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CHAPTER 16

Challenges, opportunities, and future perspectives

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Key messages:
- Resilient and strong health systems are the foundation of an effective and timely response to pandemics.
- Cooperation and partnership must be at the heart of the response to tackle the pandemic and achieve a peaceful world free of disease and injustice, and built upon solidarity, cohesion, and convergence.
- Health is the precondition, outcome, and indicator of a sustainable society, and it has an inevitable relationship with the economic, political, and social aspects of human life.

16.1 Introduction

The emergence of COVID-19 in Hubei province of China in late 2019 has become a great shock and the worst challenge of the century in many areas, including in health care systems, economics, business, transportation, etc. in roughly 223 countries.¹ From 1918, when the H1N1 epidemic broke out, to the emergence of COVID-19, the world has not experienced such a widespread pandemic. Although there are major similarities and differences between the two outbreaks, COVID-19 is far more dangerous and severe than influenza.² The COVID-19 outbreak has imposed a global health emergency and its global impact have caused growing concern to the extent

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that the World Health Organization (WHO) declared the crisis on January 30, 2020 a “Public Health Emergency of International Concern” (PHEIC).  

The prevalence of COVID-19 in various countries has been changing frequently. At the beginning of the global outbreak, China, South Korea, Italy, and Iran were ranked as the top four countries in terms of total confirmed cases. On March 4, 2021, while the United States, India, Brazil, and Russia were ranked the top four countries with confirmed COVID-19 cases, the number of new cases in China had dropped dramatically since early March 2020, ranking China as the 84th on that date.  

Coping with this global health crisis is a complex issue that requires vision, planning, and flexibility at the individual, organizational, and international levels. Policy makers need to adopt interdisciplinary and multidisciplinary approaches to succeed in their battle against the pandemic. The COVID-19 experience has shown us that countries’ preparedness is the most fundamental factor to prevent more costly consequences and governments to respond to the crisis more appropriately. 

For instance, the government of China, the first country that reported the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), established a central committee headed by the prime minister as well as provincial counterparts commanded by governors to combat COVID-19 outbreak. In the United States (US), for coordinating the administration’s efforts to battle this pandemic, the White House Coronavirus Taskforce was established. Federal, state, and local governments have been given the authority to make decisions for their mitigation strategies based on guidelines, mostly prepared by the Centers for Disease Control and Prevention (CDC). Some European countries such as Italy and Spain also delegated authority and decision-making to their states to combat against COVID-19 independently. On the other hand, learning from the experiences previous SARS pandemic in 2003, the Southeast Asian countries including Taiwan, South Korea, Hong Kong, and Singapore showed more preparedness to control the pandemic and decrease the number of new positive cases. The government of Iran established the National COVID-19 committee, led by the president and coordinated through the Ministry of Health and Medical Education (MoHME). The provincial COVID-19 committees were also established in each province, headed by governors with the aim of improving intersectional cooperation to combat the pandemic.

Most notably, community participation in the implementation of the adopted strategies is an essential need that many governments may
encounter some challenges for its implementation during this pandemic. Governments need to know that overcoming this challenge requires a greater understanding of public perceptions regarding these strategies, as well as they need to appreciate the context, where public adherence behaviors may increase or decrease. For instance, governments need to understand whether encouraging people to observe protective measures is enough or detention measures such as fines against any violations needs to be enforced to determine people’s attitudes and perceptions.

Delayed execution of these strategies will lead to public uncertainty and diminishing trust in the governments. Previous epidemics’ experiences have shown that although significant cooperation is needed to succeed in fighting the virus, it is not clear how people will react to unexpected events such as outbreaks. Although international organizations and governments always endeavor to provide appropriate and timely guidelines to deal with outbreaks and make them available to the public, such emergency guidelines are not enough on their own to anticipate and identify barriers and enablers in relation to people’s responses and reactions to the crises. Many factors including access to resources, socioeconomic status, health literacy, and public awareness of the consequences of noncompliance with recommendations, will affect the level of acceptance of guidelines and recommendations by people in the community. Therefore, realistic evaluation of proposed public health intervention strategies, along with awareness of what increases public acceptance of the adopted solutions and strategies are among the significant factors that public health, the scientific community, and governments may face during this pandemic.

16.2 The coronaviruses epidemic and the challenges and opportunities

Despite all challenges, COVID-19 has also provided health officials and governments with a variety of opportunities for policy learning. In this chapter, we will review global challenges and risks due to the COVID-19 pandemic, along with the opportunities, consequences, and impact on different sectors of societies.

In this section, first, we will discuss the importance of resilient and strong health care systems, the value of coordination and collaboration among and within countries, and some significant consequences of this pandemic on the world economy. This will be followed by highlighting the
importance of social media, digital technology, and psychological outlook that governments have been facing during the COVID-19 pandemic.

16.2.1 Health care systems

Although some countries performed better than others, COVID-19 revealed fundamental shortages in this regard worldwide. The countries’ ability to deal with the COVID-19 pandemic largely depends on their health system resilience and strength. Such resilience is related to the extent and speed to which health systems are able to diagnose, detect, and control the spread of the virus; the capacity of laboratories for performing required number of COVID-19 diagnosis tests per day (particularly polymerase chain reaction [PCR]); the process of health care screening; provision of necessary infrastructure for contact tracing; mobilization of a sufficient workforce through employment of medical students and retired health professionals to help the health system during crisis, and preparing hospitals to be sufficiently ready to deal with the pandemic, among other measures.5

The COVID-19 pandemic is revealing inadequate infrastructure and insufficient facilities, including personal protective equipment (PPE) such as masks, gowns, shields, gloves, disinfectant solutions; intensive care unit (ICU) beds; prepared human resources; and ventilators in many low and middle income countries (LMICs) as well as some high-income countries (HICs) that were not properly equipped to deal with this crisis in a timely manner.12 The magnitude of problem multiplies in countries like Iran as a result of unilateral sanctions13 that has brought overwhelming challenges to the health system,14 particularly for people in the lower socioeconomic status.15 In addition, many citizens with chronic conditions, e.g., non-communicable diseases (NCDs)16 or in need of acute care, did not seek required care due to their fear and anxiety to get infected with COVID-19.17–19 These situations will impose greater challenges and exacerbate the COVID-19 consequences for the health systems worldwide.12,20

