, and, on 1 April, persons arriving from countries not subject to travel bans were placed in mandatory quarantine. Beginning 19 March 2020, all foreign visitors were required to have a contact phone number and a mobile device on which to download the health-checking app. Overall, however, the ROK remained accessible to most foreign visitors.

Rwanda

Rwanda, a landlocked country located in the Great Rift Valley at the intersection of the Great Lakes region and East Africa, displayed extraordinary vigilance against COVID, the risk of which was clearly external.² To stop the disease at the border, it began screening arriving travelers back in January, when the disease was just acknowledged in China. The first confirmed case of COVID in Rwanda was reported on 14 March 2020. By 16 March, there were 7 reported cases in the country. The Government responded on 18 March by suspending all international flights for 30 days. The land borders were also closed on the same day, except for cargo and Rwandan nationals, who were subject to a mandatory 14-day quarantine upon entry.

Uruguay

While its neighbouring countries have struggled to contain the pandemic, Uruguay has managed to keep the transmission of COVID under control. Brazil, which emerged as the epicenter of the pandemic in Latin America, was perceived to be the main source of COVID risk for Uruguay. Consequently, the country closed the border with Brazil on 22 March. In addition, mandatory quarantine for travellers from highly infected countries was imposed to block the risk at the border.

Viet Nam

Viet Nam also proved to be one of the most pro-active countries in responding to COVID. On 3 January, eight days before the first confirmed COVID-related death was reported in China, the Vietnamese Government set the public health system on high alert. It was not until 20 days later that Viet Nam reported its first confirmed COVID case. The country took almost immediate action to stop the disease at the border, beginning with a ban on all flights to and from China starting from 1 February. During that month, Viet Nam reported fewer than 20 confirmed cases. After the number of confirmed cases spiked at the beginning of March — a likely result of an influx of foreign tourists and returning travelers and overseas workers and students — all inbound international flights were banned, starting from 21 March.³ Starting end-January, arrivals at all major airports in Viet Nam were required to undergo body temperature screening and to complete a health declaration that included their contact details and travel and health history. The declaration was mandatory, and the potential criminal charges against anyone who falsified information or refused to self-declare provided strong incentives for truthful reporting. The land border with China was not closed completely, allowing some cross-border trade activities and limited travel to continue.⁴

Brazil, Italy, and South Africa

In contrast to the countries above, Brazil, Italy, and South Africa were late in risk identification and taking measures to avoid the risk. For example, the Government of Brazil denied or downplayed the COVID risks for a long time. South Africa also responded late. Italy too was late in recognizing the high risks posed by COVID.

Determinants of risk identification measures across countries

The review above shows that countries included in this study differed regarding being pro-active or reactive. They also differed regarding whether they had an early or delayed start. Using these two criteria, it may be possible to summarize the experience regarding identification of risk in the form of Table 1.

The question of interest is what determined the location of individual countries in one or the other slot of the matrix of Table 1. It seems that the responsiveness of the government to emerging public needs and the efficacy with which it could respond to these needs played the main role. However, certain unique country-specific factors played an important role too. For example, prior experiences of SARS (in 2003) and MERS (in 2015) of Viet Nam and the ROK, respectively, and of Ebola and AIDS in Rwanda, played an important role in the responses of these countries. Confirming the saying, “Once burnt, twice shy!,” these countries were determined to avoid a repetition of the bad previous experiences, and were extra-sensitive to any sign of another epidemic coming from outside. This, in particular, explains Viet Nam’s early response, when even China had not yet determined whether another epidemic had arisen. The same has been the case with the ROK and Rwanda. A similar early response was expected of China, which actually bore the brunt of SARS. However, as noted above, there was some reluctance on the part of the local Chinese authorities in realizing and recognizing the emergence of a new epidemic in areas under their supervision.

The overall governance systems of Germany and Iceland were also responsive and efficient. However, neither of these countries had experienced an epidemic in recent times and hence felt less inclined to be pro-active

Table 1
Classification of countries in terms of timing and activeness of response

	Proactive	Reactive
Early Start	ROK, Rwanda, Uruguay, Viet Nam	Iceland
Delayed start	China	Brazil, Germany, Italy, South Africa

Source: UN DESA.

in this regard. Iceland, however, has a long history of facing volcanic eruptions and earthquakes, and this experience helped the country to do better at other stages of the COVID response, as noted later in this paper. Brazil, on the other hand, delayed the response mostly by choice.

4 Variations in containment measures across countries

A wide range of containment measures was adopted in the countries of the sample. Broadly, these measures can be classified into two main types: (i) Lockdown (LD), and (ii) Trace-Test-Quarantine (TTQ). LD refers to putting people in place and restricting their ventures outside. For the most part, LD in the sample countries did not take the form of imposing curfews, one of the more extreme measures of this type. Instead, it mostly implied strict restrictions on people's venturing out of their homes for non-essential purposes. Consequently, LD is also associated with various *shutdown* measures, such as closing of education institutions, offices, and factories producing non-essential products and services. LD measures also include restrictions on transportation services, such as shutting down parts of the public transportation systems. The term Lockdown in this paper is therefore used in two senses: the strict sense, referring to putting people in place, and the more expanded sense that includes various shutdown and other restrictive measures. The context will make clear the sense in which it is used in this paper.

The TTQ measures, by contrast, do not impose blanket restrictions on people's venturing out of their homes and also do not require the shutting down of establishments and putting restrictions on transportation. Instead, it refers to efforts made to trace people who may potentially carry the infection, testing them to determine whether they are actually infected (which then creates another round of tracing activity), and quarantining those whose conditions do not yet require hospitalization, and hospitalizing those whose condition requires more serious intervention.

It is important to note that LD and TTQ approaches do not exclude each other; indeed, most countries adopted both types of measures. However, they differed regarding the relative importance of one or the other in their overall containment strategy. Some countries leaned more heavily on LD measures while others on TTQ. Also, the relative importance of LD and TTQ measures changed over time even within a particular country.

Containment in China

China is generally associated more with the LD strategy. Indeed, once the Chinese authorities realized the threat and discarded initial hesitation to recognize it, they took the drastic step of locking down (on 23 January) Wuhan, a city of about eleven million people, and extended the lockdown the following day to all major cities of the Hubei province, thus putting in place about 55 million people (Zheng, 2020). To implement this lockdown, all airports and rail stations of Wuhan were closed.⁵ Highway check posts were established to prevent movement by motorized vehicles. Following the example of Wuhan and Hubei, several other cities and provinces of China also imposed restrictions on movements. However, while the lockdown of Wuhan and Hubei was aimed at preventing COVID from spreading outward, movement restrictions in other provinces were aimed primarily at preventing COVID from spreading inward.⁶

Apart from the external lockdown, the Chinese authorities imposed internal restrictions within cities and provinces. For example, the subway (metro) and other public transportation systems in Wuhan city were shut down, and, on 13 February, authorities ordered schools and all non-essential businesses in Hubei province, including manufacturing plants, to be closed at least until 20 February (later extended to 10 March).

In addition to the external lockdown and internal shutdown, many other specific containment measures were adopted throughout China.⁷ In fact, China's special institutional structure (such as neighbourhood committees) and governance system (a combination of centralization and de-centralization and political uniformity) allowed it to adopt a variety of, and sometimes unique, types of restrictions. These include: (i) restrictions on the number of outside trips; (ii) close management of communities (*fengbishi guanli*, in Chinese), under which people could leave and enter through one exit only, thus allowing easy monitoring not only of the number of trips each person made, but also the body temperature, etc. of each member of the community; and (iii) restrictions through technology, such as the requirement to download (to mobile devices) particular apps, including for facial recognition, to allow authorities to monitor people's movements, individuals with whom they interacted, and their health conditions.⁸ As noted above, different types of restrictions were not mutually exclusive and were often used in combination. For example, Chinese authorities mandated the use of its COVID tracking apps and used information gathered through them to classify citizens into different risk groups — red (posing risk), yellow (indeterminate) and green (not posing risk). This electronic monitoring facilitated both LD and TTQ measures. Also, it should be noted that although the lockdown of Wuhan and other cities of Hubei province received more publicity, most other parts of China did not have to adopt LD measures. Containment efforts in these places relied more on TTQ measures.

The drastic lockdown, internal shutdown, and other restrictive measures adopted by Wuhan city, Hubei province, and other cities and provinces of China proved to be effective. According to Cyranoski (2020), early models of COVID spread, which did not take into account the containment measures and assumed a transmission rate of two (i.e. each infected person spreads the disease to two additional persons), predicted that COVID would infect 40 per cent of China's population, i.e. more than 500 million people. However, data for the period 16-30 January, which included the first seven days of LD, indicated that the transmission rate was 1.05, almost half the assumed rate. This rate decreased further, and the total number of infections stabilized as the containment measures had more time to exert their impact. As of 20 October, the number of new COVID cases in China declined to negligible levels (Figure 2) and the total number stabilized around 91,000 (Figure 3). There are contentions that China's COVID case numbers reflect under-reporting. However, researchers note that even if there were 20 or 40 times more cases, which seems unlikely, the LD containment measures still worked (Chinazzi et al., 2020). The relative success of China in containing the number of infections is more pronounced when considered in terms of the proportion of the population.

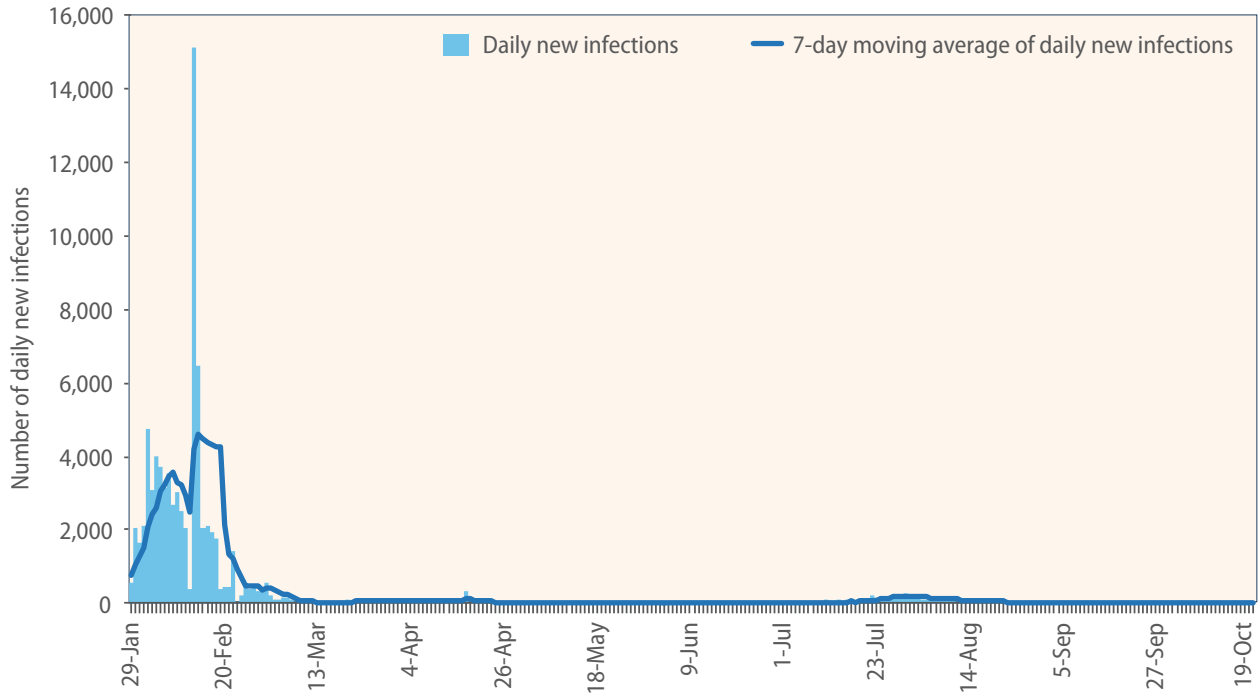
Determinants of China's containment strategy and outcome

Though China used both LD and TTQ measures, it leaned more heavily on the former. A careful analysis points to several factors why that was the case. The first was the fact that, being the first country of the outbreak, China did not have prior knowledge about the threat. Second, by the time it geared up the action, the disease had already spread within its territory, particularly in Wuhan city and Hubei province. The third was China's dense population, with about 11 million people in Wuhan city alone and about 55 million in Hubei province. For such a large, dense population, and in a situation where the disease had already spread considerably, TTQ would have been too little too late. In this sense, China was almost forced to adopt LD.

Several factors contributed to the effectiveness of the LD strategy in China. The first was the enforcement capability of the government, supported by several inherent aspects of China's governance system, such as the neighbourhood committees and political uniformity across the country. The LD strategy also necessitated a steady supply of essentials (food, medicine, etc.) to those under lockdown, a service also facilitated by the neighbourhood committees.

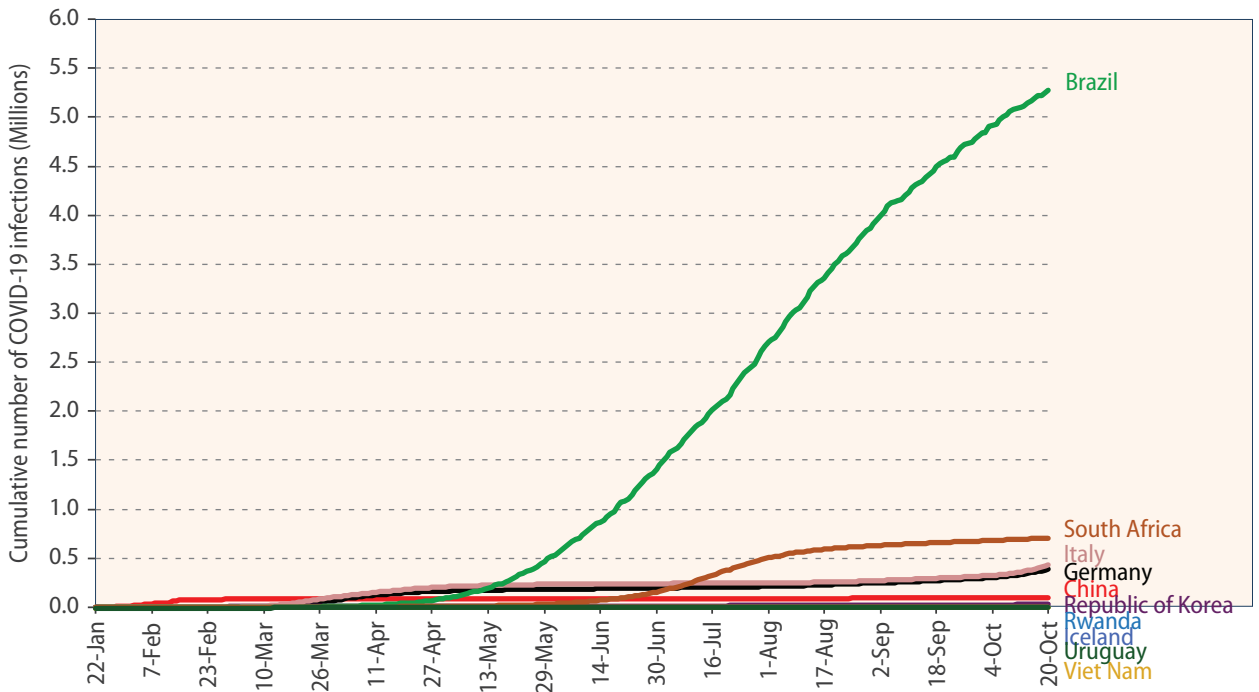
A particular characteristic of China's governance system is the special combination of a strong central state with considerable power delegated to provincial and local governments. The latter allowed different provinces

Figure 2
Daily and 7-day average number of new COVID infections in China



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Figure 3
Daily and 7-day average number of new COVID infections in the sample countries



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Note: Large values for Brazil dwarf the curves for other countries in this graph. Figure 6 below, therefore, presents this graph after dropping the countries with high values so that the curves for countries with small values can be seen more clearly.

and cities to customize the containment measures to their concrete situations. At the same time, the political uniformity of the governance system was used to ensure a common central direction.

The LD also required that those restricted from working were ensured a minimum level of income and consumption. This was challenging for China, which has been in transition since the reforms were introduced in 1978, and many parts of the society — including its social protection system — are still evolving. The problem is further complicated by the fact that migrant labourers comprise a significant share of the population of many large cities, including Wuhan. Due to China's *Hukou* (household registration) system, migrant labourers do not always enjoy the same social protection as do registered residents. Consequently, the prevailing social security system was inadequate for LD.

China's national authorities therefore took a number of steps to overcome these inadequacies (Tang, 2020; ILO, 2020). For example, temporary unemployment assistance was provided — though at a lower benefit level — for unemployed workers who did not meet the conditions for unemployment insurance. According to the Ministry of Human Resources and Social Security, some 2.29 million people received unemployment insurance in January and February, while in the same period, an estimated 5 million urban jobs had been lost in China. The purpose of these steps was to broaden the coverage to those who were eligible for existing social protection schemes. Furthermore, those ineligible for unemployment insurance but with income below the minimum threshold could apply for special assistance, and those who contracted COVID at work became eligible for employment injury benefits.⁹ On 21 April, the Government of China (State Council) also announced a new package of welfare support for many of the 300 million migrant workers — who had been particularly hard-hit by the lockdown. This package included unemployment benefits and other forms of emergency aid (Tang, 2020). These emergency measures helped to ensure a minimum level of income for the people under lockdown and thus make it bearable for them.

As noted above, many provinces and cities of China avoided LD and opted for less-disruptive measures, such as shutting down certain businesses. However, these measures also led to unemployment and loss of income for many people. The Chinese authorities therefore took steps to help make the shutdown and other restrictive measures less onerous. For example, provinces were allowed to exempt medium, small and micro-sized enterprises from employers' contribution to three social insurance schemes — pension, unemployment, and employment injury — for up to five months. Larger enterprises were allowed to reduce their contribution to these schemes by 50 per cent for up to three months. Enterprises classified as being in “operational crisis” could also apply for a postponement of contribution payment for up to six months. Also, through a special ordinance issued on 30 January (more on this ordinance later), the Chinese government removed any financial burden of testing, necessary particularly under TTQ measures.

Containment in Germany

The containment experience of Germany is of particular interest, because it involved switching, at various points in time, between TTQ and LD measures and also among different types of TTQ measures. Germany started with a strategy largely focused on TTQ. On 16 January, shortly after the genetic information about the virus was made available, researchers in Berlin developed and shared the world's first diagnostic test and made it widely available (Bennhold, 2020). With this tool, German authorities responded to the first reported cases by rapidly expanding TTQ measures. At the end of February, the Government took steps to expand its testing capacity in preparation for a surge in demand. A nation-wide, decentralized network of diagnostic labs also greatly facilitated these efforts.

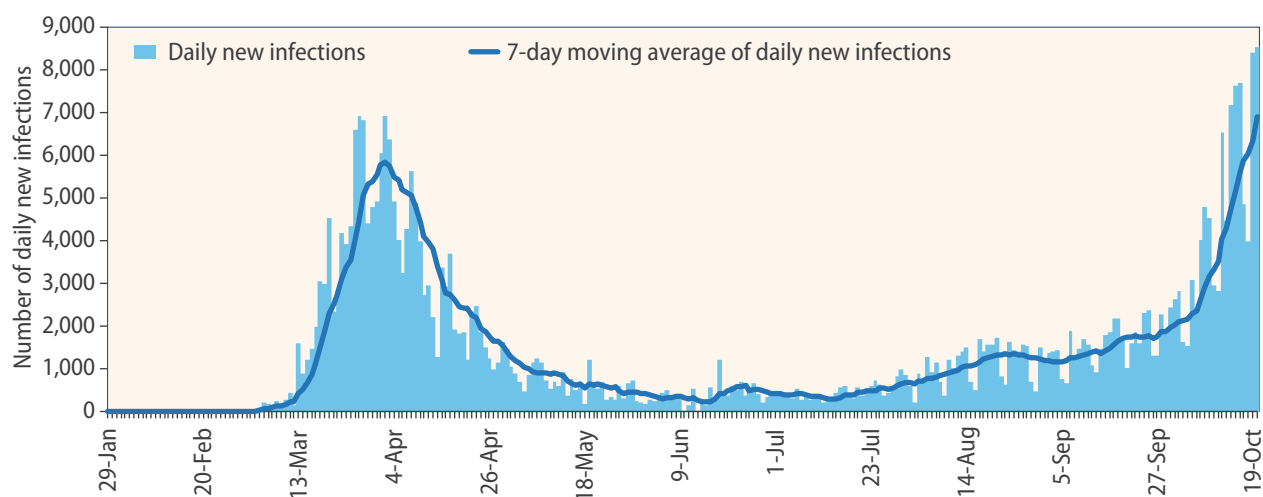
At first, tests were available only for people with symptoms and who were in contact with someone who tested positive or had travelled to one of the high-risk regions. The policy was later expanded to allow testing

of anyone with symptoms, though in practice there were still some limitations. Testing was complemented by efforts to trace those who might have been exposed to the virus. By 26 February, it was clear that a large number of people were in contact with confirmed patients, and by 4 March extensive contact tracing was initiated in all affected states. However, this policy was modified on 18 March because the large cumulative number of confirmed cases made it impractical to trace all contacts. Only those who were in *close* contact with a confirmed case were traced. On 9 April, the Government shifted its efforts once again and began to develop a digital system for contact tracing (Ferretti, and others, 2020). Germany's Deutsche Telekom started providing anonymized "movement flows" data of its users to the country's disease control and prevention research institute. Telecommunication network operators had access to data on the movements of millions of people at fine spatial and temporal scales and in near real-time (OECD, 2020). However, the Government had to prove that privacy protections were in place before digital tracing could become acceptable to the German population (Barker, 2020).

Alongside TTQ, the Government resorted to various shutdown measures and the imposition of various restrictions to limit person-to-person contact. German states started to close schools and restrict business activities on 26 February. Federal and state authorities announced a number of restrictions on public life, hoping to avoid the same fate and sobering death tolls of Italy, France, Spain and Switzerland. On 29 February, federal authorities recommended the cancellation of public events. Authorities also took steps to limit travel between states, and some states announced restrictions on inter-state entry and exit. On 16 March, schools across the country were closed as the number of daily confirmed cases surpassed 1,000. By 20 March, all states in Germany had banned social events and public gatherings. Two days later, authorities agreed to ban public gatherings of more than two people (Hale, and others, 2020). To prevent the situation from getting out of control, Germany started to take measures that were close to LD. In fact, several states and the city-state of Berlin issued stay-at-home orders. On 22 March, non-essential shops and leisure facilities were closed and limits were placed on restaurants. Other stores and businesses remained open on the condition that they establish social distancing practices.

All these interventions ultimately proved effective in limiting the spread of the virus. By the beginning of April, the reproduction rate of the virus was less than one, causing the number of new cases to decline over time. The average daily number of new cases started to drop from early April until mid-June, when it reached a low point of 324 new cases per day (Figure 4).¹⁰ Since then however the number of new daily infections has

Figure 4
Daily and 7-day average number of new COVID infections in Germany



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

trended upwards. By early September, more than 1,200 new cases were being reported daily, so that the total number of cases is now increasing (Figure 3). This later experience shows that achieving early success is not enough. A country also needs to be careful with its easing measures so as to avoid secondary outbreaks, as will be noted below in the discussion of Stage 4.

Determinants of Germany's containment strategy and outcome

Germany's success in developing the first test kit gave it the confidence to tackle COVID with TTQ. The availability of a large network of diagnostic labs also helped. Many epidemiologists and scientists from trusted institutions communicated with the public. Angela Merkel, with her scientific background, spoke to Germans about the danger and the necessity of containment measures (Davidson, 2020). Germany's well-developed healthcare system also instilled confidence. According to the Federal Ministry of Health, public and private health insurance has been covering coronavirus tests and other costs since 28 February, 2020 (Escritt, 2020). However, insurance funds did not cover costs associated with precautionary quarantine.

Germany is known for its comprehensive social protection system, which is essential not only for LD measures but also for TTQ, as noted earlier. The 2001 Infection Protection Act (IfSG) provides that anyone placed in quarantine or barred from working because of infectious diseases, thereby suffering a loss of earnings, is eligible for compensation. However, to deal with the unprecedented situation of the COVID pandemic, Germany had to take additional emergency measures. Authorities passed a supplementary budget that included expanded access to a short-time compensation fund for employers designed to preserve jobs and incomes (Federal Ministry of Finance, 2020). The compensation amounted to 60 per cent of the net income of employees without children (67 per cent for employees with children), thus relieving the employer of the costs of keeping workers on their payroll. As of 23 April, over 700,000 companies registered with the programme. The budget also expanded childcare benefits for low-income parents; eased access to basic income support for the self-employed; and provided grants to small business owners and self-employed persons. State governments complemented the above measures with their direct support measures and loan guarantees (IMF, 2020).

An important feature of Germany's overall governance system is its decentralization, with 16 state governments having jurisdiction over education, health and cultural affairs (Stelzenmüller and Denney, 2020). The fact that these state governments could belong to rival political parties made policy coordination a challenging task. It was therefore not surprising that Germany had 16 preparedness plans and a confusing patchwork of rules at the onset of the COVID pandemic.¹¹ Federal authorities could only make recommendations that the states were free to ignore. However, because of the national character of the pandemic, the country needed to react as one coordinated unit. Recognizing this necessity, the 16 states joined the federal government to ask the legislature to centralize some powers needed to address the current crisis. This proposal was passed on 27 March as part of the Infection Protection Act, temporarily giving the federal legislature the power to declare a national health emergency, which empowered the federal health ministry to enact rules "for the preservation of health care" and to recruit medical personnel. The ministry was also able to mandate identity and health checks at the borders. This emergency legislative measure proved to be important in imparting Germany's COVID response with the necessary coherence and contributed to its effectiveness. However, as noted above, despite the initial success in containing COVID, Germany became a victim of a second wave of COVID infection — a problem that will be discussed in more detail later.

Containment in Iceland

While China's containment policies leaned toward LD, and Germany switched between TTQ and LD, Iceland's containment policies were more firmly anchored in TTQ. With several confirmed COVID cases reported at the beginning of March, Iceland's health authorities declared a state of uncertainty and began an

urgent effort to trace and test all individuals that might have been in contact with those infected. By 5 March, about 300 individuals were tested, of whom 34 individuals proved positive, all of whom had been infected by people arriving earlier from northern Italy and Austria (National Directorate of Health, 2020).

With more cases of local transmissions emerging, the authorities declared on 6 March the highest alert level, an *Emergency Phase*. Public communications were also intensified, including by launching a dedicated COVID website, urging people with suspected COVID infection to self-isolate. A 50-person tracing unit, composed of staff with detective skills, was established in early March at the National Crisis Coordination Centre, with the sole purpose of tracking those who might have been in contact with infected individuals.¹² By 15 March, 171 confirmed cases of COVID had been reported, the majority of which were traced to skiing areas in the Alps. The number of people in self-isolation rose to more than 10,000 by the end of March. On 2 April, the infection tracing application “Rakning” was launched to support the TTQ effort. By mid-April, some 50 per cent of the population had downloaded the application. Strict social distancing rules were also introduced.

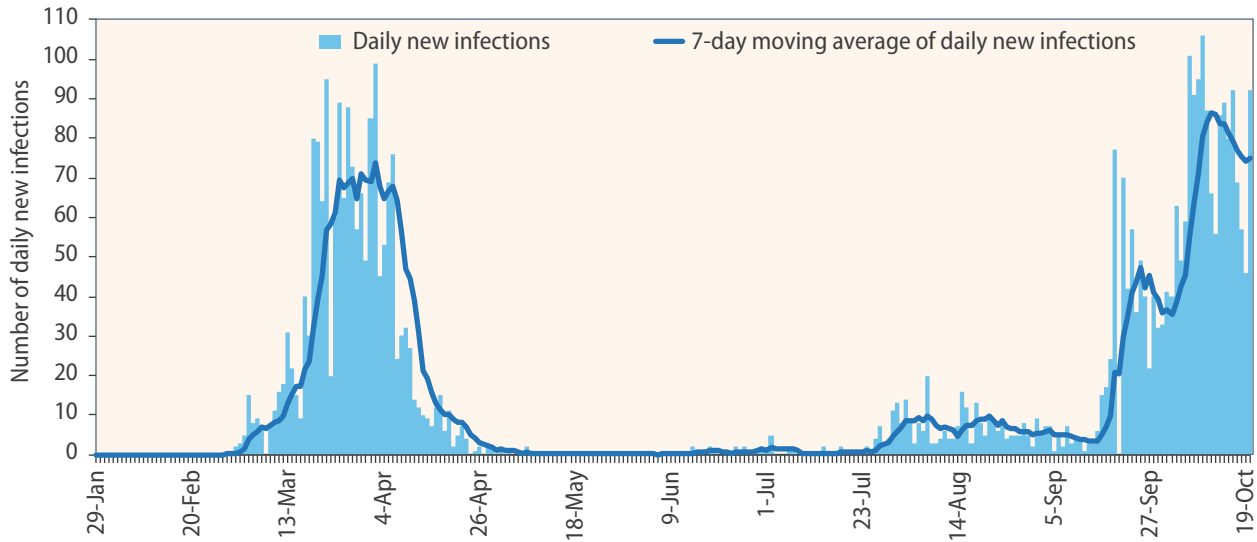
To ramp up the scale of testing, the Government went into partnership with the private research company, deCODE Genetics-Amgen, which offered testing and sequencing of the genetic code of the virus in infected individuals. By mid-April, some 11 per cent of the population had been tested either at the National Hospital or at deCODE. This included those segments of society most vulnerable to COVID as well as randomly selected samples of asymptomatic individuals. The results of the testing conducted by deCODE Genetics and published in *The New England Journal of Medicine* in April 2020 revealed that 0.8 per cent of the population was estimated to be infected with COVID, of which half was found to be asymptomatic (Gudbjartsson et al., 2020). On 8 April, deCODE Genetics also began screening individuals for antibodies, i.e. those who were infected but unaware of it and recovered.

The TTQ measures highlighted above were accompanied by social restrictions as well. Though most stores and businesses remained open, they were subject to social distancing rules. A ban on gatherings of more than 100 people was put in place on 13 March and nine days later was further restricted to 20 individuals only. A visitation ban was also imposed in hospitals and nursing and senior citizen homes. The Government also advised health workers to remain in the country and established stiff penalties for those breaking quarantine rules. Though Iceland avoided lockdown of the strict sense, it too could not avoid some shutdown measures. Beginning on 13 March, universities and higher secondary schools were closed, although primary schools and day-care centres remained open. Sports clubs, bars, and salons were also closed on 22 March and on 2 April the Minister of Health extended school closures and the ban on meetings until 4 May.

On 4 May, the ban on gatherings and school activities was relaxed and two weeks later, public places like swimming pools were reopened. Further easing of restrictions on gatherings up to 200 people were announced on 25 May and gyms were allowed to reopen at 50 per cent of normal capacity. All restaurants and bars, however, had to close at 11 p.m. The Government also relaxed on 15 June measures for those travelling to Iceland, providing them the option of being tested for COVID upon arrival or undertaking a 14-day quarantine. The impact of this measure was some rebound in incoming travel to Iceland, but at the same time an uptick in the number of COVID cases. For example, the number of COVID cases increased from 1,811 on 15 June to 1,872 by 30 July, at which time the Government decided to enact further restrictions on public gatherings as well as inbound travel to the country. This meant that people travelling to Iceland from high-risk areas and staying for more than 10 days had to be tested twice, upon arrival and again 4-5 days later. The Government further tightened these rules on 19 August with all incoming travelers to the country required to undertake a 4-5 day mandatory quarantine upon arrival prior to the second test. However, the initial success of Iceland in controlling COVID was marred by later events when the number of new infections rose again (Figure 5) and

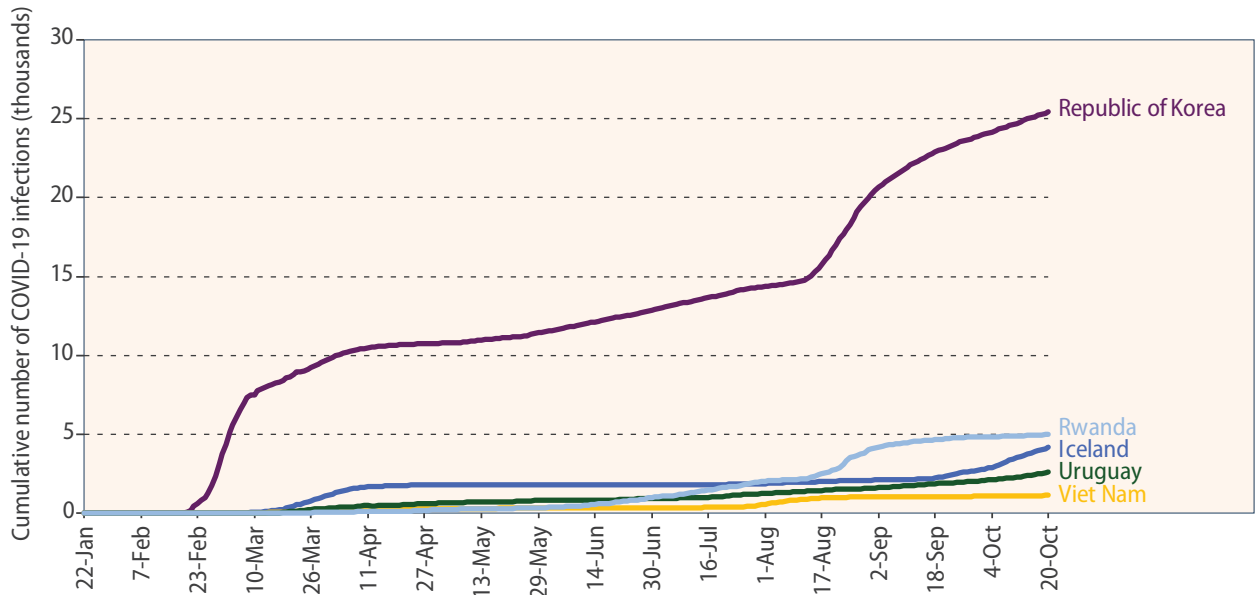
by 20 October the cumulative number of COVID cases reached 4,193 (Figure 6). The second-round outbreak of COVID in Iceland shows the importance of careful planning of the easing measures (Stage 4), as already noted on page 15.

Figure 5
Daily and 7-day average number of new COVID infections in Iceland



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Figure 6
Cumulative number of COVID infections in selected countries



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Note: This figure reproduces the cumulative infection curves already presented in Figure 3 but leaves out countries for which the numbers are of a much higher order, so as to allow the curves for countries with small numbers to be seen more clearly.

Determinants of Iceland's containment strategy and outcome

Several factors played an important role in the choice and effectiveness of the COVID containment strategy in Iceland. First, the fact that Iceland started relatively early, and the ease with which it could counter infection risk entering the country from abroad undoubtedly helped it. Second, the small size of its population made the application of the TTQ strategy appropriate for Iceland.

Apart from these “physical” factors, Iceland’s robust healthcare system played an important role (The Lancet, 2018). Iceland’s laws guarantee universal access to health care, provided through a national health service, comprising a system of state-run hospitals and primary healthcare centres, covering all and with little charge for persons seeking medical care.¹³ The healthcare system also had added preparedness for dealing with infectious diseases. In 2007, Iceland had expanded its Communicable Diseases Prevention Act, which provides the framework for effective action against a wide variety of such threats (Government of Iceland, 2019). The Chief Epidemiologist of the Directorate of Health was charged with the responsibility for monitoring the state of communicable diseases and preparing the national response to potential health threats (Government of Iceland, 2019). The fact that testing was made free of charge removed any cost-barrier to testing for individuals. Finally, though Iceland’s healthcare system is entirely public, the Government did not hesitate to enlist the support of the private sector for a major national testing effort, as noted above. This policy flexibility also helped in the successful execution of Iceland’s TTQ strategy.

Iceland’s well-established, universal social protection system also proved highly significant for the country’s COVID response. The system includes insurance-based unemployment benefits, and financial assistance is also available for individuals without other resources. To the extent that Iceland avoided LD and extensive shutdown measures, it did not have to face wide-scale unemployment and lack of income. However, to better deal with COVID, the Government took the unusual step of changing an existing law to expand the right of wage earners, self-employed individuals, and students to partial unemployment benefits. Farmers were also provided with support to hire temporary staff. A special homeless shelter was also established in the capital because of the pandemic. A special reserve service in the social sector, in addition, was created with 1,300 people registering to contribute to the COVID effort, if needed. These measures helped to ensure that people did not shy away from quarantining, if necessary.

Finally, other nation-specific factors such as the Icelandic government’s general responsiveness and the country’s preparedness to deal with emergencies caused by volcanic eruptions and other natural disasters also proved helpful in responding to the COVID pandemic.

Containment in Republic of Korea

Just as China became associated with the LD strategy, ROK, as already noted, became more known for the TTQ strategy. From the outset, ROK resorted to screening and testing on a vast scale. New laws passed after the MERS outbreak in 2015 shortened the process of approving test kits, enabling the Korean Center for Disease Control and Prevention (KCDC) and the Ministry of Food and Drug Safety (MFDS) to approve a new polymerase chain reaction (PCR) test kit developed by a Korean private company on 4 February, just a week after the application was submitted. This prompt approval made it possible for laboratories and clinics to test a large number of patients relatively quickly.

In pursuing the TTQ strategy, ROK collected samples through home visits by health professionals and at 118 testing institutions across the country, of which 71 were drive-through clinics.¹⁴ In addition, hundreds of “walk-in” COVID testing booths were set up in hospitals throughout the country. The test cost \$130 for the Government but was free for the individuals tested. Health professionals could quickly derive a test result, enabling them to focus resources on the clusters identified and isolate those with the potential to spread the

coronavirus. Of those testing positive, the ones with mild symptoms were sent for quarantine, while the ones more seriously ill were sent for treatment. Anyone entering ROK from abroad was required to self-quarantine for 14 days. Asymptomatic entrants from abroad were also tested, depending on how long they would be in the country and where they are travelling from.

ROK also made efficient use of digital technology for its containment efforts. The TTQ system relied on a combination of measures — such as a government-sanctioned smartphone app, CCTV footage, and credit card transactions — to track the location of infected COVID patients. The flow of movements of all infected persons (without revealing their identities) was publicly disclosed via mobile phones and other communication devices, and their close contacts were required to stay at home for two weeks even if they tested negative.