Ever since the COVID-19 pandemic was declared, several elective procedures and nonemergency care have been suspended in both private and public medical centers in many countries. This has been inevitable, aiming to reduce the spread of virus and preserve PPEs, ventilators supply, and ICU beds for acute patients21,22 and has threatened the ability of many health organizations to pay their expenditure. A study conducted in 2011 revealed that more than 48% of hospitals’ revenue in the United States came from elective surgeries. Due to the COVID-19 pandemic, many
hospitals, particularly private centers, which are mostly financed through elective procedures, faced financial challenges and had to lay off or reshuffle their staff.\textsuperscript{21,22}

Worse still, almost one-quarter of the world population reside in slum areas or among refugees and displaced people, for whom protective measures, i.e., social distancing, mask wearing, and hand washing might not be feasible all times. Furthermore, about three-quarters of the workforce in the LMICs work in the informal sectors, where lockdown and social distancing might be a selection between hunger and danger. Consequently, these people are more exposed to COVID-19 and may impose more burden on the health system.\textsuperscript{12} Indeed, the most vulnerable countries that are at the risk of natural and humanitarian crises are three times more likely to be exposed to COVID-19, while six times less likely to have access to needed health care.\textsuperscript{23} Despite numerous sacrifices by frontline health workers, the extensive spread of COVID-19 and continued increase in symptomatic and asymptomatic patients that are referred to in health care centers present signs of inadequate global response to COVID-19. For instance, insufficient health care providers, high burden of health care personnel, inadequate PPE, fear of being infected with COVID-19, as well as governments’ inability to properly incentivize and compensate health care workers can be mentioned, which will create the vicious cycle of shortage of health workforce and imposes an additional burden on health systems.\textsuperscript{24}

\textbf{16.2.2 Cooperation between and within countries}

COVID-19 has affected all aspects of public life in almost all countries.\textsuperscript{25} Following the declaration of pandemic by WHO on March 11, 2020, governments in many countries began to enforce a number of preventive measures, including mandatory quarantine and lockdown, borders closing, and imposing international travel restrictions. In the light of globalization and the so-called “global village,” where governments are interdependent in governing their countries, this has become a big challenge.\textsuperscript{12} On the other hand, due to the fundamental knowledge gap about this emerging pandemic, known as a “global emergency,” to combat the crisis, countries need cooperation, instead of competition, in several aspects.\textsuperscript{26} These include, but are not limited to collaborative research on vaccine and medication, innovative technologies for production of more suitable PPE, respirators and ventilators, and more importantly the exchange of experiences and policy lessons. Comparative policy and management learning is crucial to ensure the accuracy of the information provided to policy makers,
as well as to prevent infodemics and the spread of fake news.\textsuperscript{27} Last but not least, intercountries collaboration at the highest political level will pave the way for meaningful ground root cooperation between universities and research institutes, which is essential to combat the ongoing pandemic\textsuperscript{27} and turn this challenge to an opportunity for rebuilding the societies when the crisis ends. The ultimate goal of this cooperation is to establish a resilient, sustainable, and fair world based on solidarity, cohesion, and convergence.\textsuperscript{12} The COVID-19 pandemic has led to greater social solidarity within communities. In Nigeria, some organizations and companies provide food for those who lost their jobs as a result of lockdown. Some restaurants provide meals for hospital staff who cannot leave their workplace due to high workload in the UK. In China, volunteers from across the country traveled to Wuhan to assist medical staff. In France, people who lost their jobs in the cities were directed to rural areas to help farmers. In some countries, emergency teams have been established to help elderly, homeless, and disabled citizens.\textsuperscript{12} In Iran, some hotels participated in the campaign to accommodate recovering COVID-19 patients. In addition, Tehran Exhibition Center and one of the largest shopping malls in the capital city of Tehran were equipped with 2000 and 3000 beds, respectively, and were converted into mobile hospitals.\textsuperscript{6,28}

This pandemic has highlighted the importance of intersectional collaboration among relevant sectors such as military forces, ministry of road and transportation, religious groups, ministry of higher education, research centers, ministry of health, and legislative authorities for countries to better manage such crises. Improving the policy dialogue between miscellaneous stakeholders provides an opportunity for policy makers to make decisions based on the comments of various actors and can implement them with greater acceptance and compliance consequently.\textsuperscript{12} Worse still, other disasters are likely to occur simultaneously with outbreaks, for instance about 1 billion people are exposed to floods. Expanded cooperation in the health, social, and humanitarian sectors is therefore the key to deal with simultaneous crises, especially during the current global economic downturn.\textsuperscript{29}

16.2.3 Economics

COVID-19 is not just a health issue. The pandemic is also a political, economic, and social challenge for the global community. The crisis led all governments to spend more for providing extra health care services as well as to support affected businesses and families. Despite these aids, the deteriorating economic, social and health situation of almost all countries is
obvious. These challenges resulted from various reasons including lockdown, business shutting down, travel bans and massive unemployment. In other words, COVID-19 pandemic has led to direct and indirect costs. Direct costs refer to the resources needed for prevention, treatment and rehabilitation, while indirect costs refer to the costs that are imposed on society due to the disability of individuals and the reduction of labor productivity.

Depending on their economic make up, the impact of the pandemic on economies has been diverse. Nations with heavy reliance on international industries like tourism, manufacturing, agriculture, and international trade have been affected the most, both directly and indirectly. Extreme escalation of job losses also influenced individuals’ livelihoods and doubled the challenge. In the shadow of inadequate government support, most workforce in the informal sectors, e.g., garbage collectors and child laborers, have been left with no choice than working in high-risk environment to avoid starving to death.

According to the World Bank report, global economy was estimated to have shrunk by 5% due to the COVID-19 pandemic until June 2020 (Figs. 16.1—16.4). The Chinese government, for example, announced a significant reduction of its production in February 2020. Some

![Figure 16.1 Global economy trend 2010–20. (This is an adaptation of an original work by the World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by the World Bank. World Bank. Global economic prospects. Washington, DC: World Bank; June 2020.)](image)
Figure 16.2 **Real gross domestic product (GDP) (percent change from previous year).** (This is an adaptation of an original work by the World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by the World Bank. World Bank. Global economic prospects. Washington, DC: World Bank; June 2020.)

Figure 16.3 **Consensus forecasts of global gross domestic product (GDP) growth.** (Source from: World Bank. Global economic prospects. Washington, DC: World Bank; June 2020. [https://doi.org/10.1596/978-1-4648-1553-9](https://doi.org/10.1596/978-1-4648-1553-9). License: Creative Commons Attribution CC BY 3.0 IGO.)
governments have allocated considerable additional budgets to deal with this crisis. Nevertheless, some LMICs are concerned to face financial crisis as well as their increasing gap with the HICs.27 Worse still, many countries have been experiencing sharp declines in their foreign investment due to the pandemic. “This is a crisis that the world has never seen before” the International Monetary Fund had reported. It is estimated that COVID-19 outbreak can decrease the economic growth of HICs for one or two years, while this damage in the LMICs may last up to 10 years.12

In this regard, as of September 23, 2020 the United States has set the largest stimulus package at $2.6 trillion to support its domestic economy, as well as for individuals, hospitals, and medical care, and the insurance benefits intended to prevent the economic impact of the COVID-19 outbreak (Fig. 16.2).39 Let alone that the United States withdrew from the WHO membership amid the ongoing crisis.38

16.2.4 Social media
Social media, while being an appropriate tool for disseminating information and raising public awareness to prevent the spread of disease, has been the
cause of fear and anxiety by spreading false information and contributing to infodemics.\textsuperscript{40} Worse still, distrust of published information and lack of public support may be the result of inconsistencies between government recommendations, social media, and recommendations of global health organizations.\textsuperscript{8} For instance, misinformation on social networks and lack of informative and beneficial programs based on government strategies affect the acceptance of use of masks in the society.\textsuperscript{7} COVID–19 highlighted the need for contextual-based mechanisms that governments need to put in place to deal with misinformation and decrease their destructive effects during pandemics.\textsuperscript{40}

16.2.5 Digital technology

The global emphasis on social distancing and the need for telecommunication and distance education, has made the provision and access to digital technology one of the main challenges for many countries in this particular era. Undoubtedly, COVID–19 pandemic will lead to structural changes in the relationship between technology and society, with visible consequences in many areas. For example, teleworking, which was the format of working in some contexts partially, has become the normal way of doing jobs in many countries depending on their communications infrastructure.\textsuperscript{41} Some religious places have made it possible for citizens to remotely perform their duties instead of attending places of worship. With hundreds of millions of students out of school due to the outbreak of COVID–19, many governments have enabled virtual and distance education system through the internet. Most of gatherings and events, from small company meeting, mid and big size conferences, up to the highest level political meetings of heads of states, went online and through video conferencing. Most notably, for the first time in their entire 70-year history, the United Nations held its annual general assembly (UNGA) online in September 2020,\textsuperscript{42} and the WHO held its World Health Assembly (WHA) virtually in May 2020.\textsuperscript{4} Hundreds of thousands, or millions, of webinars and virtual meetings have been held by different universities and research centers around the world on various dimensions of this pandemic. Virtual medical consultation is becoming a new normal to overcome or minimize the harms for both patients and service providers.

Despite their many benefits in this situation, the need to use digital platforms have brought some fundamental challenges to many governments in the LMICs, i.e., the weak information and communication technology (ICT) infrastructure, particularly in many rural and slum areas, which might hinder the use of cyberspace capacity and increase the already existing inequalities in communities’ access to the services.\textsuperscript{15} In addition, the prolongation of the
COVID-19 crisis could lead to a reduction in the capacity of the internet, even in more industrialized countries with strong digital infrastructures.¹²

### 16.2.6 Psychosocial perspective

While more attention has been paid to the issues related to the physical complications of COVID-19, evidence shows that psychosocial effects of the outbreak, from internal strife to racist attacks and growing nationalist behavior, have increased.¹² Citizens’ mental health conditions might deteriorate in affected communities, with disorders such as anxiety, depression, and panic disorders being at stake.⁴³ The global concern is that the psychosocial effects of this epidemic may have long-term consequences that are more dangerous than the disease itself. Enhancing family disputes are among the negative psychological effects of this pandemic. As members of a household have been living together for a long period of time and in the case of many citizens in small-sized places, tensions within the family structure have increased. Unfortunately, there are some data stating that divorce rate, family disputes, marital problems, child abuse, and rape will have augmented during and after this period. In addition, due to economic problems and rising unemployment rates globally, more psychological pressure is placed on those who have lost their jobs. As people seek to regulate their negative emotions, they may use a wide range of coping strategies including drug abuse, alcohol consumption, suicide, etc., which often have adverse consequences for their mental and physical health. Hence, to prevent these complications, it is necessary to implement public health education programs and campaigns to raise public awareness to prevent and combat adverse psychosocial effects of the crisis.¹²

### 16.3 Main challenges of environmental health engineering during prevention of COVID-19 pandemic

COVID-19, similar to other two coronaviruses, which had caused major epidemics in recent years (namely, SARS and the Middle Eastern Respiratory Syndrome [MERS]), transmits through direct human-to-human contact with symptomatic and asymptotically infectious persons, contaminated objects or surfaces, or by inhalation of respiratory droplets. Environmental factors such as air temperature, humidity, air pollution, water and sewage, inanimate surface, insects, etc., are also important influential factors in the spread of microbial threats, including the COVID-19 virus.⁴⁴
Despite the influence of environmental factors on the transmission of the COVID-19 virus, the type of this influence has not yet been properly identified. For instance, regarding the effects of temperature on the transfer of COVID-19, different studies have reached different and sometimes contradictory results. A study of 122 cities in China found that rising temperatures had no effect on reducing the incidence of COVID-19. In another study, rising temperatures and declining humidity were determined as favorable factors for virus survival. In contrast, another study found that with the onset of spring and summer, virus transmission would decrease. A study of 429 cities around the world found an increase in disease transmission in colder cities. The differences in the results of different studies are due to several factors, including the impact of other variables on the spread of the virus and different measures and policies by the governments in dealing with COVID-19, which highlights the need for further investigation, while controlling other variables. Another study revealed that changes in temperature and humidity alone, without severe public health interventions, will not necessarily reduce the spread of COVID-19.