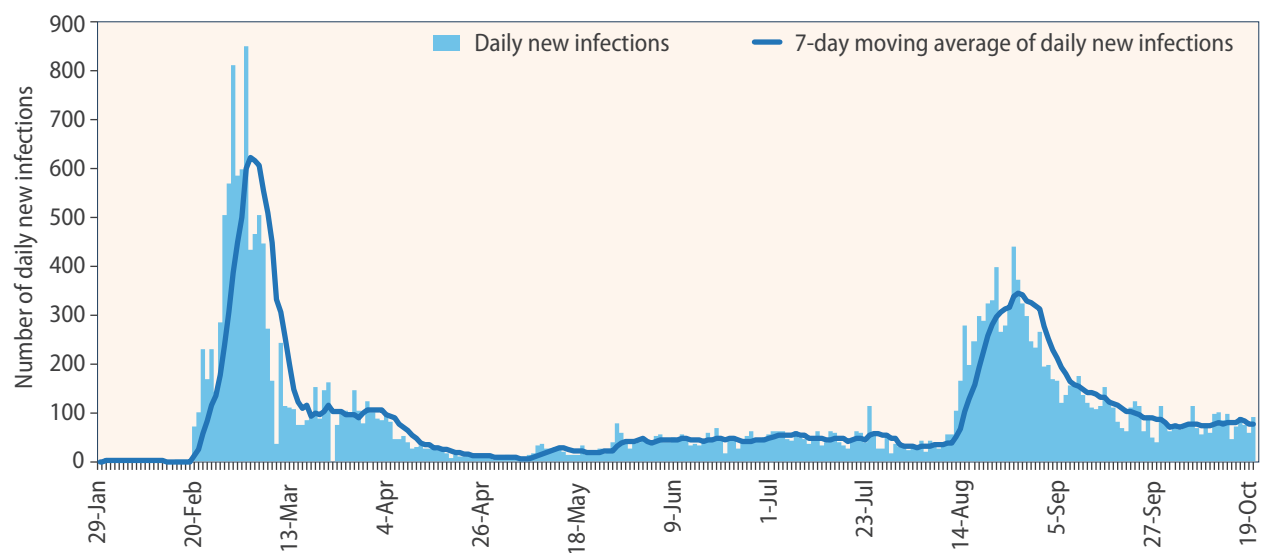
ROK also adopted various restrictive measures helpful for containment. For example, all concerts, exhibitions and other public events were cancelled, and public libraries, gyms and swimming pools were closed. In March, the Government announced the so-called aggressive social distancing policy, encouraging people to stay away from others in public spaces, wear facemasks, sanitize hands, and refrain from social gatherings. In many cases, citizens voluntarily imposed restrictions on themselves, for example, when it came to gathering and dining outside.¹⁵ Similarly, more people resorted to online shopping.

ROK put particular emphasis on containing nosocomial spread of infection, i.e. spread of infection through visits to infected people under treatment in hospitals. For this purpose, the country designated 350 hospitals for patients with non-respiratory diseases. In these hospitals, sections for respiratory treatments were completely segregated from the non-respiratory sections. Also, ROK imposed restrictions on visiting hospitalized COVID patients.

A particular feature of the ROK response was the setting up of *Life Care Centers* — comprising commercial hotels (the so-called Corona Hotels), public and corporate training facilities and sporting facilities — to quarantine and monitor patients not requiring immediate intensive medical care. Patients at these Centers were transferred to hospitals if their medical conditions deteriorated.

Effective implementation of the TTQ measures allowed ROK to limit the transmission of the disease, resulting in a rapid decline and stabilization of the daily number of new infections (Figure 7). ROK also witnessed

Figure 7
Daily and 7-day average number of new COVID infections in Republic of Korea



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

a spike in the number of new cases during late August and early September (Figure 7). However, the situation seems to have been brought under control, so that, as of 20 October, the total number of infections in ROK remained limited to 25,424 (Figure 6).

Determinants of ROK's containment strategy and outcome

Several factors contributed to the initial success of ROK's TTQ-based strategy. Apart from the efficiency of the overall governance system, a particular role in this regard belonged to ROK's experience with Middle East Respiratory Syndrome (MERS) in 2015, during which the country experienced the largest outbreak outside of Saudi Arabia, with 16,653 suspected cases, 186 confirmed cases, and 38 deaths. Many of these infections were nosocomial.

ROK drew several important lessons from the MERS experience, including the necessity of avoiding (a) late diagnosis; (b) failure to isolate close contacts and to stop the emergence of the so-called super spreaders;¹⁶ (c) inadequate hospital infection management; (d) the culture of frequent hospital visits and familial caregiving; (e) non-disclosure by patients; (f) the "doctor shopping" behavior and; (g) lack of transparent disclosure of information and cooperation with the population of the country and international partners (Kim et al. 2017).¹⁷

In view of the MERS experience, ROK took many measures to be ready for public health emergencies. The Government raised the status of KCDC, giving it more power, which facilitated quick approval of the COVID test kit.¹⁸ The drive- and walk-through clinics, new PCR test kits and the creation of layers of hospitals and isolation facilities, were all developed after the MERS epidemic. The new system also protected healthcare workers from infection and saved hospitals from being overwhelmed by a surge of patients needing urgent yet advanced medical treatments. These arrangements made the ROK responses to the COVID outbreak fast, effective and cost-efficient.

The KCDC also ensured necessary information-sharing and transparency through its twice-a-day briefings that kept people updated about both the progression of the disease and the efforts to counter it. It helped to establish trust between the authorities and the people, prompting the latter to remain calm and to cooperate with the implementation of the TTQ measures. However, the Government did not hesitate to adopt coercive measures when necessary. For example, the KCDC requested the national police to identify and monitor close contacts of infected patients.

While a TTQ-based COVID strategy helped ROK avoid widespread unemployment and loss of income, its wider success with the strategy required comprehensive, significant healthcare and social protection measures. Making testing cost-free played an important role in ROK's large-scale testing, and, although the country had a well-developed social protection system, additional measures were necessary to lessen (or remove) the economic burden of quarantine. To this end, the Government enacted new legislation on 5 March to ensure that individuals requiring quarantine were entitled to paid leave. Similarly, the Government encouraged employers to introduce or expand teleworking and staggered work schedules, and supported up to 50 per cent of the investment on ICT that small- and medium-sized enterprises needed to introduce these facilities. These measures reduced the number of people congregating even under TTQ. ROK's high technological level allowed it to trace suspects digitally using information collected via phone and other electronic devices.

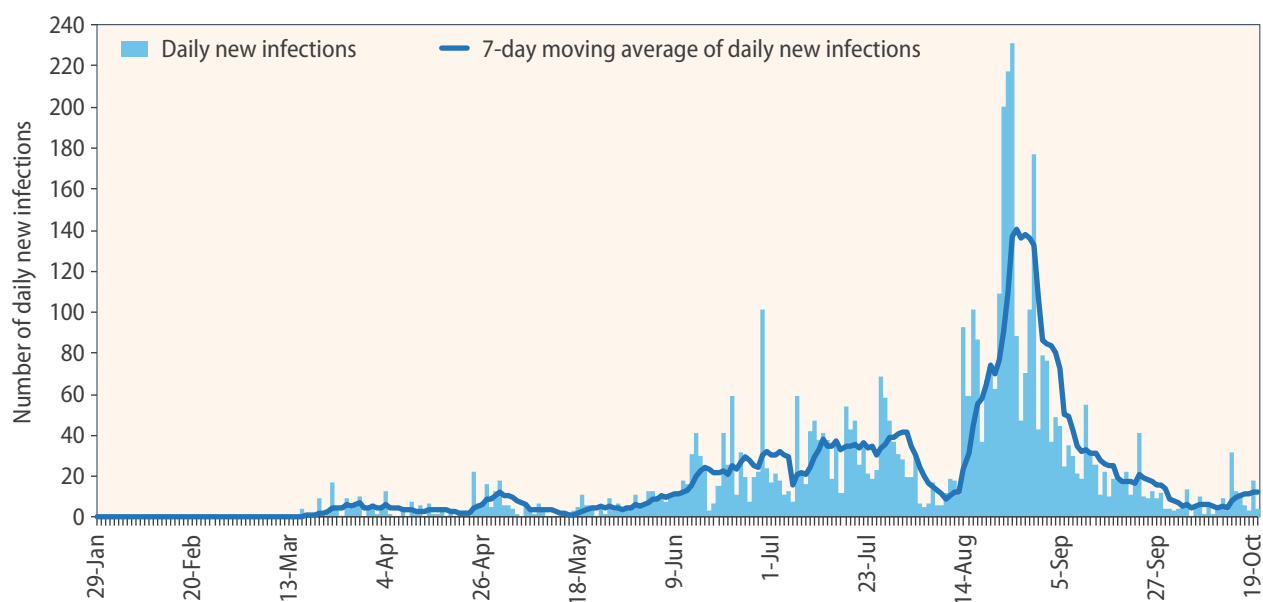
Containment in Rwanda

To contain the disease, the Rwanda government announced a lockdown on 21 March, requiring both public and private employees to work from home, making Rwanda the first African country to impose a total lockdown because of COVID. All public gatherings, schools, university classes, churches, wedding ceremonies,

meetings, and entertainment activities were suspended until further notice. These measures helped Rwanda slow down the spread of the disease. By the end of March, the number of confirmed COVID cases in Rwanda reached 75, but with no deaths reported. The first COVID-related death was confirmed on 30 May. By the end of June, the total number of confirmed cases had reached 1,025, however with only two reported deaths. The number of cases doubled by the end of July to 2,022 with 5 deaths reported. There was some increase in the number of new infections towards the end of August and early September.¹⁹ However, by the end of September these numbers decreased to low levels (Figure 8). Not surprisingly, the World Health Organization has highlighted Rwanda as one of the best performers in Africa in responding to COVID.

The success of Rwanda in containing COVID would not have been possible without careful planning by the national authorities. Already in February, when no COVID case was yet confirmed, the Government was in full preparedness mode, with draft standard operating procedures and guidelines in place, collecting funds, putting final touches to the first treatment centre and establishing a cross-sector National Joint Task Force, with support from an advisory team of scientists. The country also offered free COVID tests even before the first case was reported. Laboratories around the country were open 24/7 to conduct tests of individuals.

Figure 8
Daily and 7-day average number of new COVID infections in Rwanda



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

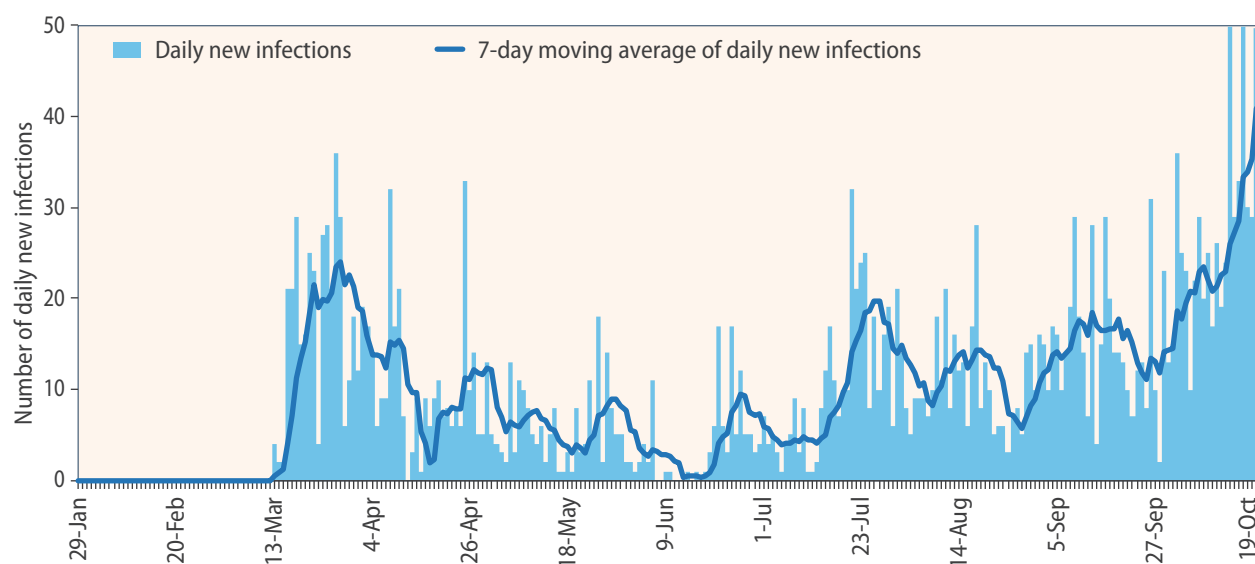
The Rwandan authorities have credited the active participation of citizens in complying with public guidelines — such as social distancing, mask wearing and washing hands — as the key to the country's success in combating COVID. According to mobile phone data, the Rwandan public have practiced social distancing to a greater degree than any other country in Africa, except South Africa. The country has conducted nearly half a million COVID tests of a population of some 12.5 million, more than any other African country except South Africa. The testing strategy of Rwanda involved application of an algorithm that allowed for pooled-testing of groups of people (rather than of each individual), which enhanced its cost-effectiveness. Not surprisingly, the COVID strategy of Rwanda has generally been described by observers as the continent's most aggressive and technologically sophisticated. As a result, Rwanda is now one of only 11 countries worldwide that the European Union considers a safe travel destination.

At the same time, the Rwandan strategy has its critics because of its reliance on tightly enforced lockdowns and other restrictions that have led to arrests of more than 70,000 people for COVID-related infractions such as violating night curfews, failing to wear masks or breaching social distancing rules. These critics claim that the COVID containment measures have been overly aggressive and infringed on civil liberties. The authorities, for example, have used drones to record images of cities and remote areas as part of monitoring infractions by citizens of the established COVID guidelines. People arrested for such infractions have sometimes been taken to stadiums and subject to hours of mandatory lectures on public health issues, which were transmitted from loudspeakers.

Containment in Uruguay

The first case of Covid-19 in Uruguay was confirmed on March 13, and epidemiologists traced the first outbreak to a wedding. All participants of the event were tested and isolated within 24 hours. Following the outbreak, the country’s recently-appointed president quickly announced that all public events and other potential centres of crowding as well as schools would close. Uruguay did not impose a mandatory stay-at-home order. Rather the Government asked people to stay at home to protect the population. The guidance by the Government was announced in close cooperation with experts, and the scientific grounding of the government’s decision-making helped to gain the trust of the population. A high level of social cohesion and public trust in the government also led to a high degree of compliance with voluntary quarantine measures and adherence to social distancing rules. Widespread awareness campaigns encouraged the population to work from home and businesses to close their doors. An awareness campaign on best health practices and hygiene protocols was launched. These measures helped Uruguay to limit the spread of the disease. Unfortunately, the number of new infections has increased in recent period, though it remains low in absolute terms (Figure 9). As of 20 October 2020, the cumulative number of infections in Uruguay remained limited to 2,623 (Figure 6).

Figure 9
Daily and 7-day average number of new infections in Uruguay



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Determinants of Uruguay's containment strategy and outcome

Early, swift, and decisive actions of the government slowed the spread of the virus and gave the country the necessary time to prepare its hospitals and testing system. Uruguay has the highest share of people above 60 years of age in the region, making it extra vulnerable to the pandemic. A key decision of the government was to extend the sickness benefit to all workers over 65 in the private sector, so that they could stay home. Other factors that played an important role in Uruguay's success in containing the disease were the broad coverage of the healthcare system, a comprehensive social protection system, and almost 100 per cent access to running water.

Containment in Viet Nam

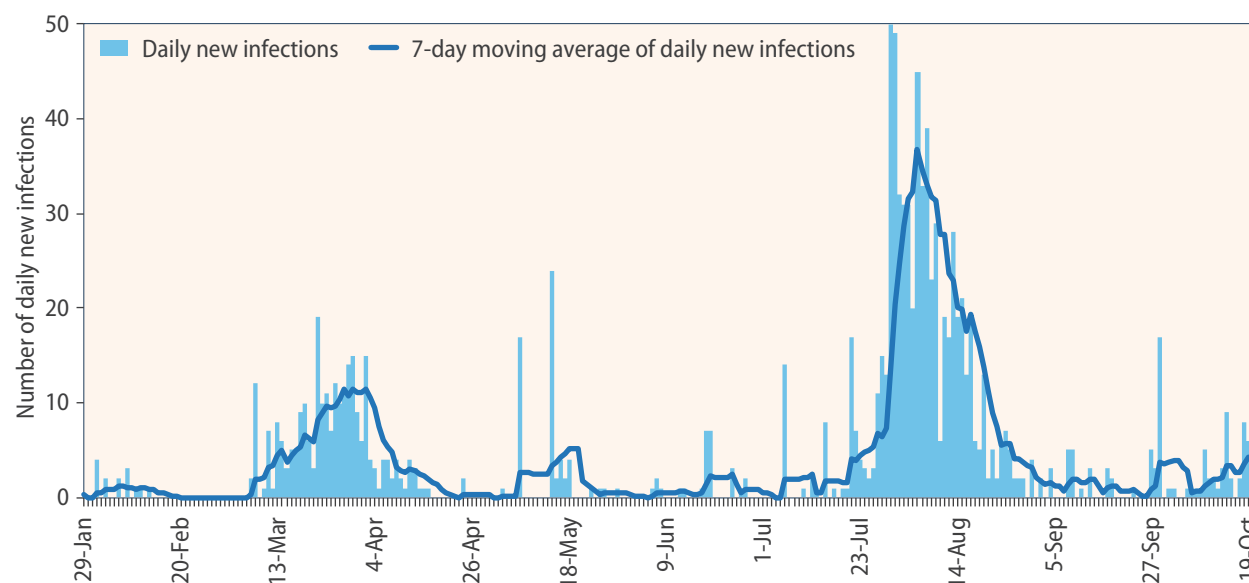
The early start allowed Viet Nam to rely on TTQ to a great extent, as noted earlier. In particular, it put emphasis on targeted testing, i.e. testing of the population that posed risk, such as the people arriving from outside, in particular, from China. Viet Nam resorted to aggressive contact tracing and targeted testing. For example, the Government tested some 800 people for every confirmed case. To facilitate large-scale testing, the country focused on developing domestic test kits. In fact, Viet Nam distinguished itself by making *low-cost* testing *widely* available. By early March, several test kits were validated by government entities, with each costing less than \$25 and producing results within 90 minutes (Klingler-Vidra et al., 2020).²⁰ Test kits developed by Viet Nam were in demand by other countries, too. It was reported that 20 countries have placed orders for the Vietnamese test kits.

Despite a relatively low level of broadband Internet penetration, Viet Nam made effective use of mobile phones to deploy various digital tools in the service of its TTQ measures. The Government made available and recommended people to download a smart-phone-based app that transmitted information about the health status of an individual to the National People's Health Database on a real time basis. All foreigners were required to do the same through a separate app. The use of this app greatly facilitated the task of tracing individuals. To enlist further help from the public in tracing and testing, the Government also disclosed information regarding those who contracted COVID or escaped quarantine, albeit without disclosing their names.²¹ Mobile phones were also used for an energetic public information campaign. Government entities partnered with messaging platforms to send daily text-to-mobile messages on COVID-related information, such as its symptoms and protection measures, urging people to take the disease seriously. Daily TV appearances by the Prime Minister to address COVID-related matters helped spread awareness. Posters and stamps were also designed to deliver public health messages.²²

In addition to the emphasis on TTQ, Viet Nam also made use of targeted LD, shut down, and other restrictions. First, the Government ordered significant restrictions on people's movements within the country to facilitate the tracing and testing process. Second, the Government promptly locked down cities or specific areas in a city where a cluster of infections was suspected. For example, on 13 February, the Government locked down villages with 10,000 people close to Hanoi after COVID cases were confirmed there. Similarly, after the three-week nation-wide social isolation imposed on 1 April, the Government kept under lockdown several districts of Hanoi city and several provinces. Third, in addition to restrictions imposed on international travel, the Government also restricted domestic travel. Most domestic flights and trains were cancelled soon after the ban on inbound international flights. In addition, people travelling between cities were subject to quarantine, and a blanket quarantine requirement was imposed on anyone entering other provinces from Hanoi — which had the highest number of confirmed cases. The Government implemented social distancing, encouraging people to wear facemasks, sanitize hands in public spaces and public transportation, and refrain from social gatherings.

Viet Nam's TTQ-dominated strategy proved to be a remarkable success. While most other countries struggled to flatten their COVID curve, Viet Nam, in a sense, nipped the outbreak in the bud, and did not allow any significant increase of new infections (Figure 10). Viet Nam did witness some increase in infections in August. However, the government again succeeded in bringing the situation under control quickly, so that, as of 20 October 2020, the total number of infected people stabilized around 1,140 (Figure 6), many of whom were infected while abroad.

Figure 10
Daily and 7-day average of new COVID infections in Viet Nam



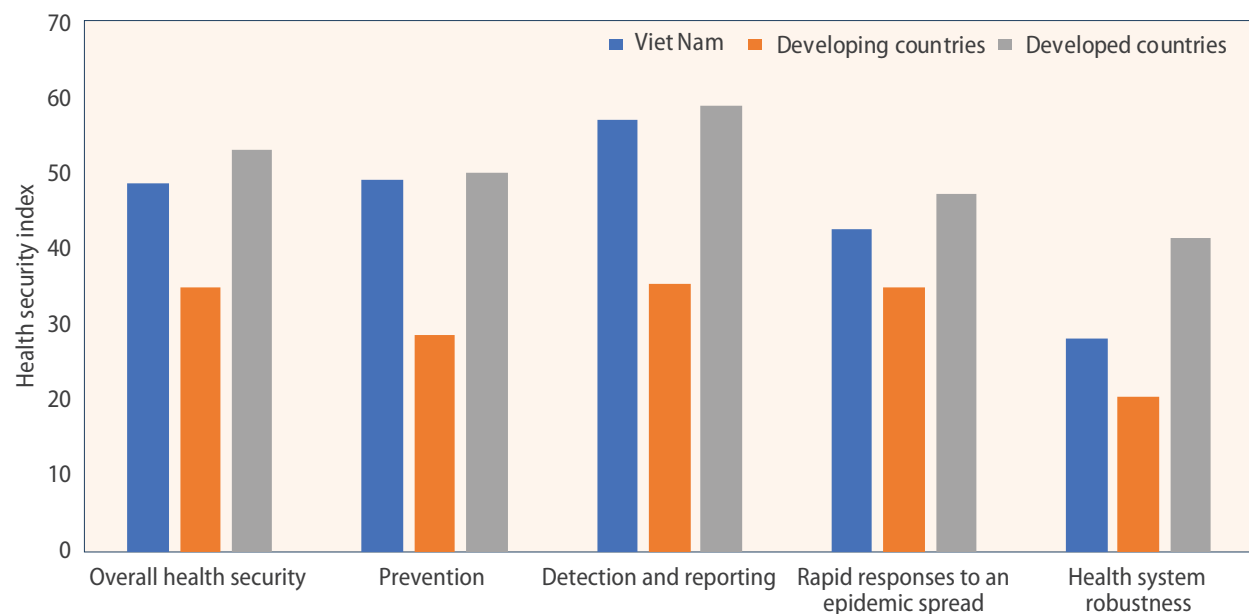
Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Determinants of Viet Nam's containment strategy and outcomes

As a lower-middle-income country, Viet Nam's public health system was expected to face significant challenges in the face of a widespread COVID outbreak. According to Global Health Security Index, the ability of Viet Nam's health sector to treat the sick and protect health workers received a score of 28.3 out of 100, considerably below that of ROK (58.7) and China (45.7).²³ In 2016, Viet Nam had about 8 doctors per 10,000 people, which was less than half of 18 doctors per 10,000 people in China, and of course much lower than in developed countries, such as the US (26), Italy (41) and Spain (41).

Viet Nam prioritized raising awareness and social consensus about COVID-19, portraying it as an "enemy" and invoking the ethos of the war years. Awareness about the general weakness of its healthcare system was one of the reasons that prompted Viet Nam to an early response, so as to avoid overwhelming its healthcare system by a large number of COVID-infected people. However, in certain areas, the Vietnamese public health system rivaled its generally more advanced counterparts in developed countries (Figure 11). In particular, based on the assessment of the Global Health Security Index, Viet Nam was among the top-10 countries in the world when it came to several specific health security dimensions, such as prevention, detection and reporting, and responses to epidemics.²⁴ Viet Nam made effective use of these strengths to confront COVID.

Figure 11
Health security: Viet Nam versus selected groups of countries



Source: UN DESA, based on data from Global Health Security Index.

Viet Nam's legislation mandates universal healthcare coverage to be achieved by 2020. As of 2018, about 73 per cent of the population had access to essential health services from the public sector (World Health Organization, 2018). To remove any cost barrier, Viet Nam, despite its lower-middle-income level, made COVID-related quarantine and treatment free of charge for its citizens.

The early start made TTQ a viable strategy for Viet Nam, despite its relatively large and dense population. By avoiding widespread and prolonged lockdowns, Viet Nam could also avoid loss of work and income for large sections of its people. The targeted lockdowns and some shutdowns and restrictions did cause loss of employment and work, and social protection was necessary to support the people suffering the loss and those requiring self-isolation and quarantine. In facing this challenge, Viet Nam could rely on its relatively robust social protection system, which includes unemployment and health insurance; social insurance as well as public assistance; and a multitude of programmes targeting vulnerable groups (Vinh, 2016).²⁵ This comprehensive set of social protection programmes provided a good foundation for enhancing the public's resilience to the economic and health shocks brought about by the pandemic. However, the Government had to take some emergency measures to protect employment. These included suspension (up to 12 months) of payment of social insurance premiums into the retirement and survivorship fund for businesses adversely affected by the pandemic. The Government also announced cash transfers to certain vulnerable population groups, including poor and near-poor households, recipients of social protection programmes, those who stopped working temporarily or were furloughed, the unemployed without unemployment insurance, and self-employed workers, etc. It was planned that these cash transfers would continue for a maximum of three months and benefit more than 10 per cent of the country's population.²⁶ The government also provided food allowance and living supplies for infected persons who were quarantined.

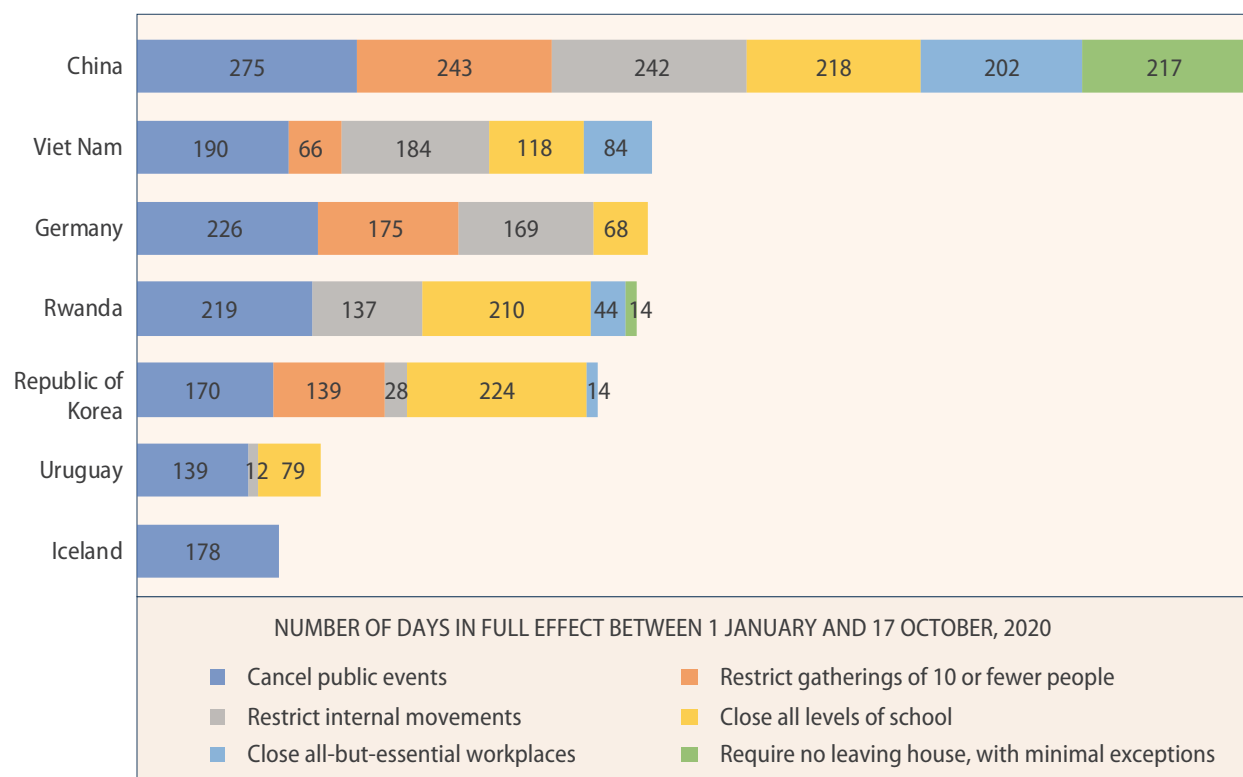
Viet Nam's overall responsive and relatively efficient governance system played an important role in the success of the country's containment strategy. Some particular aspects of this system, such as the presence of neighbourhood committees, proved helpful. Whereas in China these committees helped make the lockdown

successful, in Viet Nam they helped make tracing successful. Within communities, neighbours kept a watchful eye on people who might be infected or avoid testing (in situations where testing is ordered); and those infected would likely be reported to authorities. At the same time, the act of spreading misinformation, including false information regarding the incidence of COVID, could risk punishment, and over 800 people were fined for such misdeeds in the first three months of the year (Reed, 2020).

Continuum of strategies and variation in emphasis

The review above confirms the observation made at the beginning of this section that — despite very different types of containment measures associated with LD and TTQ — no country stuck to only one type. Figure 12, for example, shows the number of days for which various lockdown, shutdown, and other restrictive measures were in place in different countries during the period from 1 January to 18 June. It shows that the numbers were generally the highest for China and the lowest for Iceland.

Figure 12
Numbers of days different containment measures in effect across countries between 1 January and 17 October, 2020

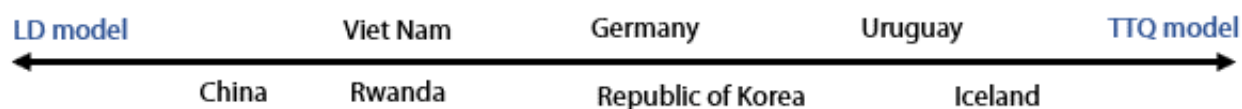


Source: UN DESA compilation, based on data from Oxford COVID Government Response Tracker.

Note: Days with various containment measures may overlap.

Since all countries adopted measures belonging to both LD and TTQ strategies, a binary classification of countries in terms of LD and TTQ is not warranted. Instead, countries may be thought of as lying on a continuum, with those putting more emphasis on LD measures at one end while those putting emphasis on TTQ measures at the other. From this viewpoint, the seven countries chosen for in-depth study in this paper can be placed as shown in Figure 13.²⁷

Figure 13
COVID containment measures: the LD — TTQ continuum



Source: UN DESA.

5 Variations in quarantine and treatment measures

While containment is necessary to prevent the spread of COVID, those who are already infected require, inter alia, quarantine and treatment. Quarantine can be carried out at home, by the infected persons themselves. This arrangement is sometimes also called *self-isolation* (at home), or *informal quarantine*. However, often conditions at home may not be suitable for effective quarantine. In such cases, moving to a facility can be more effective. The latter may be called *formal quarantine*, which may be carried out either in regular hospitals or in special facilities or quasi-hospitals, which need not be equipped with advanced medical facilities as in regular hospitals. Quarantine — either informal or formal — is generally sufficient for most cases of COVID. However, for some patients, quarantine may not be sufficient, and instead intensive medical care (treatment) in hospital settings may be necessary. A special situation is presented by asymptomatic individuals, who may not know that they are infected and may thus unknowingly serve as a source of infection for others. Extensive testing can help to identify such persons and contain the risk they pose.

This section reviews the variations of quarantine and treatment measures adopted in the sample countries and their determinants. The review will show that these countries differed widely in terms of their capacity for quarantine and treatment, particularly regarding hospital treatment, and they adopted diverse and often ingenious measures to overcome the shortfalls. Also, while all countries used hospitals for treatment, they varied regarding quarantine, with some of them emphasizing self-isolation, others creating facilities for formal quarantine, and yet others using hospitals for quarantine too. In each case, healthcare, social protection, and overall governance systems served as the main determinants.

Quarantine and treatment in China

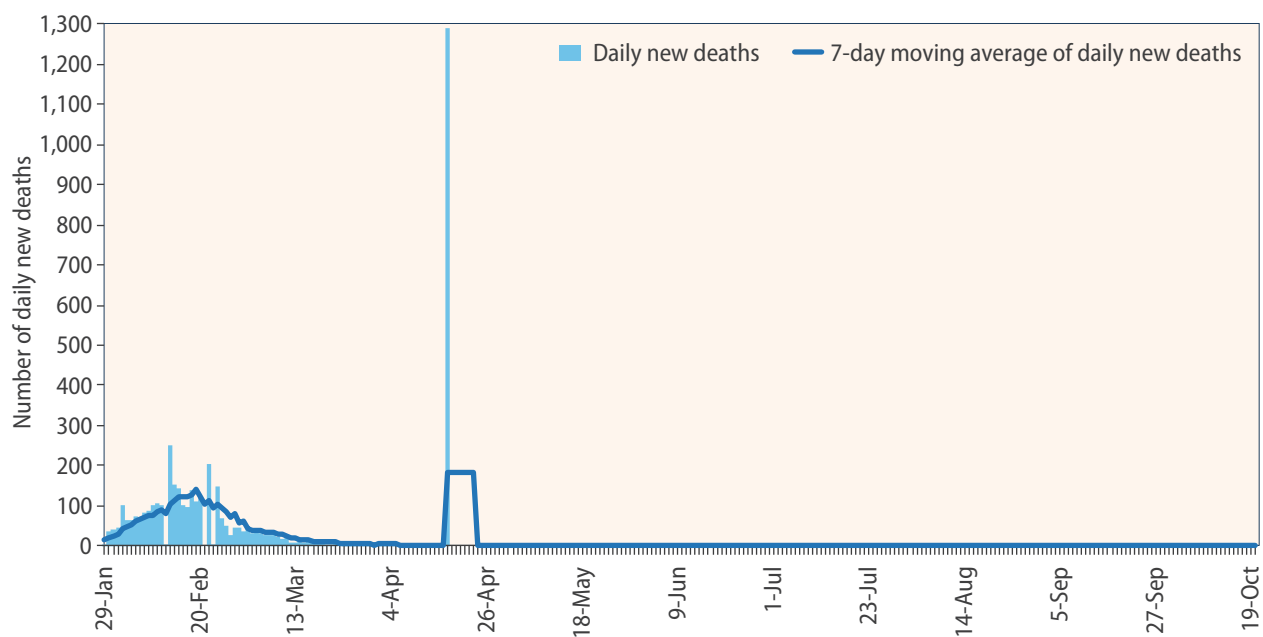
Given that China started its anti-COVID actions after the outbreak had already occurred, the likely threat of an exponential increase in the number of infected persons requiring treatment was daunting. Anticipating that its existing hospital facilities might not be adequate for meeting this challenge, Chinese authorities made a huge effort to expand its hospital capacity. To this end, it constructed two new hospitals — Huoshenshan and Leishenshan — in Wuhan city in only 10 and 12 days, respectively. These two hospitals expanded the capacity of the city from 11,500 to 14,100 beds. The rapid construction was aided by advanced technologies. For example, digital tools, such as BIM (Building Information Modelling), allowed the design institutes to utilize the industrial Internet, bringing together hundreds of BIM designers nationwide. The hospitals' design plans were produced in 24 hours and construction drawings in only 60 hours. In addition to these new hospitals, China also set up temporary facilities with necessary medical personnel and equipment for light-symptom COVID patients and also for quarantine, by re-fitting facilities such as stadiums. These measures helped to reduce cluster-infection in families, once a household member was confirmed to have contracted the virus.

China, in addition, expanded the capacity for the production of essential medical supplies such as facemasks, protective clothing and disinfectants, as well as necessary medical equipment, such as ventilators. China organized a system of partnership, matching particular cities of Hubei province with other provinces or cities in the country, with a view to securing the necessary COVID supplies. To ensure adequate availability of healthcare personnel in Wuhan, China mobilized about 40,000 doctors, nurses and other professionals to go to the city to help in testing and treatment of COVID patients.

China also took measures to remove cost barriers to treatment. As already mentioned, China’s health insurance system is still evolving and was not ready to offer necessary coverage to all who needed treatment. Anticipating the problem, the Chinese Government (State Council) issued on 30 January a special ordinance requiring relevant authorities to ensure that no patient failed “to get medical treatment due to cost issues.” It also stipulated that the “personal burden” (i.e. cost that is not covered by a person’s health insurance) would be paid by the Government to ensure “comprehensive protection.” The ordinance listed a host of other measures to ensure that cost was not a barrier to accessing testing and treatment for COVID.

Removal of the cost barrier, together with the expansion of the physical facilities of care and the mobilization of a large number of healthcare personnel, allowed China to bring down the daily number of new COVID deaths (Figure 14) and to stabilize the total number of COVID deaths to 4,739 (as of 20 October, 2020) (Figure 15). According to WHO (2020), some 45 per cent of those requiring hospitalization in China because of COVID were 65 years or older, and 80 per cent of those who died from the disease were 65 years or older.

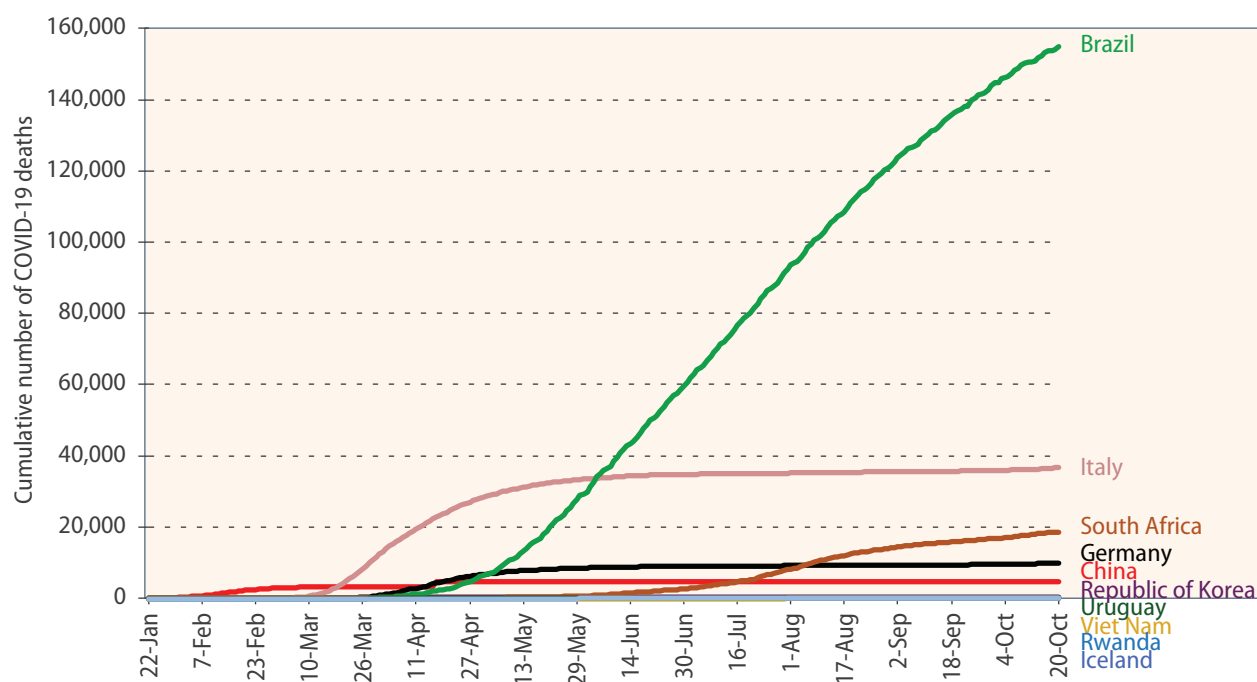
Figure 14
Daily and 7-day average number of new COVID deaths in China



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Note: The sudden hike in the reported COVID-19 death toll on 16 April was attributed by the Chinese Government to the inclusion of new data on COVID-related deaths outside of hospitals and were previously not recorded in the official statistics.

Figure 15
Cumulative number of COVID deaths in the sample countries



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Note: Large values for Brazil, Italy, and South Africa dwarf the curves for other countries in this graph. Figure 18 below, therefore, presents this graph after dropping these countries so as to allow curves for countries with small values to be seen more clearly.