Although there is currently no evidence that the virus is transmitted through air diffusion, the virus can be transmitted from asymptomatic-infected people through sneezing, coughing, talking to other people at close distance, and polluted airflow. Therefore, it is recommended to use viral filters and PPEs such as standard mask, gown, face shield, gloves, etc. Further, closed suction, air flow changes, and negative pressure air pollution in closed environments are where the virus is likely to spread, requiring use of standard masks. Also, people who are suspected to be infected with COVID-19 virus and patients with clinical symptoms should be quarantined, while others should use preventive methods such as frequently hand washing, using disinfectants, wearing PPEs, and considering social distance.

So far, there is no safe and effective medication for COVID-19 and current vaccines are not widely distributed. Therefore, nonpharmacological measures such as quarantining patients with clinical symptoms; environmental health activities and promoting hygiene activities such as wearing PPEs; social distancing; frequently disinfecting hands and surfaces; and avoiding touching one’s face including mouth, eyes, or nose with unwashed hands are currently the most effective methods to tackle the crisis and to prevent the virus spread in the societies. The IHME predicts the impact of social distance with and without the mask on the global prevalence of COVID-19, as shown in Fig. 16.5.
Reducing human contact (as measured by cell phone mobility data) can drive down infections so that mask use, testing, isolation, and contact tracing can work to contain the virus.

**Figure 16.5** Forecasting the effect of social distancing with and without universal masks use on the global prevalence of COVID-19 until March 5, 2021. *(Source from: Health Data, the Institute for Health Metrics and Evaluation. License: Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (https://creativecommons.org/licenses/by-nc-nd/4.0/). Institute for Health Metrics & Evaluation. COVID-19 projections; 2020. https://covid19.healthdata.org/. [Accessed 11 December 2020].)*
Despite these recommendations, most countries have faced a shortage of PPE and restrictions on the use of this equipment for the public and health staff.\textsuperscript{56} In addition, most vulnerable groups in the community, including street sleepers, the homeless, people who live in overcrowded households or in unventilated homes, migrants, and slum dwellers do not have access to PPE and cannot observe health protocols properly.\textsuperscript{57}

For the first time in modern history, the world observed only recently that some countries in the southern hemisphere that finished winter in October 2020 witnessed dramatic decrease in the incidence of seasonal influenza compared to previous years.\textsuperscript{58} It is speculated that protective public health measures for COVID-19, i.e., hand washing, mask wearing, and social distancing has been the key in reducing the number of cases with seasonal flu, which also play an essential role in controlling COVID-19 pandemic.\textsuperscript{59} This can decrease the immediate demand for health care services and reduce the consequences of the disease, including mortality and morbidity.\textsuperscript{60}

Ensuring access to safe water as well as providing sanitation and waste management services are essential in preventing the transmission of COVID-19.\textsuperscript{61} There is no evidence regarding the virus transmission through the stool of an infected person. Nevertheless, reports confirmed that the COVID-19 virus can survive in sewage for days or weeks,\textsuperscript{62} findings which could be useful to monitor and track the rate of virus rotation in communities.\textsuperscript{63} In spite of the virus survival in the wastewater, its presence in water resources highly depends on factors such as temperature, sunlight, the presence of organic compounds, as well as other antagonistic microorganisms. Despite the survival of the COVID-19 virus in sewage, the risk of virus transmission through contaminated drinking water has not been confirmed.\textsuperscript{61,64}

### 16.4 The mental health issues associated with the COVID-19 pandemic

The COVID-19 outbreak has affected almost all significant economic, political, and social aspects of human life around the world.\textsuperscript{65} It is not surprising, therefore, that the crisis has been described as a “mental health catastrophe,” which is among the most serious and worrying difficulty that human beings has experienced in the recent history.\textsuperscript{66} Raising fear and anxiety among population, especially in vulnerable groups, i.e., elderly, children, medical staff and care providers, and people with underlying special health problems, are reported as being heightened during the pandemic.\textsuperscript{67} Because health is a complete state of physical and mental conditions, governments have to be
aware about the most notable impacts of COVID-19 on human beings’ mental health during this outbreak and afterward.\textsuperscript{65}

The significant amount of unknowns about various aspects of COVID-19 has imposed additional stress and anxiety on both people and officials.\textsuperscript{65} Worse still, the loss of loved ones, including friends, relatives, and colleagues due to COVID-19,\textsuperscript{69} self-isolation, implementation of lockdown and quarantines, restricted face-to-face socialization, obligation to teleworking, children’s home-schooling, temporary unemployment, job losses, and economic insecurity have exacerbated the burden of mental health problems during this pandemic. Additionally, it has been forecasted that loneliness, child abuse, and divorce would be increased in this pandemic, since people have to stay at home and must tolerate each other for a long time period. Substance abuse may also increase during the pandemic as some people may use opioids for excitement, filling their leisure time or overcoming their anxiety and stress.\textsuperscript{65,68}

Even before the beginning of COVID-19 pandemic, mental health diseases were prevalent and accounted for 13\% of the global burden of disease. On October 6, 2020, for the occasion of World Mental Health day, WHO published the result of a current study on the effects of COVID-19 on mental, neurological, and substance use (MNS) services among 130 WHO member states. The results show that most countries did not succeed in providing required mental health services for their citizens, which made them more vulnerable in the sensitive and critical time of crisis.\textsuperscript{69} This also reminds us urgent the need for urgent strategies to reduce the burden of psychological impact of pandemic and preventing the ongoing difficulties to get worse.\textsuperscript{67}

\subsection*{16.5 COVID-19 global consequences and the future of the sustainable development goals}

In 2015, the United Nations (UN) launched the sustainable development goals (SDGs) with the aim of ending poverty and moving the world toward greater equity, peace, resilience, prosperity, and opportunities for all people in a healthy planet by 2030. Despite the uneven and sluggish progress in achieving some SDGs until 2020 and the probability of not meeting the goals by 2030, some gains have been achieved. These include reducing the share of children and youth out of school, declining the incidence of many communicable diseases, improving access to safe and secure drinking water, and increasing the appointment of women to leadership roles.\textsuperscript{70}
Today, going through one-third of the path into 2030 agenda, the advent of COVID-19 has adversely affected all aspects of SDGs, i.e., health, social, economic, cultural, and political. As of March 5, 2021, the total number of cases in 223 countries and territories exceeded 114 million, while 2,554,694 people died from the disease. Many SDGs are threatened by the pandemic and its vast consequences. The health systems in many countries have been on the verge of collapse, over 1.6 billion children have been out of school, many households have lost their incomes, many workers have been forced to turn to informal jobs for a living, and millions of people have been suffering from extreme poverty and hunger (Table 16.1 and Fig. 16.6). The outbreak has also increased inequalities globally, where vulnerable groups have been increasingly exposed to direct and indirect effects of the pandemic. Poor families are getting poorer, marginalized individuals and groups are more likely to get infected and die due to COVID-19 or even other chronic or acute diseases, while women and children have been exposed to more domestic violence than ever before. COVID-19 has endangered achieving SDGs significantly, and even in some of 169 targets the world has fallen behind. These show that policy makers and researchers need to explore multiple dimensions beyond population health and well-being and create a sustainable and strengthened context for further progress toward SDGs.