Quarantine and treatment in Germany

Germany’s health infrastructure was well prepared for a crisis such as the one posed by COVID. The number of hospital beds per capita in Germany was close to being double the OECD average (Table 2).²⁸ In addition, even smaller health care facilities had intensive care units and were capable of treating COVID patients. Their availability would allow the burden to be shared by the entire health care system, instead of it falling on a small number of large hospitals (OECD Stat, 2020). However, the significant death toll in Italy and alarming epidemiological forecasts convinced the German authorities that, despite their strong health infrastructure, they must be prepared for the worst-case scenario. Germany therefore quickly expanded further the number of intensive care beds and ventilation units and made other preparations. Hospitals rapidly expanded their capacity from 28,000 intensive care beds equipped with ventilators to 40,000 beds nation-wide in case the worst-case scenario proved true.

Table 2
Health indicators in Germany and OECD, 2017

	OECD average	Germany
Current health expenditure (per cent of GDP) (2018)	8.8	11.2
Practicing physicians (per 1,000 persons)	3.4	4.3
Practicing nurses (per 1,000 persons)	9.2	12.9
Hospitals (per 100,000 persons)	2.8	3.7
Number of hospital beds (per 1,000 persons)	4.6	8.0

Source: UN DESA compilation, based on OECD (2019).

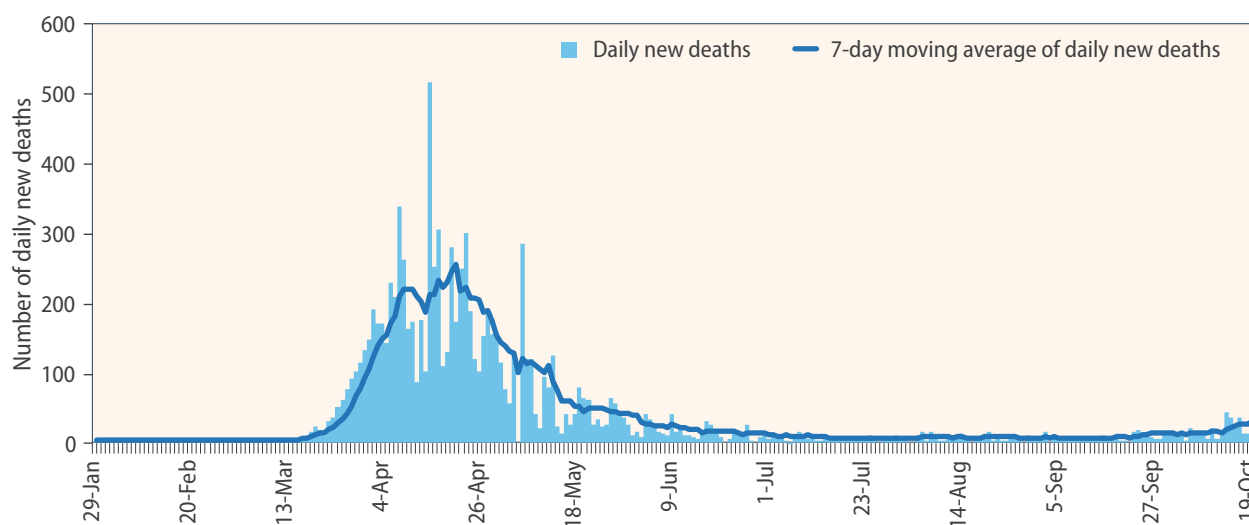
Germany also made progress toward building a sophisticated *digital* health infrastructure before the COVID crisis (Olesch, 2020). Telemedicine services have been available to the population since 2018. In late 2019, the German parliament passed the Digital Care Act to digitize the country's healthcare and encourage investments in digital health solutions. Electronic health records facilitated the accurate collection and distribution of epidemiological information. These prior technological advances helped Germany in managing the treatment of COVID patients.

Issues of access, financial burden, and protection of work and income during and after treatment posed less of a problem for Germany because of its robust social protection system. Since 2009, every person was required to have either private or public health insurance. Public or statutory health insurance is mandatory for those who earn less than a certain salary. Private health insurance is available for those who earn more than the threshold or are self-employed and choose to purchase their own. Notably, most hospitals and physicians treat both public- and privately-insured patients. The system is also decentralized, with the states, the federal government and the various self-regulated organizations of payers and providers making health care policies and decisions jointly (Bennhold, 2020).

Early intervention and hospitalization improved the chances of surviving a rapid health decline caused by the virus. Some German towns found creative ways to preempt emergencies. In Heidelberg, doctors and nurses made house calls for those who were sick with the virus, looking for signs of deterioration. In fact, the success of the non-health interventions in limiting the spread of the virus kept the need for these resources below their capacity, so that many hospital beds remained unused, and Germany was able to admit some patients from neighbouring countries. It also supplied much-needed ventilators and facemasks to Italy.

The combined effect of Germany's containment strategy and its robust healthcare system kept hospital resources from being overwhelmed. In contrast, Italy's health system struggled to cope with the large number of infections and a larger rate of mortality. By the second half of April, the COVID daily number of deaths in Germany started to decline, from a peak of 232 people on 21 April to five in mid-September. However, the number of new infections rose in late September and early October (Figure 4). Fortunately, these have been less fatal, so that the number of new deaths remained relatively low even during this spike (Figure 16), and the total number of COVID deaths in Germany stood at 9,882, as of 20 October (Figure 15).

Figure 16
Daily and 7-day average number of new COVID deaths in Germany

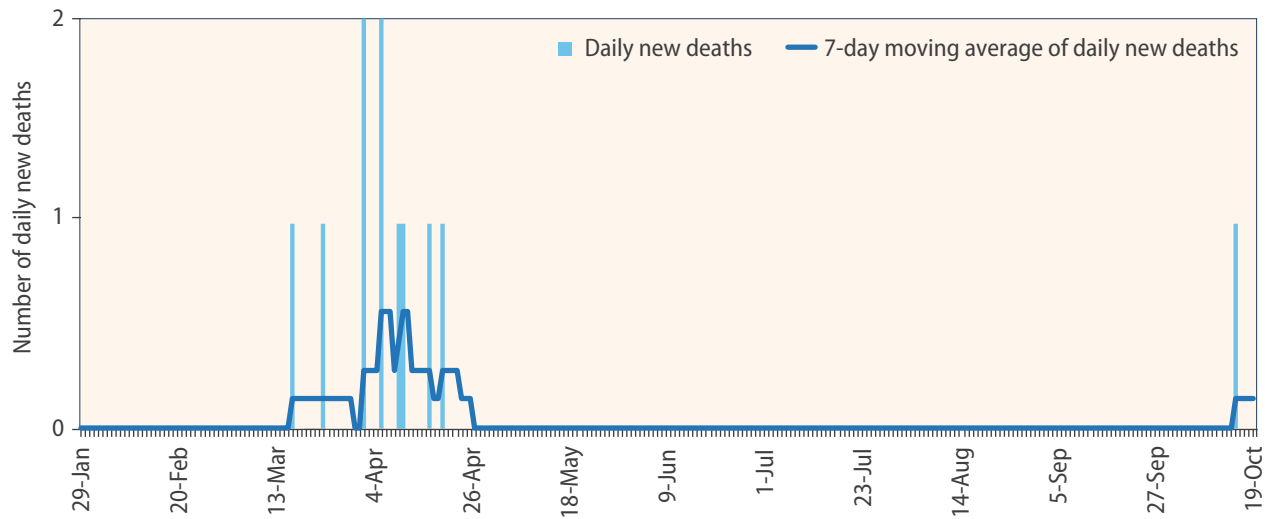


Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Quarantine and treatment in Iceland

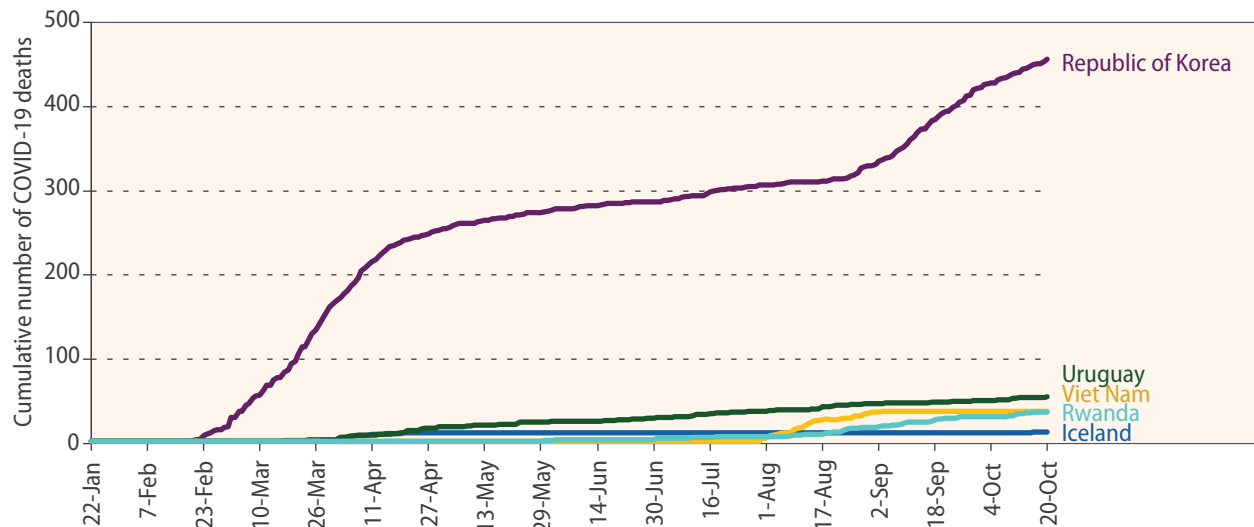
In Iceland, healthcare facilities proved to be more than adequate for those requiring treatment. Its universal healthcare coverage guaranteed treatment for all, with little charge for patients. Actual requirements for treatment turned out to be roughly equal to or a little less than predicted by statistical epidemiological models used by the national authorities.²⁹ As of 15 May, 105 persons were hospitalized, with 27 being placed in intensive care, and of these, 15 requiring ventilators (National University Hospital of Iceland, 2020). By the end of May, all COVID patients in Iceland had recovered. Between 15 June and the end of August, some 100 individuals were placed in self-isolation and 900 in quarantine, but none were hospitalized or had to use ventilators. The number of COVID fatalities in Iceland, despite the recent spike in the number of infections, remained low (Figure 17), and the total number of COVID deaths, as of 20 October, stood at 11 persons (Figures 15 and 18).

Figure 17
Daily and 7-day average number of new COVID deaths in Iceland



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Figure 18
Cumulative number of COVID deaths in selected countries



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Quarantine and treatment in ROK

ROK was also relatively well equipped with physical facilities, healthcare personnel, and access to treatment, as compared with other developing countries and even the OECD countries (Table 3). In fact, in terms of the number of hospital beds and number of doctor consultations per capita, ROK fared better than the OECD average. Its number of beds per population is the second highest among the OECD countries, after only Japan.

Table 3
Health indicators in Republic of Korea and OECD, 2017

	Republic of Korea	OECD average
Health expenditure (per capita, \$, PPP)(2018)	3,192	3,994
Extent of healthcare coverage (per cent) ^a	59.0	73.0
Practicing physicians (per 1,000 persons)	2.3	3.5
Number of hospital beds (per 1,000 persons)	12.3	4.7
Number of doctor consultations (per person) ^b	16.6	6.8

Source: UN DESA compilation, based on OECD (2019).

Notes: ^a Government and compulsory insurance spending, as proportion of total health spending.

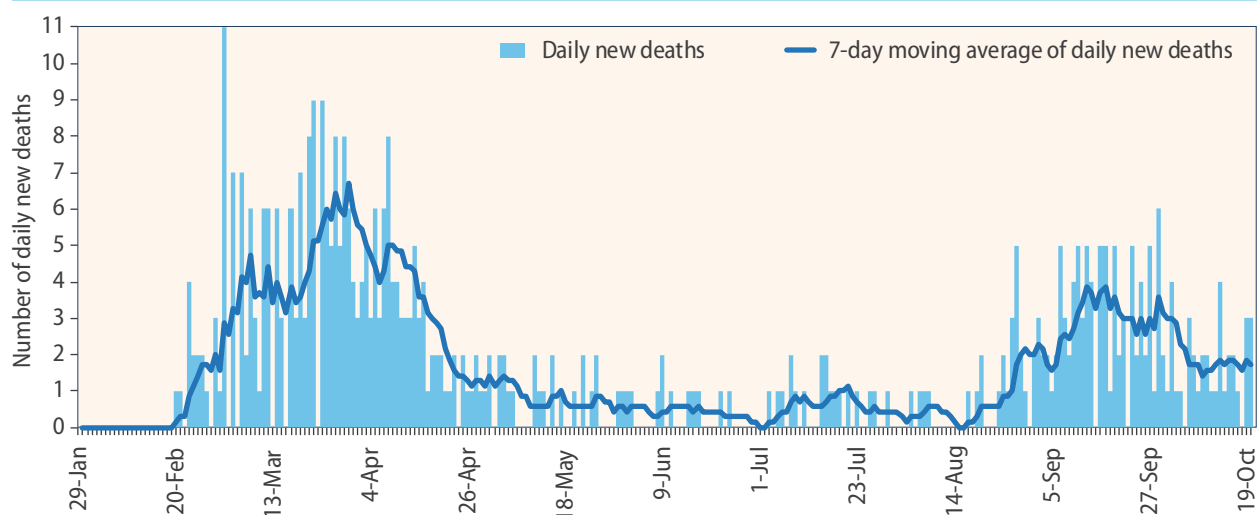
^b The number of contacts with physicians, including generalists and specialists.

ROK also has a universal health insurance, established in 1989; and insurers were integrated into a single-payer system under the National Health Insurance Services (NHIS) in 2000. Everyone is covered either through employment or communities.³⁰ However, as noted above, the MERS experience revealed many weaknesses of the ROK healthcare system, and it was consequently upgraded after 2015.³¹ Furthermore, as previously stated, to remove any remaining cost barrier to treatment, ROK declared COVID as a designated infectious disease, ensuring government coverage of the entire medical and care expenses, including testing, isolation outside hospitals, and treatment in hospitals. Non-Korean nationals living in the country also received these free-of-charge healthcare services.

ROK also paid attention to protection of work and income of people during and after treatment. A qualified patient was entitled to receive social welfare payments from the Government if the patient were not given paid sick leave from her employer.³² The national government and local governments also provided emergency living expenses to those who lost jobs due to COVID. The Government reimbursed medical facilities and clinics for losses incurred from imposed quarantines.

Due to ROK's effective quarantine and treatment measures,³³ the number of new deaths remained limited, despite some increase in late August and early September (Figure 19). The total number of COVID deaths in ROK was 450 (as of 20 October, 2020) (Figures 15 and 18), allowing the country to have one of the lowest fatality rates in the world.

Figure 19
Daily and 7-day average number of new COVID deaths in ROK



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

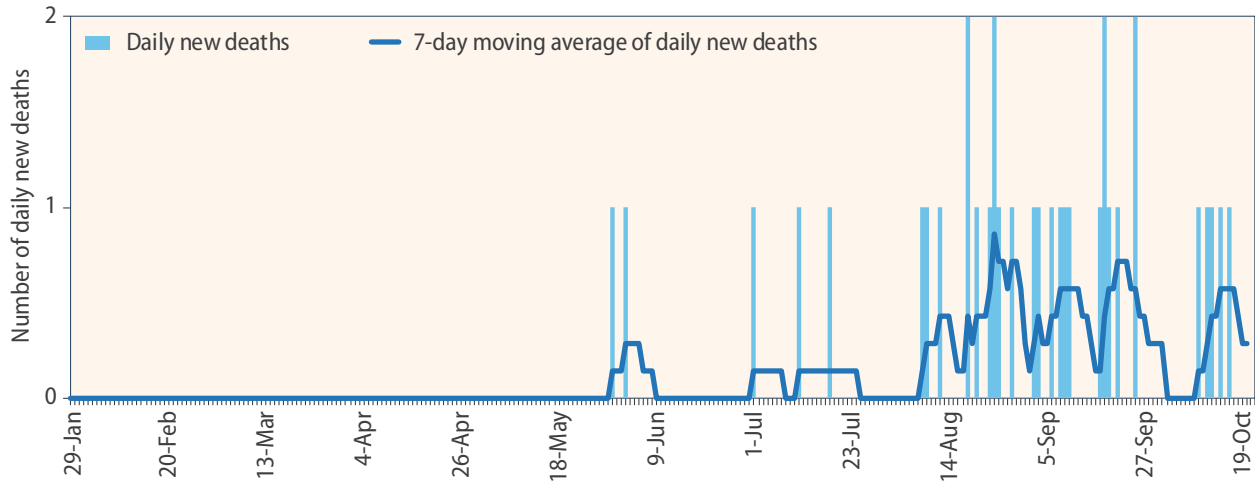
Quarantine and treatment in Rwanda

In Rwanda, all testing and treatment of COVID patients are free of charge. In fact, Rwanda has become, in many ways, a global model for building a strong health system in a low-income country with limited resources. Rwanda is one of the few developing countries to have near universal health coverage, with its community-based health insurance programme reaching more than 90 per cent of the population. Because of the strong COVID prevention and containment measures adopted by the national authorities, which have resulted in a low number of reported cases and deaths, relatively few people in Rwanda required hospital care. Consequently, the hospital system managed to provide care to those individuals who required such support. The authorities, furthermore, set-up 17 treatment centres to respond to demand. The Government, in addition, established occasional drive-through mass testing centres. Anyone testing positive for COVID was immediately quarantined at a dedicated clinic. The previous experience of Rwanda's public health system in dealing with other infectious diseases, such as Ebola and HIV/AIDS, helped the country in responding to COVID. Rwanda largely used — in dealing with COVID — the same infrastructure and personnel that dealt earlier with Ebola and HIV/AIDS.

Rwanda also showed that even a low-income country can make use of high-tech solutions for medical care. For example, because of the low number of medical doctors and nurses in the country, the authorities minimized the risk to health professionals by deploying robots in some COVID treatment centres. These robots had the capacity to perform such tasks as temperature screening, take readings of vitals, deliver video messages and detect people not wearing a mask.

The successful containment strategy, together with efficient quarantine and treatment measures, helped Rwanda to keep the COVID death toll low (Figures 15, 18, and 20).

Figure 20
Daily and 7-day average number of COVID deaths in Rwanda

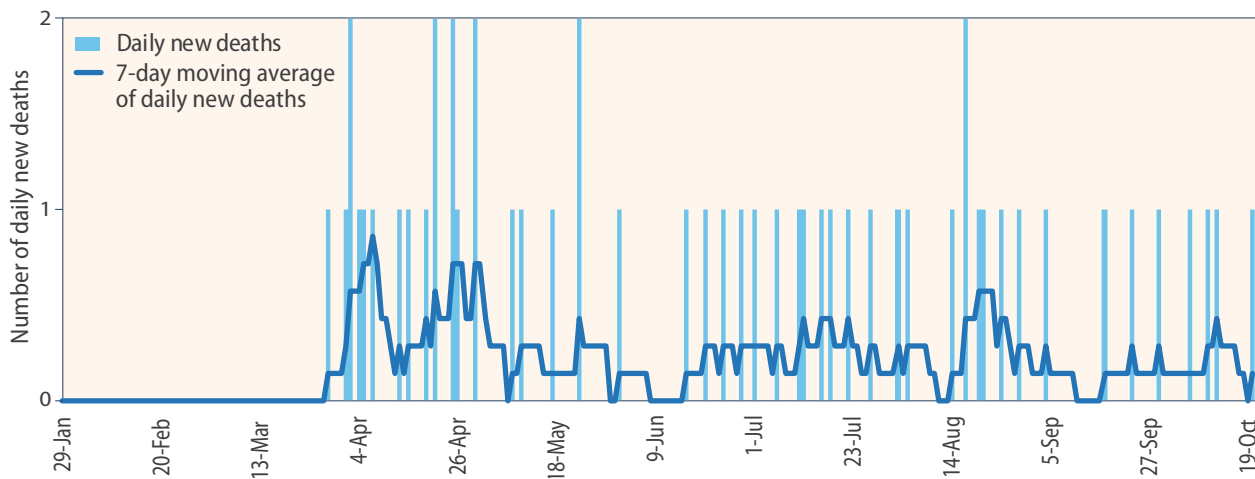


Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Quarantine and treatment in Uruguay

Uruguay avoided extensive lockdown and instead followed more of the TTQ strategy, as noted earlier. The success of this strategy depended on extensive testing, tracing, and quarantining.³⁴ Among all countries of the world, Uruguay has the highest number of tests conducted per new confirmed case. One of the key factors for this success was the development of a domestically produced testing kit. In the backdrop of a shortage of diagnostic kits due to the global demand and protectionist tendencies, the nationally-produced testing kits helped Uruguay increase its testing capacity from 200 tests per day in March to 1,000 tests per day at the end of May. Another factor contributing to Uruguay’s success in testing was the establishment of a diagnostic lab network, which connected 24 laboratories across the country and enabled decentralized testing. The availability of this network helped to cut down the testing time from several days to less than one. Once the prevalence of the infection was lower, Uruguay began pool and matrix-pool testing to maximize efficiency. Under this system, multiple samples were pooled and tested together rather than testing individual samples. In June and July, the number of new cases per day remained below 10 and increased slightly to around 15 in August and September. However, the daily new and cumulative number of COVID deaths remained limited (Figures 15, 18, and 21).