16.5.1 SDG 1: No poverty
Prior to COVID-19, the world was looking to end poverty by 2030, yet it was predicted that 6% of the world’s population would remain in extreme poverty by 2030. Now, with the emergence of COVID-19, it is estimated that an additional 71 million people will live in extreme poverty. For the first time in decades, COVID-19 has increased global poverty. Although income inequality is diminishing in some countries, the global economic downturn following the epidemic could plunge millions into poverty and exacerbate inequalities.

16.5.2 SDG 2: Zero hunger
Despite substantial progress since 1990 to reduce hunger, the world is still struggling with a growing hunger crisis. In 2019, the number of serious starving people suffering from crisis level hunger rose from 113 million to
Table 16.1 Comparison between main effects of some of the sustainable development goals, before and after the outbreak of COVID-19.

| Targets | Before covid-19 | Current forecast after covid-19 (2020) | 2030 |
|---------|----------------|----------------------------------------|------|
| SDG 1: No poverty | Proportion of people living below $1.90 a day 8.2% (2019) | 8.8% | 6% |
| SDG 2: Zero hunger | Prevalence of moderate or severe food insecurity 25.9% (2019) | N/A | |
| | The proportion of children under 5 years of age suffering from stunting 21% (2019) | | |
| | The proportion of children under 5 were affected by wasting, or acute undernutrition 6.9% (2019) | 3% | |
| SDG 3: Good health and well-being | Under-5 mortality rates 17.7% (2018) | Hundreds of thousands of additional under-5 deaths are expected | N/A |
| | Coverage of the required three doses of diphtheria 86% (2018) | It was reported moderate-to-severe disruptions or a total suspension of vaccination services | |
| | Coverage of the second dose of measles-containing vaccine 69% (2018) | | |
| SDG 4: Quality education | The proportion of children and youth out of primary and secondary school 17% (2018) | About 90% of all students (1.57 billion) were out of school | Over 200 million children will still be out of school |
| | Prolonged absence from school is associated with lower retention and graduation rates and worse learning outcomes 85% (2019) | Prolonged absence from school, accompanied by reduced retention and graduation rates and worse learning outcomes | N/A |
Table 16.1 Comparison between main effects of some of the sustainable development goals, before and after the outbreak of COVID-19.—cont’d

| Targets | Before covid-19 | Current forecast after covid-19 (2020) | 2030 |
|---------|----------------|----------------------------------------|------|
| SDG 5: Gender equality | Despite improvements, full gender equality remains unreached (2019) | up to 30% increase in domestic violence in some countries/ Women now spend about three times as much as men in unpaid domestic and care work as men. | N/A |
| SDG 6: Clean water and sanitation | The proportion of the global population using safely managed drinking water services | 2.2 billion people lack safely managed drinking water/4.2 billion people lack safely managed sanitation (2017) | 3 billion people worldwide lack basic handwashing facilities at home |
| | Some countries experience a funding gap of 61% for achieving water and sanitation targets. | | Water scarcity could displace 700 million people |
| SDG 8: Decent work and economic growth | GDP per capita growth rate | 1.5% (2019) | Real GDP per capita is expected to decline by 4.2% |
| | The growth rate in labor productivity | 1.4% (2019) | Changes in labor productivity growth, influenced by global reductions in working hours and declining economic growth |
| | The percentage workers in the informal economy | 61% (2016) | up to 60% drop in informal workers income |
| | Global unemployment rate | 5% (2019) | up to 14% drop in global working hours |
| | 400 million job losses in 2nd quarter of 2020. | | |
| SDG 9: Industry, innovation, and infrastructure | 51% decrease in the number of air passengers from January to May 2020 compared to the same period in 2019 |
| SDG 11: Sustainable cities and communities | Share of urban and rural population | Living in slums rose to 24% (2018) | Over 90% of COVID-19 cases are in urban areas | N/A |
| SDG 16: Peace, justice, and strong institutions | Change in intentional homicide rates | 5.8 per 100,000 population | Rising cases of violence and murder in Latin American countries/reducing cases of violence and murder in European countries | 5.2 per 100,000 population |
| SDG 17: Partnerships for the goals | Increased risk of COVID-19 with overcrowding in prisons in 60% of countries | Global foreign direct investment (FDI) | Increase by 2% (2018) | Decrease by up to 40% | N/A |
| | Global merchandise trade | 2.1% (2018) | Declined by 13%–32% | |
135 million, indicating that the world has not only failed to achieve SDG 2, but has also fallen behind. Regrettably, in 2020, with the emergence of COVID-19, achieving this goal has become even more challenging. The UN World Food Program (WFP) has estimated that this number is likely to double to 265 million in 2020.76

All four dimensions of food security, including availability (is the supply of food adequate?), accessibility (can people obtain the food they need?), utilization (do people have enough intake of nutrients?), and stability (can people access food at all times?), are directly affected by COVID-19. This can be mainly due to individuals’ income loss and their inability to pay in addition to rising food prices. Because of travel restrictions, seasonal farmworkers cannot travel to harvest crops, the possibility of food exportations is also limited, that in turn will constrain food availability and accessibility by affecting supply chain.38 The absence of international cooperation, inadequate protection by governments, and disruption of supply chains may also lead to food shortages and rising food prices around the world.29 Consequently, these could affect all four aspects of food security and may lead to rising the number of people starving.
The COVID-19 pandemic showed that sustainable use of land and water resources, plus planning for resilient growing of basic nutrients, is essential. To do this, we need to reduce food waste to a minimum. Annually, near $400 billion worth of food is wasted worldwide. This amount can feed approximately 1.26 billion people annually. Moreover, panic buying across the world following the pandemic has led to more food wastage and an impact on the quality of diets due to lack of fresh food.

16.5.3 SDG 3: Good health and well-being for all in all ages

Despite progress in SDG 3, COVID-19 has raised growing concerns about the regression of all that has been achieved so far. COVID-19 accounts for the bulk of the health system’s limited resources, as a result of which many other health needs have been underconsidered. The UN Children’s Fund (UNICEF), for example, has notified that 116 million newborns and mothers are at risk of inadequate health care due to the COVID-19 pandemic. A study published in The Lancet Global Health predicts that more than 2 million under-five deaths and more than 1 million mothers’ death could occur within 12 months in 118 LMICs due to limited access to basic care, food, and vaccinations. During this pandemic, 70 countries are at the risk of interrupting childhood vaccination programs. Moreover, many other health care services, i.e., cancer screening, family planning, or other non-COVID-19 infectious diseases, have been discontinued or neglected in many countries. Consequently, any disruption in the continuation of other patient treatment and provision of health care services may influence inversely the years of progress in this area and affect the population health in the future.

16.5.4 SDG 4: Quality education

COVID-19 is the most unprecedented challenge the world educational systems have ever encountered. In an attempt to maintain social distancing and prevent the virus transmission, many countries were forced to shut down their educational institutions, at least temporarily, and switch to distance education, which in turn has posed new challenges to both learners and educators. The UN Educational, Scientific, and Cultural Organization (UNESCO) declared that more than 1.6 billion students are out of school due to school closure. Lack of access to education, in addition to the short-term effects of decreasing literacy, increases the likelihood of dropping out and not returning to school in the long-term, which might in turn further threaten future socioeconomic opportunities.
It is also predicted that the negative effects of school closures will be disproportionately greater on the most vulnerable groups, which will increase existing inequalities, in particular, gender inequality. Before the COVID-19 crisis, near 130 million girls were out of school. Shutting down the schools will lead to additional 11 million girls not going back to school. Depriving girls from going to school, in addition to jeopardizing years of striving for progress toward gender equality, will raise other concerns, including the risk of forced early marriage, adolescence pregnancy, and domestic violence.

In many rural or marginalized areas, there is no adequate infrastructure and facilities for remote learning. Students in these areas suffer from digital inequality, meaning lack of access to the internet and computers. These vulnerable children, who have less opportunity to learn at home, are at greater risk of exploitation. Furthermore, using the internet for distance learning may rise the exposure of children to cyberbullying, high-risk online behaviors, and online hunters.

School closures are also a serious threat to the health and safety of children, especially vulnerable children. For millions of children, school is not only a place to learn, but also a safe place away from violence. Children at school can receive health services such as vaccinations, as well as nutritional services, including free meals and iron supplements. As a result of shutting down schools, approximately 379 million children may face food insecurity because they do not have access to free or subsidized school meals, which is a threat to their immune system and their ability to fight diseases.

With the end of the summer holidays, the reopening of schools has created a new challenge, the so-called “duality in prioritizing health or education” for both students and teachers around the world. On the one hand, to realize the right of students to enjoy education and due to the challenges of distance education, there is an urgent need to reopen the schools. On the other hand, the threat of COVID–19, especially as it coincides with the beginning of autumn and the second wave of the disease, has raised concerns among students and their families. Considering some of the positive effects of school reopening on students’ health, especially vulnerable children, some, including the director of school-based programs at the WFP, believe that the effects of school closures on students’ health are greater than its reopening. Therefore, many believe that instead of shutting down schools, reopening should be considered along with some protective strategies such as reducing class sizes, improving hygiene, alternating days at school, etc.
To prevent inequalities escalation, the educational systems’ responses to COVID-19 should be adjusted according to the contextual factors of communities and taking into account cultural, socioeconomic, geographical, and gender differences.29

16.5.5 SDG 8: Decent work and economic growth

The global economy, including many national and international industries, e.g., tourism, international trade, and travel, have been tremendously affected by the COVID-19 pandemic. For instance, the tourism industry has dropped down dramatically due to travel restrictions and border closures. The UN World Tourism Organization (UNWTO) announced a 22% reduction in international tourism during the first quarter of 2020 as the result of COVID-19 pandemic. It estimates the number of international tourism will also experience 60%—80% fall during 2020. This amount is responsible for $910 billion to $1.2 trillion loss from tourism revenues, which will impose a major impact on the global economy.85 In particular, countries whose tourist attractions accounted for the bulk of their gross domestic product (GDP) will face severe recession.38 This endangers millions of livelihoods and may reverse the progress made so far in advancing the SDGs.

Due to the dependence of other SDGs on financing and extra investment, the economic downturn caused by the COVID-19 pandemic, in addition to challenging the economic growth goal and targets, has indirectly posed challenges to other SDGs as well. Even before COVID-19, SDG financing was underfunded by $2.5 trillion.38

16.5.6 SDG 11: Sustainable cities and communities

In an attempt to fight COVID-19, many governments have encouraged people to stay home to prevent virus transmission. Such a situation is even more devastating for the 79.5 million displaced people who have neither a safe house nor a formal job. Globally, almost 1 billion people live and work in informal, low-service, and insecure urban areas, most of whom live in crowded conditions with limited access to safe tap water, electricity, health, and other services. The COVID-19 pandemic poses a serious threat to the access of displaced people (refugees, migrants, or internal displaced people) to health care services and economic safety nets. This situation causes them to be considered as a threat for the settled citizens, which in turn increases their isolation, deprivation, and vulnerability.29
16.5.7 SDG 13: Climate action

COVID-19 is not the only global threat to SDGs. The world is predicted to encounter more stressful conditions including more catastrophic pandemics or epidemics, floods, earthquake, storm, wildfires, droughts, and so forth. The frequency and severity of all of these may be intensified as a result of climate change. Indeed, climate change is a greater challenge to national security than the COVID-19 pandemic. The UN SDG progress report 2020 stated that as a result of the pandemic, restrictions and extreme decline in people activity, greenhouse gas emissions has fall down by 6% that is less than 7.6% target in the Paris Agreement.