Figure 21
Daily and 7-day average number of COVID deaths in Uruguay



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

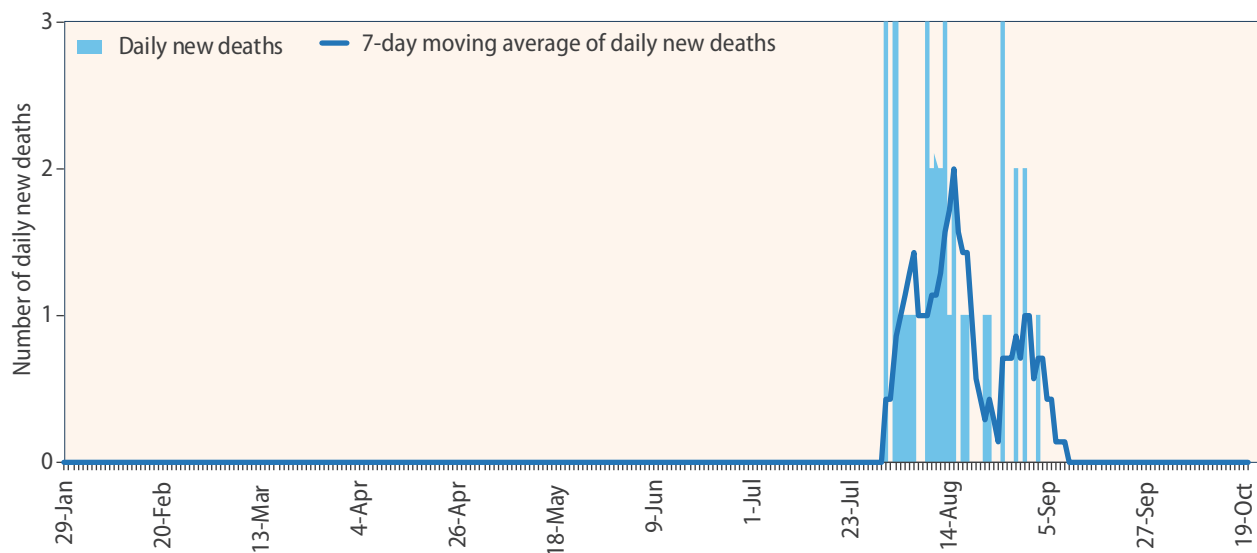
Quarantine and treatment in Viet Nam

Viet Nam's healthcare system, despite its strength in certain areas, was weak in general, and in terms of hospital facilities, in particular. Anticipating the possibility of surges in COVID cases, the Vietnamese Government began setting up, in early February, field hospitals with thousands of beds in major cities and near the border with China. The success in containing the pandemic helped Viet Nam's limited hospital facilities avoid being overwhelmed. It also bought time for the country to produce medical supplies that helped it prepare for a potential second wave of COVID. The country expanded its domestic production capacity to manufacture 7 million fabric masks and 5.7 million surgical masks a day. Vingroup — the country's largest publicly listed corporation — retooled its automotive and smartphone factories, with the plan to produce 55,000 ventilators per month (Jennings, 2020). Viet Nam also sought overseas supplies to improve its readiness. For example, the country imported 200,00 rapid test kits from the Republic of Korea to add to the supply of the locally produced test kits.

As noted earlier, at the time COVID hit Viet Nam, it was yet to achieve universal health coverage, so that some gaps remained. However, to remove any cost barrier to treatment, Viet Nam declared COVID-related quarantine and treatment free of charge. It also took measures to ameliorate any loss of work and income that individuals suffered due to COVID-related quarantine, isolation and treatment.

All these measures helped, first, to reduce the number of people that required treatment in hospitals, and second, to ensure efficient treatment for those who needed it. Until the end of July, Viet Nam had no COVID deaths. Since then, the increase in COVID cases led to some deaths, but the total number of deaths remained low (35, as of 20 October, 2020) (Figures 15, 18, and 22).

Figure 22
Daily and 7-day average number of new COVID deaths in Viet Nam



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

6 Variations in post-treatment and easing measures

As the COVID crisis subsided, countries faced the task of returning to normal and dealing with its aftermath, in addition to ensuring proper burial and funeral services for the dead and supporting the families who lost their loved ones. So far as easing measures are concerned, the situation differed depending on the COVID strategies pursued. For countries that had depended more on lockdown measures, the easing entailed radical changes. By comparison, for countries that depended more on TTQ measures, the change was less radical though important. In both cases, however, the risk of second-round outbreaks remained. In fact, all countries, despite differences in COVID strategy, faced a trade-off between getting back to normal sooner and taking the risk of second-round outbreaks. Each country had to take into consideration its unique situation in deciding about this trade-off. Some countries took more risk and hence witnessed second-round outbreaks of the disease. The review below shows that both common and unique factors influenced a country's trajectory regarding post-treatment and easing measures.³⁵

Post-treatment and easing measures in China

Since China depended heavily on LD measures, ensuring successful unlocking was of vital importance. China reopened Wuhan city on 8 April, a day after China reported no new death in the city for the first time since January. However, a lot of preparatory steps were taken before the reopening. In general, the city authorities adopted a gradual and sequenced approach, while being cognizant of the growing urgency to resume economic activities. In prioritizing specific sectors, regions and population groups, the authorities relied on continuous risk assessment.

The first step toward reopening was to formulate a detailed plan for the resumption of businesses, including the continuation of some containment measures and flexible employment arrangements. To keep the process orderly, businesses were required to apply for government approval to reopen. Leading firms were called upon to coordinate activities in the industrial chain in order to quickly restore full capacity. National and provincial policies were implemented with a view to strengthening the operations of small- and medium-sized enterprises and to providing financial support for service companies. These various strategies were consolidated over time, and by 5 April, three days before ending the lockdown of Wuhan, 94 per cent of the city's almost 11,000 businesses had resumed operations. Schools also reopened in Wuhan starting from 5 May, a key step that made it easier for parents to return to work.

A similar cautious and gradual approach was taken toward easing measures in other cities and provinces in China, though the switch there was less dramatic. In planning and implementing the easing measures, China made use of the phone-based information gathering system that it had put in place during the COVID crisis. Thus, hundreds of Chinese cities required residents to present a "green health code" on a government-sanctioned smartphone app, indicating their COVID-free status, in order to be allowed to leave their residences and enter shops, office buildings and other public places. Not surprisingly, these requirements also caused some problems, and there were reports of residents of Wuhan city and Hubei province facing discrimination in their search for housing and employment in other parts of the country. These experiences illustrate the importance of maintaining focus on social solidarity beyond the containment and treatment measures. The contact tracing apps also allowed the authorities to keep tabs on the movement of users. In some cities, passengers were required to scan their health codes after boarding and when disembarking airplanes and trains so that the authorities could locate them later, if necessary.

Over the summer of 2020, life started to go back to normal in most parts of China. Cinemas, certain parks, libraries and museums were allowed to open with limited capacity and larger gatherings were given permission

to take place. China also gradually loosened its borders, and international flight arrivals to and from selected countries resumed based on their COVID risk profile. However, as the country started to navigate a route to opening up, with increased international travel and public activity, a number of new confirmed cases were reported, with clusters recorded in separate regions. In the second half of August, there were around 15 new confirmed cases daily, all of which were imported ones.

Consequently, several cities and regions were put under strict lockdown for a limited duration and local authorities took immediate action to limit the possibility of a second wave (Figures 2 and 14).

Post-treatment and easing measures in Germany

Unlike China, Germany did not wait until new deaths reached zero to start lifting containment measures. As noted earlier, Germany had built a robust contact tracing and testing system that helped it to contain COVID (The Medical Futurist, 2020). Contact tracing was implemented by local authorities and more than 10,000 people were involved. This robust TTQ capability, together with the adequate treatment facilities, provided Germany the confidence of being able to deal with any serious second-round outbreak of the disease.

Germany started its easing measures at the end of April, when the spread of COVID and the number of deaths had slowed sufficiently to suggest that the goal of zero COVID deaths was within reach. Starting on 27 April, all shops were allowed to reopen but asked to implement measures for controlled access to avoid crowds. Schools were reopened, and most students expected to be back in class before the summer holidays. The German soccer season also resumed, with games being played without an audience.

States were allowed to decide on when and how much to ease restrictions on activities such as bars, clubs, gyms and amusement parks. The decentralized governance structure thus allowed for more flexibility and context-specific unlocking strategies. However, federal authorities required that lockdown measures be reintroduced for hospitals, nursing homes or entire municipalities if they registered more than 50 (35 in Bavaria) new infections within seven days per 100,000 inhabitants.

The re-opening of the economy and public facilities was also subject to people's adherence to social distancing rules. Germany, furthermore, started to reopen its borders with other European countries on 15 June without quarantine requirements. Travel from non-European states was opened in a step-by-step manner based on their COVID risk profile (Kupferschmidt and Vogel, 2020).

Germany was also able to bring students back to school under a system of widespread testing and rapid isolation of infected students and teachers. The system has so far proved manageable. In Berlin, for example, 49 infections were identified in 39 of the city's 803 schools. Notably, no more than 600 students have been isolated on any given day, out of a total number of 366,000.

Post-treatment and easing measures in Iceland

Having reached near-zero condition in terms of both new infections and new deaths by the end of April, Iceland began to ease its COVID measures. The effective contact tracing and testing system that the country put in place gave it confidence to deal with any possible new outbreak. On 4 May, Iceland announced the relaxation of many COVID measures, with restrictions on public gatherings lifted and all shops and schools allowed to open. The Government also announced additional relaxation measures on 25 May, including opening of swimming pools and gyms. The re-opening of the economy and public facilities continued to be subject to people adhering to the social distancing rules. Iceland further announced plans to open the country to all travel from mid-June, with visitors given the option of either undergoing COVID testing upon arrival or be

subject to a 14-day quarantine. All travellers to Iceland would also be requested to download a contact-tracing app (Johnson, 2020). However, as the number of COVID cases grew during the months of July and August with increased international travel to the country, as noted earlier, the Government opted for stricter policies, including introduction on 19 August of the requirement for a mandatory 4-5 day quarantine for all visitors to the country prior to a second test.

Post-treatment and easing measures in the Republic of Korea

With the COVID crisis under control, the Government of ROK became confident to move towards easing measures. ROK initiated easing from the beginning of May. On 5 May, ROK replaced its previous policy of “aggressive social distancing” with new guidelines called “everyday life quarantine.” The guidelines allowed people to engage in certain levels of economic and social activities, as long as they stayed at arms-length, washed hands regularly, and took other precautions. On 13 May, the Education Ministry eased social distancing measures and issued guidelines to facilitate the re-opening of schools and other public facilities. Guidelines were issued to teachers and students on how to maintain proper hygiene and social distancing once classes resumed.³⁶ However, a spike of new COVID cases in May forced the authorities to postpone the planned re-opening of schools on 13 May. On 20 May, however, the senior high school students were allowed to attend classes at school to prepare for the nation-wide college entrance examinations to be held in December 2020. Students from the remaining grades were scheduled to return to school in the following weeks.

Post-treatment and easing measures in Rwanda

Success in containment and treatment helped Rwanda to adopt easing measures with confidence. The Government of Rwanda relaxed most COVID lockdown measures on 1 June, with further easing of restrictions announced on 16 June, following an expansion in testing and tracking capacities. As of October 2020, Rwanda resumed most business operations, including restaurants, hotels, shops, and tourism operations, under specific health guidelines, such as temperature checks and mandatory mask wearing. However, schools and bars (including bars located inside hotels and restaurants) remained closed. National parks were also open to visitors with a negative COVID test. Rwanda also resumed international air travel with entry into the country, conditional on passing a COVID test. Travelers leaving Rwanda were also required to pass a COVID test within 120 hours prior to departure. The Government, furthermore, continued to enforce a curfew between 10 p.m. and 4 a.m., and about 10,000 field workers remained engaged in contact tracing around the country.³⁷

Post-treatment and easing measures in Uruguay

Success in containing the disease allowed Uruguay to go for easing measures early. Already in April, the country began reopening schools. Soon thereafter, restaurants and sports clubs reopened. As of early June, shopping centres were allowed to reopen across the country, with the exception of the region closest to the border with Brazil. The country also began the limited easing of the ban on non-resident foreign nationals entering the country.

Post-treatment and easing measures in Viet Nam

Since Viet Nam made considerable use of LD and shutdown measures, the country was eager to embark on easing of those restrictions. In doing so, Viet Nam relied on the efficient TTQ infrastructure that had been developed to contain the COVID pandemic, as noted above. Viet Nam however followed a slower pace in unlocking and easing the containment measures. By 9 May, all schools had re-opened, but restrictions on the

internal movement of people and public gatherings remained in place, and some economic sectors remained closed. Viet Nam also allowed for some decentralization in decision-making, giving local authorities more autonomy in implementing the unlocking process. The social distancing measures introduced on 1 April were eased on 23 April when most businesses in Viet Nam resumed operations, following no new reported cases. The Government was also discussing in May to resume granting e-visas from 1 July to citizens of 80 countries. Viet Nam, in addition, is in discussions with China and ROK about opening travel corridors among the three countries.

7 COVID experiences of Brazil, Italy, and South Africa

To complement the in-depth studies of the seven better-performing countries above, the paper reviews briefly the experiences of a few other countries which were not as successful in combating COVID. These countries are Brazil, Italy, and South Africa. While Italy is a high-income country, Brazil and South Africa are middle-income countries from Latin America and Africa, respectively. The experience of Italy provides a useful counterfoil to the experience of Germany, studied in-depth above. To facilitate comparison with the experience of the better-performing countries, the analytical scheme presented in Figure 1 is used, by and large, to analyze the experience of these three countries too.

COVID experience of Brazil

COVID spread in Latin America significantly, with some countries, such as Brazil, Peru, Mexico, Chile, and Colombia, witnessing high numbers of COVID cases and deaths, both in terms of total and per million of population. Among them, Brazil tops the list in terms of both the total number of cases and deaths. In fact, as of 20 October, 2020, Brazil ranked second in the world in terms of COVID deaths, with a total of 154,837 (Figure 15), or 739 per million persons — a rate that is higher than that of the USA (616).

Risk identification

There were two main sources of COVID risk for Brazil. One was represented by Brazilian citizens returning from China, which is the country's largest trade partner. The second was Brazilians and visitors from those parts of Europe, particularly Italy, where COVID had already spread. On 5 February, Brazil sent two planes to bring home its citizens who were residing in Wuhan. The first confirmed case — a returnee from Italy — was reported on 25 February. The second confirmed case was also from Italy. However, the Government, particularly at the federal level, was reluctant to recognize COVID as a serious threat, and as a result the disease spread rapidly. In the first weeks, the spread was mainly in wealthier areas, but the transmission gradually spread to poorer neighbourhoods, with devastating impact. By 21 March, COVID cases were reported in every state of Brazil.

Against the backdrop of limited national coordination by the federal authorities, the state governments developed their own response strategies to deal with COVID. Brazil's mayors and state governors implemented measures to restrict the movement of people and encouraged social distancing, but the contradiction between local officials and the President fuelled confusion. While local officials and the health sector adopted risk management measures such as social distancing, conflicting statements from the President undermined the conditions for risk mitigation.

Containment

Towards the end of March, Brazil started to take more vigorous containment measures. For example, on 27 March, a temporary ban was imposed on foreign air travel and flights were authorized only under certain conditions. Schools were also closed in some cities (e.g. Rio, Goiás, Sao Paulo, and other cities) and only authorized stores were allowed to be open until further notice. Restaurants, sports and events were not allowed to open, as these were not considered essential services.

The Government took some additional measures to facilitate containment. For example, on 23 March, the Federal Government published a provisional measure aimed at promoting remote working and the use of vacations and holidays, etc. The Government also took fiscal measures on 26 March to help the unemployed, informal workers and professionals, and mothers responsible for supporting a family. These measures included temporary income support to vulnerable households through expansion of the *Bolsa Familia* program to cover more than a million additional beneficiaries and through the adoption of the temporary *Auxilio Emergencial* (AE) program, providing employment support to workers, who were laid off or whose working hours were cut. On June 9, Brazil declared the creation of the *Renda Brasil* program, which would unify several social and income distribution programmes. On 16 June, the Senate unanimously approved the provisional measure that allowed companies to reduce their working hours with a proportional decrease in wages. The objective was to preserve jobs and income of workers and also to help companies face the economic crisis caused by the COVID pandemic.

At the same time, Brazil's President continued to downplay the danger presented by COVID, terming it as a kind of flu and suggesting that the body constitution of Brazilians was strong enough to withstand it. He supported this proposition by alluding to the fact that he himself contracted COVID and recovered without much difficulty. As a result of this ambivalence, Brazil, in early June, began averaging about 1,000 deaths per day from COVID, joining the United States — and later India — as the countries with the world's highest death tolls.³⁸

On 19 June, the federal government issued an ordinance to prevent, control and mitigate the risks of transmission of COVID in work environments. It contained general guidelines, including the requirement of immediate removal, for 14 days, of workers who were confirmed or suspected cases of COVID and also of those who had contact with confirmed cases of the disease. It was stipulated that, during the removal period, the remuneration must be maintained by the employer-company. If employees were asymptomatic for more than 72 hours and a laboratory test proved negative, it was possible for them to return to work before two weeks were over. However, testing was rolled out at a slow pace, and in June Brazil reported 7,500 tests per million people, which is almost 10 times less than the United States and 12 times less than Portugal at the time.³⁹

Quarantine, treatment, and easing measures

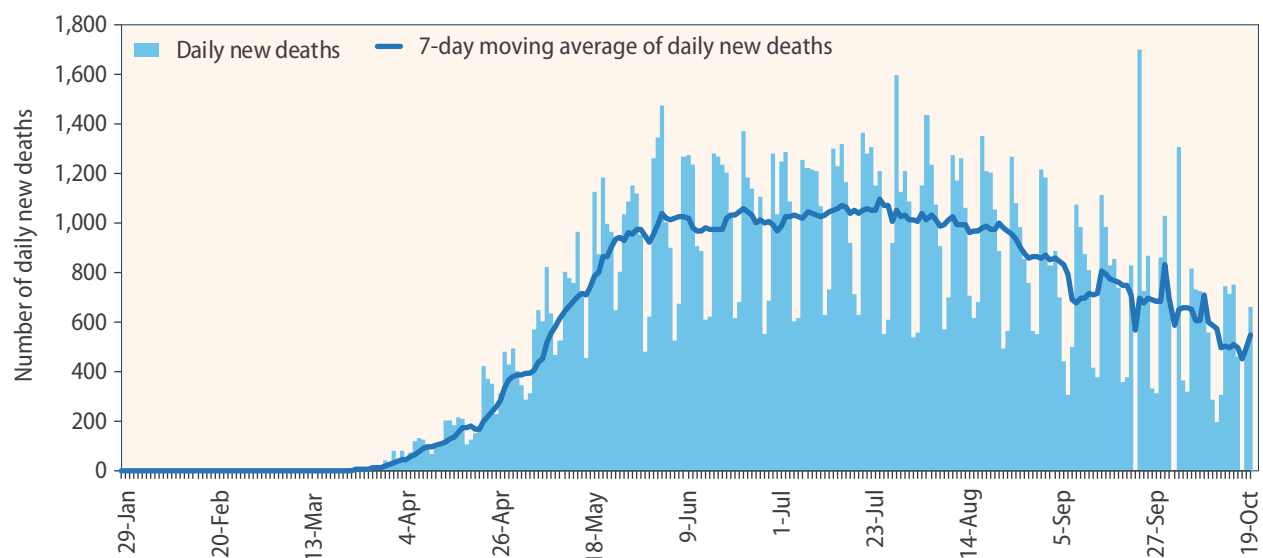
Eventually, almost all of Brazil's more than 5,600 cities reported COVID cases. Many patients were not cured by quarantine and needed treatment, for which Brazil lacked adequate facilities. More than 90 per cent of Brazil's cities lack intensive care units, and more than half did not have ventilators.