16.5.8 SDG 15: Life and land

In addition to disrupting ecosystems, wildlife trafficking is responsible for the spread of infectious diseases. Therefore, reducing smuggling as well as the supply and demand of illegal wildlife products, which is considered in SDG 15, would reduce the likelihood of transmitting new viruses to humans. Pangolins, for example, which are suspected to be the intermediary animals in the transmission of COVID-19 from bats to humans, are being trafficked more than any other animal in the world. Pangolin meat is sold in wet markets, which are known to be the possible sites of early transmission of the coronavirus to humans. Between 2014 and 2018, 370,000 pangolins were seized worldwide. Focusing these goal and targets may be helpful to reduce probability of further outbreaks.

16.5.9 SDG 16: Peace, justice, and strong institutions

Even in the absence of COVID-19, conflict is recognized as a social determinant of health, which creates a wide range of health problems, from the lack of access to quality health care services to inadequate infrastructures. Measures to mitigate virus spread may increase domestic violence and threaten citizens’ mental health. In order to properly respond to and prevent COVID-19 within vulnerable groups, the UN Security Council called upon the whole world for peace and a cease fire. Due to the increasing focus on COVID-19, attention to international agreements, treaties, and peace agreements has been also decreased. In addition, according to the UN High Commissioner for Human Rights, under exceptional or emergency measures, there has been a dramatic increase in police harshness and civil rights violations.
16.5.10 SDG 17: Partnerships for the goals

As a result of the economic crisis caused by COVID-19, many donor countries prefer to spend most of their capital on their own citizens, which has led to a meaningful reduction of many official development assistances. With the withdrawal of the USA from the WHO, a significant proportion of the organization’s funding was cut. The UN predicts that global foreign direct investment will decline by 40% in 2020. Up to 16% of GDP across African countries comes from remittances. Due to lockdown and the economic challenges posed by COVID-19, these remittances, which supported millions of households in the LMICs, are expected to decline dramatically from $554 billion in 2019 to $445 billion in 2020. Ten months into the crisis, the real consequences of COVID-19 is not clear yet. Until safe vaccines are widely distributed or a certain effective treatment become available to control the outbreak, we cannot determine the precise consequences of the pandemic on sustainable development. The world needs more strict surveillance and precise monitoring system to accurately track the virus and predict its future behavior, viral evolutions, transmissibility, and pathogenicity, all of which will influence on the virus mortality rates and prognosis as well as its global consequences.

16.6 Lessons learned from COVID-19 outbreak

In the fight against COVID-19, an expanded spectrum of policies has been adopted by different countries, each of which led to its own consequences. Meanwhile, health policy learning tailored to each country’s context can be helpful in increasing countries’ preparedness to make more appropriate and timely decisions in the face of possible future waves of the COVID-19 as well as probable future crises, which in turn will have more favorable consequences for promoting global health. Countries like South Korea, China, and Singapore, which had learned lessons from the previous outbreaks such as MERS, SARS, etc. have often taken the COVID-19 threat more seriously, performed more effective in this battle, and therefore, achieved more desirable consequences. Evidence shows that countries with decisive and effective leadership, which mostly have appropriate coordination, were significantly less affected by COVID-19 than other countries.

Our study to compare 10 selected countries’ policies during the first wave of outbreak, we discovered the importance of three main strategies for better control of the outbreak, including timely measures, extensive open public testing for early detection of the cases, and comprehensive contact
tracing. Adopting these strategies in addition to the strong political support played key role in response efficiently to the crisis.6

Despite the many threats and challenges, pandemics can be an opportunity to increase creativity and innovation. Increasing the use of novel technologies in tracking, tracing, testing, diagnosis, and treatment, will directly help control the outbreak and can be also effective to prevent the disease by reducing exposure. Also, by replacing humans with new technologies, such as telemedicine, governments can protect the economic cycle while maintaining social distancing and reducing contact.7,8

COVID-19 reminded us of the global fragile preparedness and the countries’ weak ability to face large-scale crises. It also taught us that countries need to build and steadily improve their capacity for sustainable prevention, detection, and rapid response to health emergencies.9,5 Global public health security needs to be invested, prioritized, and funded more efficiently. To increase global emergency preparedness, all countries need to have long-term, predictable, flexible, and sustainable financing on a large scale and based on global solidarity. Relying on a small number of HIC aid, foundations, and institutions is not enough to deal with public health security threats. Formulating more efficient policies and strategies to improve global health security along with implementing more preparedness interventions is also required globally.9,6,97

According to the International Health Regulations (IHR) (2005), all member states are obliged to develop minimum core public health capacities for the effective implementation of the IHR (2005). In 2008, the WHA adopted a resolution under Article 54 of the IHR (2005) requiring member states and the WHO to report progress on IHR implementation. In this regard, since 2010, WHO developed a self-assessment questionnaire for countries’ progress self-assessment toward implementing IHR capacities. In 2018, the WHO introduced a new State Parties Self-Assessment Annual Reporting tool (SPAR). The SPAR is a quantitative tool and the only mandatory component of the IHR monitoring and evaluation framework.98 The 2019 data showed progress in all 13 IHR capacities worldwide, particularly in the area of surveillance, laboratory, and IHR Coordination and National IHR Focal Point, but more effective and sustainable efforts are needed with regard to the chemical events, points of entry, and radiation emergencies. Based on this report, the average score of the member states was 64%, showing more work is needed to reach an acceptable global status.99

The 2019 global health security (GHS) index, jointly published by Johns Hopkins Center for Health Security, Nuclear Threat Initiative, and The Economist Intelligence Unit, reported 195 countries preparedness in the
face of outbreaks. The GHS measures countries capability to prevent, detect and report, in addition to the country’s health system to protect people, their compliance with global norms, and the countries environmental risks and vulnerability to microbial threats. According to the GHS index, global average score was 40.2 out of 100, which highlighted the weak preparedness of the world. The index also showed that the USA is the most prepared country in this regard; nevertheless, the COVID-19 experience violated the result and showed the need to revised the GHS indicators and develop more comprehensive and realistic indices. Actually, none of the previous indices could precisely predict countries’ preparedness to deal with the coronavirus threat and save lives. Also, the COVID-19 crisis showed that to measure the countries’ preparedness in the face of public health threats, in addition to indices related to the health sector, other indices from other sectors, i.e., social protection and political support should also be considered and interventions should be made to promote these indices before the crises occur.