In Brazil, the majority of the population receives primary care from the Brazilian Public Health System, but most of the intensive care unit (ICU) beds are in private health facilities. There is also a large difference in the number of available ICU beds across the states. In some of the states of Brazil, such as Amazonas, Pernambuco and Ceará, the healthcare system was on the verge of collapse in June with 100 per cent of ICUs beds occupied.⁴⁰ The situation in the hospitals has also been very difficult in large cities, in particular in Sao Paolo, contributing to the high death rate in the country.

As a result of high infection rates and inadequate treatment facilities, Brazil witnessed large numbers of COVID deaths, with the daily number of new deaths exceeding 1,000 during June–August (Figure 23). Though this number has been declining since then, it remained around 500 in mid-October, with the cumulative numbers of COVID cases and deaths increasing steadily (Figures 3 and 15). The pandemic still remained to be brought under satisfactory control in Brazil.

Figure 23

Daily and 7-day average number of new COVID deaths in Brazil



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

With the decline in the number of new cases and deaths,⁴¹ there were now plans to reopen schools in cities, so that in-person classes could resume in November.

Inequality

A particular feature of Brazil's experience with COVID pertains to inequality. Brazil is well-known for high income inequality, with a Gini index value of 53.9.⁴² A recent survey by the Brazilian Institute of Geography and Statistics found that Brazilians of African origin were twice as likely as the white population to have COVID symptoms.⁴³ The study also found that the former were more likely to lose their jobs or face pay cuts than white workers during the pandemic. Broadly, the death rate in Brazilian poorer cities has been substantially higher than in the richer ones.⁴⁴ The most vulnerable population groups have had a higher probability to be infected because of their need to continue to work in person and due to the inequalities in living conditions. The loss of income due to the crisis affected disproportionately self-employed workers, mainly low-skilled employees in the services, retail, and construction sectors. These people also had no or only precarious healthcare. The overlap of racial inequalities with income and educational inequalities exacerbated the disparities in the risk of infection, while the persistence of unequal access to healthcare increased the severity of illness and the number of deaths. Meanwhile, COVID deepened the income inequality between rich and poor through its lasting economic and social impacts, thus creating a vicious cycle.

COVID experience of Italy

Italy is one of the developed countries that suffered badly from the COVID pandemic. As of 20 October, 2020, the number of COVID cases and deaths per million of population stood at 7,188 and 607, respectively. By comparison, Germany's corresponding numbers were 4,586 and 119.⁴⁵ Thus compared to Germany, not only did Italy have more COVID cases, it also was less successful in treating the infected, resulting in much higher death rates. This dissatisfactory performance was in part due to the lack of effective initial response.

Risk and initial spread

Italy was the first country to be severely hit by COVID after China, with which the country has considerable trade, investment, and other economic links. The source of COVID risk for Italy was primarily Chinese workers returning to their jobs in Italy. The initial ineffective response led to a surge in the number of COVID deaths in Italy, reaching about 30,000 by early May (Figure 15). Almost half of the deaths reported in Italy were recorded in the Lombardy region, of which Milan is the capital. It is estimated that some 150 doctors in Italy died from COVID.

Containment

The initial ravage by the COVID in March and April persuaded Italy to adopt draconian containment measures. It began with “quarantine measures” imposed on 8 March in northern Italy, affecting 16 million people. The next day, the Government extended the measures to the rest of the country, because people from northern Italy started moving to other parts of the country to avoid the measures introduced. Thus started what came to be known as the “national quarantine” that included a ban on non-essential travel and public meetings; limitations on free movement; closure of non-essential commercial and retail businesses; closing down of schools and universities; placing infected persons under quarantine and surveillance; and shutdown of all non-essential industries. These quarantine and lockdown measures, lasting in Italy between 9 March and 3 May, are considered one of the most drastic measures implemented by any country outside China to combat COVID. The compliance was far from being universal. For example, between 11 and 17 March, some 700,000 citizens were stopped and checked, of which 43,000 were found to have violated the quarantine. Nevertheless, these measures had the desired effect, and Italy moved from having one of the highest infection rates in Europe in March to one of the lowest during the summer months. For example, the daily number of new COVID deaths declined from 969 on 27 March to five on 27 July.

Treatment

The daily number of people requiring hospitalization (excluding intensive care units) in Italy because of COVID increased from 101 on 24 February to a peak of 29,010 on 4 April. Such a sudden large increase in the demand for hospital care overwhelmed Italy's healthcare system, and the country had to appeal for help from other countries. However, as noted above, the “national quarantine” — from 9 March to 3 May — helped to reduce drastically the number of infections, so that the number of COVID, non-ICU hospitalizations declined to 768 on 13 July and remained below 900 until 20 August. A similar pattern can be observed for patients in ICUs. The number of COVID patients in ICUs increased from 26 on 24 February to a peak of 4,068 on 3 April. The “national quarantine” helped this number to decline to 65 on 13 July.

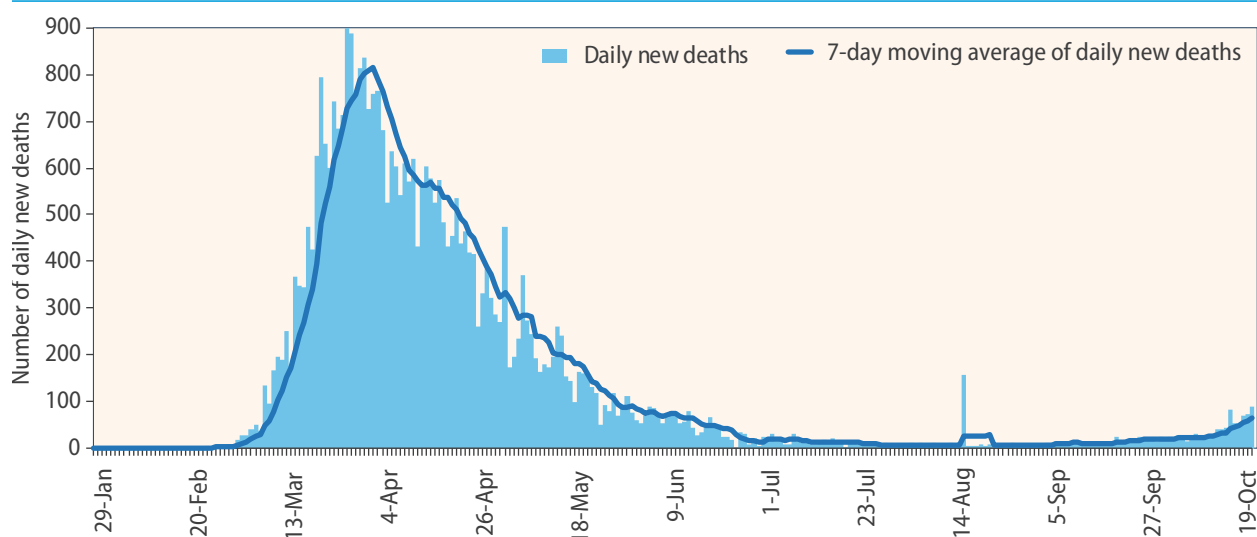
Second-round outbreak?

The summer reopening of businesses and civic life and increased domestic and international travel led to a resurgence of COVID in Italy. By 22 August, the daily number of new COVID cases bounced back to 1,071, the first time this figure exceeded 1,000 since May, when the Government eased the lockdown measures.

According to the National Institute of Health, some 20 per cent of recent cases stem from people who traveled abroad. Similarly, the number of COVID patients in ICU rose and reached 107 on 1 September. In view of the situation, the Italian Government reintroduced restrictions on daily life with effect until 7 September, by ordering the closure of nightclubs and mandating mask-wearing in public transport and in public spaces, including shops, hospitals and clinics, as well as maintaining a social distance of at least 3 feet. As of 20 October, the daily number of new COVID deaths was still on the increase (Figure 24). It therefore remains to be seen how soon Italy can finally come to grips with the pandemic.

Figure 24

Daily and 7-day average number of new COVID deaths in Italy



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

COVID experience of South Africa

The continent of Africa witnessed a significant spread of COVID, with countries such as South Africa, Egypt, Morocco, Ethiopia, and Nigeria witnessing large number of COVID cases and deaths. Among them, South Africa ranks first in terms of both the total number and per million of COVID infections and deaths. As of 20 October, the total number of COVID cases and deaths in South Africa stood at 706,304 and 18,656, respectively, implying 11,863 cases and 313 deaths per million of population, respectively (Figures 3 and 15).

Risk identification

The source of COVID risk for South Africa was two-fold. One was China itself, with which the country has significant trade relations. The other was parts of Europe where COVID had already spread. Indeed, the first confirmed case of COVID in South Africa, reported on 5 March, was a male returning from Milan, Italy on 1 March. The first case of local transmission was reported on 15 March, before the country undertook any serious measure to stop the risk at the border.

Containment measures

Realizing the risk, the South African government geared up its action. On 15 March, the President of South Africa declared a state of emergency. On 18 March, schools and most universities were closed. On 19 March, the Government introduced price controls on essential items after panic buying was reported. On the next day, the Tambo International Airport in the capital city instituted isolation of foreigners on arrival and returned

them to their countries of origin. On 23 March, a national 21-day lockdown (Level 5) was announced to begin on 26 March and to hold until 16 April, along with the deployment of the National Defense Force. On 9 April, the lockdown was extended to the end of the month. On 10 April, the Health Minister recommended the use of facemasks in public. On 13 April, the Government indicated that the lockdown had been effective in delaying transmission. In March, there were 1,353 confirmed cases and 5 deaths. Rates of new infections fell to an average of 5,000 a day from a peak of 12,000 a day. The lockdown is also credited for fewer deaths from road accidents and homicides.

In view of the progress above, the lockdown level was eased on 1 May to Level 4 to allow people to go to work with a permit. Public transport service resumed and the curfew hours lasted from 20:00 until 5:00. On 1 June, the level of lockdown was lowered further to Level 3.

Various lockdown and restriction measures, as described above, did help to contain the disease. The number of new confirmed cases declined significantly in August, after the July peak (Figure 25). Accordingly, the lockdown was lowered to Level 2 on 17 August, following which the inter-provincial travel ban was lifted; restaurants and bars were allowed to open; and restrictions on tobacco and alcohol sales were lifted. As of September, the country expected to lower the lockdown to Level 1, meaning most normal activities would be allowed to resume with precautions.⁴⁶

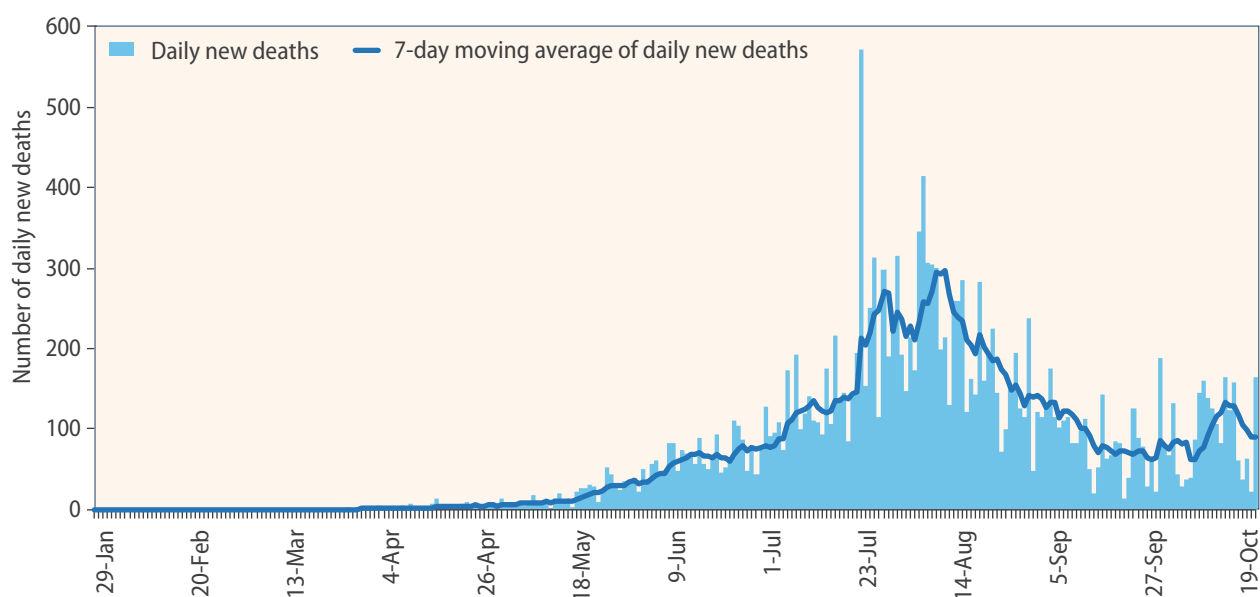
Quarantine and treatment

National responses of South Africa to COVID comprise multiple and overlapping stages.⁴⁷ The first stage focused on preparing the country for COVID by putting in place adequate testing capacity. At a later stage, the government deployed more than 28,000 community health workers to conduct house-to-house search in highest-risk communities to find COVID cases. The country took advantage of its existing tuberculosis control protocol and community contact-tracing teams and used them for monitoring COVID spread. A mobile phone app was used to administer a symptom checklist, and household data, including location coordinates, were used to map screening coverage. Individuals who showed COVID symptoms were then referred to mobile testing stations or health facilities. Up to mid-June, the public sector institutions, including the National Institute for Communicable Diseases and the National Health Laboratory Service, led the polymerase chain reaction (PCR) tests. As time passed, the number of test sites in private hospitals and clinics increased, so that by August the majority of the tests were conducted in the private sector. As of early September, about 3.8 million tests were conducted.

The South African guidelines issued in May 2020 stated that if quarantine was administered by the authority, an individual must enter into a designated quarantine facility.⁴⁸ It also made self-quarantine acceptable provided that certain criteria, including access to a separate room for self-isolation and the ability to contact and/or return to a health facility — if health conditions worsened — were met. The contact tracing protocol, mentioned above, was also used to monitor compliance with quarantine requirements.

Despite deep concerns that hospitals would be overwhelmed during the peak of the pandemic, most hospitals were able to take care of the patients they received, and the official death toll of about 15,000 as of mid-September — while high — was lower than the even most optimistic predictions.⁴⁹ It is unclear what led to the better-than-expected outcome. According to Professor Salim Abdool Karim, chair of the South African government's COVID-19 advisory panel, possible factors include pre-existing immunity to common coronavirus, warmer temperature, younger demographics, and early lockdown, etc.⁵⁰ Despite the measures and factors above, South Africa continues to experience new COVID cases and deaths each day (Figure 25), so that the cumulative numbers of COVID cases and deaths continue to increase (Figures 3 and 15).

Figure 25
Daily and 7-day average number of new COVID deaths in South Africa



Source: UN DESA, based on data from Johns Hopkins Coronavirus Resource Center.

Inequality and trust in government

With one of the world's highest levels of economic inequality and widespread poverty, South Africa faces challenges in providing a significant part of its population adequate healthcare, electricity, and water. Combating COVID in South Africa therefore posed a big challenge. The economic disparity, together with other factors, led to relatively low trust in the government, undermining the extent to which the public complied with the COVID containment policies.⁵¹ Empirical data from the pandemic show the debilitating effects of economic inequality on public health outcomes. For example, researchers — using data from the National Income Dynamics Study-Coronavirus Rapid Mobile Survey — found that poor populations were disproportionately affected by the adverse health effects of COVID.⁵² The negative relationship between income level and health was found to be stronger in the case of COVID than in previous health crises in South Africa, possibly due to the unprecedented scale of economic disruption, including the nationwide lockdown, caused by COVID.⁵³ Overall, COVID proved to be a challenge for South Africa. Though the death toll was less than the worst prediction, it was quite high and continued to increase.

8 COVID strategies and their determinants across countries — Findings and lessons

Sections 3 to 7 above offered analyses of COVID experiences of ten countries. Of these, seven countries — China, Germany, Iceland, ROK, Rwanda, Uruguay, and Viet Nam — are generally regarded to have performed better in dealing with the pandemic, at least during its first outbreak. The remaining three — Brazil, Italy, and South Africa — are countries that are generally regarded not to have performed well in dealing with COVID. The analysis was conducted using a common framework that distinguished four stages of COVID response — namely identification of risk; containment; treatment; and post-treatment and easing measures. The goal was to identify the main determinants of COVID responses and the channels of their influence. The insights and lessons offered by these analyses can be summarized as follows.

Difficult to beat an early start

An early start in response can give a country a huge advantage in containing COVID. This is borne out most prominently by the experience of Viet Nam, and is also supported by the experiences of Iceland, Republic of Korea, and Rwanda. Germany allowed some delay in ratcheting up its response between mid-January and early March, and hence suffered from more spread than initially expected. China's initial response also had some delay, with serious consequences. The consequences of delaying the response are most clearly illustrated by Brazil, the federal government of which did not want to recognize the gravity of the COVID threat, and now (20 October, 2020) has the second highest number of deaths caused by the pandemic in the world.

The starting point influences the type of strategy that may prove effective

Whether a country starts early or not also plays an important role in determining which COVID containment strategy is more appropriate for it. Countries with an early start have a greater chance of success with TTQ, as exemplified by the experiences of Iceland, Republic of Korea, Uruguay, and Viet Nam. By contrast, for countries starting late, drastic lockdown measures become almost unavoidable, as has been the case with China and Italy.

TTQ and LD strategies are not mutually exclusive

The TTQ and LD measures are not mutually exclusive. Some countries that start off with TTQ may also need to resort to LD and shutdown measures, as has been the case of Germany. Conversely, countries that impose a lockdown may also need to undertake TTQ measures, like in the case of China. The relative emphasis on TTQ and LD measures may also change over time, even for a single country. For example, at some stage Viet Nam needed to impose lockdown measures for a brief period and in a limited scale, though by and large it stuck to TTQ strategy to deal with COVID. The same is the case with Rwanda.

Healthcare system — most important determinant of COVID success

The healthcare system is the most important proximate determinant of COVID success. The system has to ensure (i) an adequate supply of healthcare materials, equipment and physical facilities; (ii) an adequate supply of healthcare personnel; and (iii) the removal of cost barriers to testing and treatment. Countries may differ in their initial capacity with respect to these requirements. However, carefully devised strategies can allow them to offset weaknesses in some respects with strengths in other respects.

Social protection — another important determinant of COVID success

Adequate social protection is another important determinant of COVID success. Without protection of income, it becomes difficult for people to be away from work while they self-isolate, quarantine, or receive treatment. Without protection of income, it also becomes difficult for people to comply with lockdown and shutdown measures. Ensuring adequate social protection is therefore a pre-condition for success in dealing with a pandemic like COVID.

Emergency measures are needed to fill gaps in healthcare and social protection systems

Even countries with highly developed healthcare and social protection systems faced gaps in confronting the extra-ordinary situations created by a pandemic such as COVID. Germany, Iceland and ROK — all with excellent healthcare and social protection systems — needed to take emergency steps to bridge the gaps. To

overcome gaps in physical facilities, China built new hospitals on an emergency basis. Countries with larger gaps will do better taking steps in advance. Also, strategic thinking may be more important to them. For example, Rwanda and Viet Nam took early, pro-active, and energetic measures to stop the disease at the border so as to prevent gaps in its healthcare facilities from becoming a handicap in dealing with the COVID challenge.

Low income level is not an insurmountable barrier to successful COVID response

Low income level is not an insurmountable barrier to success in dealing with COVID. This was best shown by Rwanda and Viet Nam, which — through their early start and energetic efforts to stop the disease at the border — reduced the incidence of infection; created low-cost test kits in great supply for wide application; set up field hospitals as a low-cost quarantine option; and used mobile phone technology for effective public communication, even in the face of limited broadband Internet penetration.

Governance system — an overall determinant of COVID success

The governance system serves as the basis for a country's overall COVID performance. Whether or not a country can have an early start; devise a coherent and visionary strategy and implement it efficiently; establish effective communications with the public, enjoy its trust, and enlist its active cooperation; ensure cooperation of the experts; etc. — all depend on the overall strength and quality of a country's governance system. Countries may differ markedly regarding their political system, extent of decentralization, nature of bureaucracy, etc. However, they all need to ensure a minimum level of responsiveness and efficiency of their governance systems. Different paths are possible in this regard. For example, when differing COVID responses of its sixteen states became a problem in Germany, the political parties of the country decided to cooperate in passing the Infection Prevention Act that provided the federal government with emergency powers to bring uniformity to the national COVID response. The presence of grassroot-level governance structures, such as neighborhood committees and village governments, proved to be of much help for China and Viet Nam in implementing both LD and TTQ measures. Overall governance capability also played an important role in the COVID performance of Rwanda. However, governance systems have to be indigenous, and what works for one country may not do so for others.

Inequality can increase the number of COVID cases and deaths

Inequalities and disparities in society can be an additional force driving up the number of COVID cases and deaths. This is borne out by the experiences of both Brazil and South Africa, where pre-existing inequalities in income, access to healthcare, and coverage of social protection played an important role in raising the rates of COVID infection and death.

Unique country-specific determinants can play an important role

Though healthcare, social protection and overall governance systems are the common and main determinants of COVID performance, some unique, country-specific determinants can also play an important role. Thus, the SARS experienced of 2003 and the MERS experience of 2015 helped Viet Nam and the ROK, respectively, to confront COVID more efficiently. However, the role of these unique factors was mediated through the three main determinants. Thus, the MERS experience prompted ROK to upgrade its healthcare system, including its physical facilities, rules and regulations, institutional arrangements and the health insurance

system. Similarly, the SARS experience made Viet Nam bolster its capacity for prevention; detection and reporting; and responding to epidemic spread; and altogether to have a more robust health system. The previous experience of Rwanda with Ebola and HIV/AIDS also greatly influenced its quick response to COVID. In the same vein, the persistent threat of earthquakes and volcanic eruptions has led Iceland to improve emergency preparedness regarding both the healthcare and overall governance system. In addition, cultural and social factors and lifestyle and habits also affect disease transmission. The unique determinants can be useful only to the extent that a country uses them to make such improvements in their healthcare, social protection, and governance systems as are necessary for dealing with pandemics, such as COVID.

Technology has an important role to play

ICTs can play an important role in successfully dealing with COVID. This role is wide-ranging, extending across decoding the genome of the virus; devising test kits; building hospitals in record time; implementing TTQ measures; devising and manufacturing necessary medical equipment; engaging in effective communication with the public; etc. Even in technologically less-developed countries, apps downloaded to smartphones could be used for both collecting information from the citizens and disseminating information to them. The experiences of Rwanda and Viet Nam showed that countries with low per capita income can also use new technologies — such as apps and drones — in dealing with COVID. In technologically advanced countries, digital technology helped the tracing of potentially infected persons. However, privacy concerns and cultural norms play an important role in determining the extent to which this potential can be tapped.

Relevance of COVID lessons for the future

Many developing countries that have avoided a major COVID outbreak so far may face such a pandemic in the future. On the other hand, countries now undertaking unlocking and easing measures face the risk of second-round outbreaks. The danger of COVID will not be over until an effective vaccine is invented and widely available. Hence, the insights gathered from the COVID experience will remain relevant for a long time to come. Furthermore, as many observers have pointed out, COVID may just be the latest in a series of epidemics and pandemics that are becoming more frequent due to the increasing pressure of human societies on animal habitats and wildlife.⁵⁴ That being the case, the findings, insights and lessons summarized above will be relevant even after the COVID pandemic is over.

9 Concluding remarks

This paper presents an in-depth study of the COVID experience of ten countries. Of these, seven countries — China, Germany, Iceland, ROK, Rwanda, Uruguay, and Viet Nam — are generally regarded to have performed well in dealing with the pandemic, at least during its first outbreak. The remaining three — Brazil, Italy, and South Africa — are countries that are generally regarded not to have performed well. The study was conducted using a common analytical framework that distinguishes four stages of COVID response — namely identification of risk; containment; treatment; and post-treatment and easing measures. The goal of the study is to identify the main determinants of COVID responses and the channels of their influence.

The broad lessons emerging from the study include the following: (a) early start is of crucial importance; (b) whether a country can start early or not determines which coping strategy is more appropriate; (c) the two broad strategies of dealing with COVID — namely Lockdown and TTQ — are not mutually exclusive, though it is possible to put more emphasis on one or the other at a particular point in time, depending on the

concrete situation; (d) low income level is not a barrier to confronting COVID effectively; and (e) smart use of technology can play an important role in dealing with the pandemic.

The study also shows that healthcare and social security system are the two important proximate determinants of COVID performance, with the former being the most important one. The overall governance system affects the COVID performance both directly and through its influence on the healthcare and social protection systems. The paper notes that unique, country-specific factors can play an important role, though this role is mediated through the above three determinants. The study also shows that inequalities with respect to income, access to healthcare, and coverage of social protection can be an additional factor driving up the number of COVID cases and deaths. At the same time, the impact of COVID aggravates pre-existing inequalities, so that a vicious cycle characterizes the relationship between COVID and inequality.

The study also shows that no matter how developed a country's healthcare, social protection, and overall governance systems are, many weaknesses and gaps surface in the face of a pandemic. Consequently, all countries should be ready to undertake emergency measures to overcome the weaknesses and fill the gaps.

Finally, the study shows that creating universal healthcare and social protection systems should be taken up as an urgent task by all countries, including low-income, developing countries. COVID has shown that the global public healthcare system can be only as strong as it is in the weakest country. Consequently, it is in the enlightened interest of developed countries to help developing countries to strengthen their public healthcare systems. The study also points to reduction of inequality as an important task for mitigation of the effects of future epidemics and pandemics.

Despite the wide range of experiences covered in this study, the investigation of the issues considered in this paper can be extended further by bringing under examination the COVID experience of more countries. Such extensions can proceed in different directions. First, qualitative and case studies, as conducted in this paper, may be extended to other countries. Second, quantitative analysis, including a regression framework, may be conducted using data from a larger number of countries. There is a trade-off between the insights that in-depth qualitative studies generate and the statistical inferences that quantitative studies produce. Both have their merits and demerits. Future studies of both these strands can enrich our understanding of how best to avoid and confront pandemics such as COVID and other zoonotic pandemics that, according to many scientists, will become more frequent unless important corrections are made soon in human interaction with nature (Andersen, 2020).

Endnotes

- 1 The first confirmed case in Germany came (on January 27) by way of a woman from Shanghai who contracted the virus in China from relatives visiting from Wuhan. The woman then spread the virus to several of her colleagues in Germany during a work trip. Even then, officials considered the arrival of the virus as a manageable and containable peril.
- 2 Rwanda is one of the smallest countries in Africa, with a population of about 12.5 million people and a per capita income of \$900. It was in the middle of an economic boom prior to the COVID pandemic, experiencing a GDP growth rate of nearly 10 per cent in 2019. The pandemic, however, is expected to reduce the GDP growth rate in 2020 to somewhere between 2.0 and 3.5 per cent.
- 3 Nguyen (2020) provided a detailed analysis of the profile of COVID patients. It shows that the earliest confirmed cases of COVID involved Vietnamese or foreign nationals who had travel history associated with Wuhan in China, whereas the spike of confirmed cases in early March started with many cases imported from Europe. As the pandemic situation has stabilized, the Government began to relax certain international flights starting from end-April.
- 4 The volume of trade by land was small relative to that by air and sea. The permission to travel was limited to those living in the regions closest to the border, and incoming travelers were obligated to undergo a 14-day quarantine.
- 5 Wuhan airport was not closed off completely, and some flights were allowed to take off.
- 6 Persons who contracted the virus in Wuhan (or in Hubei province) and moved out before the lockdown might have caused the spread of the virus to other parts of China. Also, the lockdown of Wuhan was announced at 2 am with effect from 10 am on January 23. It is estimated that about 300,000 people left the city during that small window of time. Some of them might have contracted COVID in Wuhan city and Hubei province and then spread it elsewhere in China.
- 7 Among these were the obligation to wear facemasks when in public, a ban on outdoor congregation, social distancing, and various restrictions regarding venturing out of homes.
- 8 The following types of restrictions were observed.

Restrictions on the number of outside trips: Under this system, only one person from each household was permitted to go outside for provisions once every two days, except for medical reasons or to work at shops or pharmacies.

Closed management of communities (fengbishi guanli, in Chinese): Under this system, the communities would keep only one entrance and exit point open, and each household was allowed a limited number of entries and exits. In some places, nighttime access was prohibited altogether, and in certain cases, even daytime exit and entry were further restricted. People entering and leaving were required to wear masks and receive temperature tests. By February 12, 2020, a total of 207 cities (including 26 provincial capitals and sub-provincial cities) announced the implementation of closed management of communities.

Restrictions through technology: Under this system, citizens were required to download to their mobile devices particular apps, including for facial recognition, to allow authorities to monitor their movements, the people with whom they interacted, and their health conditions. The data obtained through these electronic means, together with other relevant information, allowed the authorities to determine how much risk a particular person posed from the viewpoint of COVID transmission.
- 9 China also increased the use of online platforms for social security services (e.g. for unemployment insurance) to avoid physical contact for claim approval, payment, and related services. The Ministry of Human Resources and Social Security issued a notice on managing social insurance services during the COVID outbreak. It requested the social insurance administrations at all levels to consult with financial departments and explore ways to secure pensions paid monthly through online services.
- 10 The seven-day trailing average of newly confirmed cases has been less than 1,000 per day since May 6, down from over 5,000 in early-April.
- 11 For example, in some cities, people were forbidden from going to stores but not to the park. In other cities, the rules were just the opposite
- 12 See Marx and Bishop (2020).
- 13 The country does not have private health insurance. In 2018, health spending per capita was \$4,349 according to the OECD. There were also 2.9 beds available for every 1,000 people. Life expectancy at birth is about 82 years. In a study conducted by the British Medical Journal Lancet in 2017, Iceland's healthcare system was ranked the second-best in the world in terms of access and quality of service.
- 14 In these drive-through testing centres, drivers remain in their cars as they answer a brief questionnaire, have their temperature taken and are swabbed inside the nose. The entire procedure takes about 10 minutes.

- 15 For example, citizens refrained from large public gathering since the first case of the novel virus was reported on 20 January. Following the early spread of the infection resulting from dining at restaurants and bars, most people stopped eating outside, instead making use of delivery services.
- 16 The super spreaders are a small group of patients — about one in five people — who transmit infections to far more people than the majority of patients do.
- 17 Kim et al. (2017) concludes that “[t]he outbreak was entirely **nosocomial**, and was largely attributable to infection management and policy failures, rather than biomedical factors.”
- 18 The head of KCDC was given a ministerial rank.
- 19 The end of September saw another doubling of cases to 4,063 with the death toll tripling to 16 and active cases rising to 2,034. By the end of September, the total number of cases and deaths had risen to 4,836 and 29 respectively, while active cases had declined to 1,682.
- 20 By end-April, one of the test kits was approved by the WHO through the Emergency Use Listing procedure, which was established to expedite the availability of diagnostics needed in public health emergencies. The total cost of the 261,000 tests was estimated to be \$130,500 — a paltry amount compared to the country’s annual health spending of over \$14 billion. The estimation here is made with the assumption that each person only does one test. If a person would do multiple tests, as per common practice, the cost will multiply but still remain minuscule relative to the country’s total health spending.
- 21 Information disclosed includes age, gender, COVID symptoms, travel history, their links with previously identified patients, and location of treatment. With few exceptions, names are typically withheld. There were incidences where the identities of COVID patients being leaked on social media, causing concerns over personal data protection.
- 22 Such as the necessity of wearing masks, which was made compulsory since 16 March.
- 23 Viet Nam’s annual health spending of \$122 per capita in 2016 put it well below the ASEAN average of \$423.
- 24 Viet Nam ranked first among all countries in terms of epidemiology workforce (reflecting the availability of epidemiology training and the total number of field epidemiologists); also first in terms of trade and travel restrictions (reflecting the country’s assertiveness in monitoring passengers arriving at its main international airport); and tenth in terms of emergency response operation (reflecting the existence of an Emergency Operations Centre).
- 25 Viet Nam’s social protection programmes consist of social insurance (support to minimize risks of sickness, occupational accidents and aging), as well as unemployment and health insurance, social assistance (regular assistance and emergency relief), and a multitude of programmes targeting vulnerable groups (for example, exemption from healthcare and education fees) (Vinh, 2016). The comprehensive set of social protection programmes provides a foundation of the public’s resilience to the economic and health shocks brought by the pandemic.
- 26 The Government of Viet Nam has introduced a fiscal support package valued at VND 266 trillion (3.5 per cent of GDP) to support the economy. Measures include deferring payment of value-added taxes and cutting various fees. Other implemented measures include tax exemptions for medical equipment; lower business registration fee effective from 25 February; streamlined tax and custom audit and inspection at firms; and allowing firms and workers to defer (up to 12 months) contributions to the pension fund and survivorship fund without interest penalty.
- 27 As noted above, the relative importance of LD and TTQ measures changed over time for a particular country. This can be seen from the overall Stringency Index of government response of the five countries at different time periods between 1 February and 1 June, as measured by the Oxford COVID Government Response Tracker. This Stringency Index combines lockdown restrictions and closures; health measures such as testing and tracing and investments in healthcare and vaccines; and economic policies such as fiscal measures and financial support to households. The full list of indicators and the methodology for calculating indices can be found at https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/index_methodology. It is also interesting to observe that countries such as China and Viet Nam were more stringent in imposing both the LD and TTQ measures, as compared with countries such as Germany and Iceland.
- 28 Before the pandemic, German hospitals had about 28,000 intensive care beds equipped with ventilators, or 34 per 100,000 people. By comparison, Italy had 12 ICU beds per 100,000 people, and the Netherlands just 7.
- 29 The small group of senior civil servants leading Iceland’s response to COVID had at the outset engaged the Health Sciences Institute at the University of Iceland to develop a prediction model to help ensure that the national healthcare system was equipped to handle the large number of additional patients. A baseline scenario estimated that 130 people might need hospitalization in Iceland because of COVID. The most recent number of people hospitalized — 103, as of 26 April — remained close but below this prediction. Similarly, the model had predicted that 27 individuals might need to be placed in intensive care. The most recent number — 27, as of 26 April — is the same as the one forecasted in the baseline scenario.
- 30 In 2000, the Health Insurance Review and Assessment Service (HIRA) was established and has set up rules for setting healthcare and medical treatment fees and monitoring receipts electronically.

- 31 As of 2017, 59 per cent of the entire medical expenditure and 65 per cent of hospital care were paid from the government and compulsory insurance (OECD, 2019). About 70 per cent of the population brought private health insurance to supplement public healthcare coverage. A hospitalized patient is required to pay 20 per cent of medical expenses, and outpatients paid between 30 – 50 per cent of total examination fees and other expenses, depending on the type of medical institution, such as clinics, and regional and national hospitals.
- 32 For example, a patient with a family of four would be entitled to receive about \$1,000 a month
- 33 The main elements of the country's response to the outbreak are: (1) testing the vast majority of those who have been screened, and; (2) if found positive, isolating patients who are mildly ill or with no symptom in non-medical facilities, such as hotels and training and sports facilities, and hospitalizing and treating those who are critically ill.
- 34 Another key factor in Uruguay's success was extensive testing.
- 35 The easing measures were also related to various recovery and stimulus measures different countries undertook. To keep its scope manageable, this paper however leaves the latter measures outside of its purview, as already noted.
- 36 These included regular temperature checks, wearing facemasks at all times, and minimal talking. Students were sent home if they displayed certain health symptoms.
- 37 On 8 June, the Government launched a 100 billion RWF Business Recovery Fund to support private enterprises and safeguard employment. Assistance would be provided from this fund to hard-hit sectors such as hotels, which lost 90 per cent of their usual revenue because of COVID. The Government had plans to double the size of the fund so as to help ensure food security in parts of the country most affected economically by the pandemic.
- 38 See Manuela Andreoni, "Coronavirus in Brazil: What you need to know", *The New York Times*, September 1, 2020.
- 39 See Médecins Sans Frontières (MSF) International, "Brazil's COVID-19 nightmare is far from under control", June 17, 2020. Available at: <https://www.msf.org/coronavirus-covid-19-nightmare-continues-brazil>.
- 40 See Palamin and Marson, "COVID-19 – The Availability of ICU Beds in Brazil during the Onset of Pandemic ", *Annals of Global Health*, August 13, 2020. Available at <https://www.annalsofglobalhealth.org/articles/10.5334/aogh.3025/>.
- 41 In Sao Paolo, the epicentre in the country, the number of confirmed cases has dropped significantly in August and September, with around 1,000 new cases daily and the lowest ICU occupancy rates since the beginning of the pandemic.
- 42 See World Bank, "Gini Index", *World Development Indicators*, 2018.
- 43 See Nassif-Pires, Carvalho and Rawet, "Multidimensional Inequality and COVID-19 in Brazil", *Levy Economics Institute of Bard College*, September 2020.
- 44 The Survey in Portuguese can be found at <https://covid19.ibge.gov.br/pnad-covid/>
- 45 Source: Johns Hopkins Coronavirus Resource Center (accessed on 20 October 2020).
- 46 The lockdown measures caused significant economic hardships. Within the first three months of the lockdown and subsequent easing, three million people were estimated to have lost their jobs, contributing to food insecurity and poverty. During Level 3 of the national lockdown (between 17 June and 4 July), nearly 6 per cent of the people changed their provincial residence to cope with the situation. In response to food shortages and the alcohol ban, a number of liquor stores and food stores were looted in several provinces in the country. The lockdown imposed in March was predicted to lead to a contraction of the GDP by 10 per cent in 2020. To deal with the situation, the Government announced in May a decision to increase fiscal deficits from 6.8 per cent to over 10 per cent of GDP in 2020 to finance various income-supporting programs.
- 47 <https://www.nejm.org/doi/full/10.1056/NEJMc2014960>
- 48 <https://www.nicd.ac.za/wp-content/uploads/2020/05/Guidelines-for-Quarantine-and-Isolation-in-relation-to-COVID-19.pdf>
- 49 <https://www.bbc.com/news/world-africa-54207503>
- 50 Ibid.
- 51 <https://www.csis.org/analysis/south-africas-bold-response-covid-19-pandemic>
- 52 <https://www.researchsquare.com/article/rs-77109/v1>
- 53 <https://theconversation.com/covid-19-how-the-lockdown-has-affected-the-health-of-the-poor-in-south-africa-144374>
- 54 See for example, Andersen (2020).

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