The COVID-19 crisis also highlighted the importance of investing on prevention rather than treatment. Estimations resealed that ending COVID-19 crisis costs between $8.1 and $15.8 trillion globally (obtained by calculating the reduction in gross domestic product plus the cost of economic loss due to hundreds of thousands of workforces death from the disease worldwide); while, globally $22.2—$30.7 billion per annum is required to prevent or remarkably reduce new diseases transmission that is about 500 times less than ending the pandemic up.

In addition, the high prevalence of COVID-19 even in countries with a strong health system, once more, proved the increasingly need for universal health coverage (UHC) more than ever. Governments should spend more on health systems strengthening to improve its resiliency and maintain health security in the face of crises. This requires a strong political commitment with a view to achieving sustainable health development.

The COVID-19 crisis affects all aspects of societies and needs inter-sectoral collaborations and multilateral interventions within not only the health system but also the governments and societies, so-called whole-of-government and whole-of-society approaches. Until widespread distribution of the vaccine or detection of a definite treatment, in addition to the government, people are equally responsible to preserve each other from being infected. Ethically, it is everybody’s duty to be committed to the personal hygiene, not only to protect his-self/her-self but also other people in the society.
The important of one-health approach become more apparent than ever through COVID-19 outbreak.\textsuperscript{104} Prevention, detection, and controlling zoonosis requires the integration of both humans and animals surveillance health systems.\textsuperscript{90} Prior to COVID-19, previous outbreaks revealed that the occurrence of zoonotic diseases are increasing and might be continued\textsuperscript{105} due to the increasing human-animal cohabitation. More research is required to build reproducible animal models to prevent the occurrence or minimize the consequences of any other emerging zoonotic infectious diseases.\textsuperscript{90} Toward utilizing one-health approach, improving zoonotic infection prevention and control measures could be an applicable solution that has evidently been implemented in camel farms following the MERS outbreak in 2012.\textsuperscript{103}

16.7 Main points

- The COVID-19 pandemic revealed global health systems’ fragility.
- A pandemic is a global event that affects human beings’ livelihoods and does not respect boundaries.
- The complexity of fighting pandemics requires integrated and coordinated global actions, beyond the whole-of-government and whole-of-society approaches, and in line with a whole-of-world approach.
- Although evidence has not confirmed airborne diffusion of COVID-19 thus far, the virus can be transmitted from person to person through sneezing, coughing, talking to other people at close distance, and polluted airflow.
- Environmental factors such as air temperature, humidity, air pollution, water and sewage, inanimate surface, insects, etc., are effective in spreading the COVID-19 virus.
- COVID-19 pandemic has made the world upside-down by creating uncertain conditions. This has led many people to experience fear, worry, and anxiety during this period.
- Some vulnerable groups of population, i.e., health care providers, refugees, elderly, informal workers, and people who suffer from underlying disease, might be more exposed to mental problems, due to their special characteristics.
- Given the effects of COVID-19, updating SDGs and their targets should be taken seriously, taking into account three points: (1) will SDG goals and targets still remain priority after COVID-19? (2) If so, will be we witnessing development or growth in these indicators? (3) Is the path to achieving SDGs resilient enough to overcome sudden disruptions, including the ongoing and probable upcoming global crises?
The COVID-19 pandemic highlighted the necessity of global alliance, solidarity, and partnership to achieve good health and well-being for all (SDG 3).

Imposing problems for national, local and communicable levels of almost all countries, COVID-19 does not respect international boundaries.

Future pandemics look inevitable, rendering all countries, irrespective of their level of development, to become more resilient and strong enough to face the future long-scale crisis, especially in the field of health.

Ever since COVID-19 outbreak initiated, one-health approach has attracted global attention. It has become more explicit and clearer, now more than ever, that human beings and animals’ health systems are highly interconnected.

16.8 Conclusion

Historically, the most efficient reforms in the health systems have usually occurred in response to major crises. For example, health care systems in Europe and Japan improved dramatically after World War II. Similarly, high incidence of HIV/AIDS and financial crises led to robust plans to reach UHC in Thailand. Thus, governments can use the experiences and policy lessons learned from the current pandemic to establish more resilient health care systems that are strong enough to overcome any possible future crisis. Current response to COVID-19 needs to be strengthened urgently; otherwise, the world is likely to face chaos and devastating catastrophes for years and perhaps decades to come.

Unfortunately, although current vaccines are not distributed widely and there is no definitive treatment for COVID-19, nonpharmacological interventions and environmental health activities such as quarantining patients with clinical symptoms; wearing PPEs; social distancing; frequently disinfecting hands and surfaces; and avoiding touching one’s face including mouth, eyes, or nose with unwashed hands have been suggested as effective methods to control the disease. However, given that implementing social distancing, lockdown, quarantine, and obligation to stay at home might intensify the psychological burden of this outbreak, it is necessary that health authorities prioritize people mental health and prepare appropriate strategies for people to cope with psychological consequences of the outbreak.

COVID-19 revealed that SDG targets are not resilient enough in the face of such a powerful global threat. Some reports indicate that not only two-thirds of SDG targets are under threat as a result of COVID-19
pandemic, but 10% of goals may also intensify problems and reinforce the effects of further outbreaks. Nevertheless, some of the targets including Target 15.7 (end poaching and trafficking of protected species and address demand and supply of illegal wildlife products), are critical to reducing the risk of outbreaks such as COVID-19. In addition, SDG 3, in particular achieving UHC (SDG 3.8), is vital to contain the impact of outbreaks, especially in the LMICs. Therefore, SDG revisit might be necessary to replace some SDG priorities with a set of more realistic targets. It should be considered which goals are achievable in a less connected world with a slow global economic growth.

Despite its devastating challenges, the pandemic and its lessons learned can provide an opportunity for many governments to rebuild their health system toward greater surveillance and preparedness and plan and implement necessary measures to reach UHC and rebuild global trust. The ongoing pandemic reminds all countries and their governments the importance of intersectoral and multisectoral collaboration inside and outsides of their borders. COVID-19 reminds authorities across the globe that reaching UHC in all countries is necessary, now more than ever.

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