

11. Covid-19 and Its Impact on the World

Trishna Devi

Dept. of Psychology,
Gauhati University, Guwahati, India.

Debajit Sarma

Dept. of EEE, IIT Guwahati,
Guwahati, Assam, India.

Abstract:

The coronavirus disease has terrifically affected lives of people around the globe. At this moment, insecurity takes on new meaning and along several axes. The novel coronavirus disease (COVID-19) has created tremendous chaos around the world, affecting people's lives and causing a large number of deaths. The COVID-19 outbreak has affected all segments of the population including every sphere of social groups in the most vulnerable way. It is utmost necessity of government as well as other entities to ensure that the public is aware of the seriousness of COVID-19 with proper information. A high degree of population understanding solidarity and discipline is required to apply strict personal hygiene, coughing etiquette, self-monitoring and social distancing measures.

But at the same time, some good signs were also seen especially in environmental and climatic conditions. The global account of greenhouse gases has decreased to a noticeable amount due to shut down of industries globally. Another major change has been noticed in the education system where COVID-19 has forced educational system to go online as much as possible where people were seen adopting various online study methods like online classes, online study materials, webinars leaving behind traditional offline practices. Obviously, coronavirus disease has led to a pandemic situation which has significantly disrupted the whole societal scenario. Keeping an eye to this, this is our small effort to pen down about COVID-19 and its impact on society in various domains.

11.1 Introduction: Covid-19 - A Pandemic Created by Virus:

In the month of December 2019, a new respiratory tract disease was diagnosed among the residents in the city of Wuhan, Hubei province, China [1]. Yet unknown to that point, it was referred to as novel coronavirus 2019 (nCoV-2019) initially and was identified as the causative agent.

The coronavirus disease (COVID-19) is caused by the virus called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and has rapidly spread around the globe, emerging as a significant threat worldwide [2]. The new virus has 80% sequence identity with the SARS-CoV virus, which caused the severe acute respiratory syndrome (SARS) outbreak in 2002 [3].

The novel SARS-CoV-2 virus infection is mainly transmitted by micro-droplets generated in the airway of an infected person and is ejected during cough, sneeze and ordinary talk. It was very contagious in nature and can infect a healthy person when he/she comes in contact with an infected person. On January 13, the first case of COVID-19 was recorded in Thailand, outside of China. But by the end of February, it was creating an adverse situation in many European countries like Italy, France, Spain, Germany, UK etc. Towards the month of March, it spread almost all over the globe including countries like USA, Canada, India, Russia, Brazil etc. Deeply concerned by the alarming levels of spread within a small span of time and its severity, on 11th March, World Health Organization (WHO) made the assessment that COVID-19 can be characterized as a pandemic. Towards the end of May 2020, more than 55 Lakhs (5.5 Million) of infection has been reported with almost 3.5 Lakhs of deaths worldwide. The same number for India is: more than 13.9 Lakhs of infected case with more than 4 thousand deaths.

COVID-19 outbreak has dramatically exposed our weaknesses on various points at the individual, scientific, and organizational levels. However, it has also given us a chance to rethink our possibilities as well as responsibilities as man-kind and how the human race can be saved along with various flora and fauna through our united efforts. One of the first lesson of doing this can be an unprecedented global open access to high-quality knowledge and international exchange of clinical experience, organizational and technical expertise.

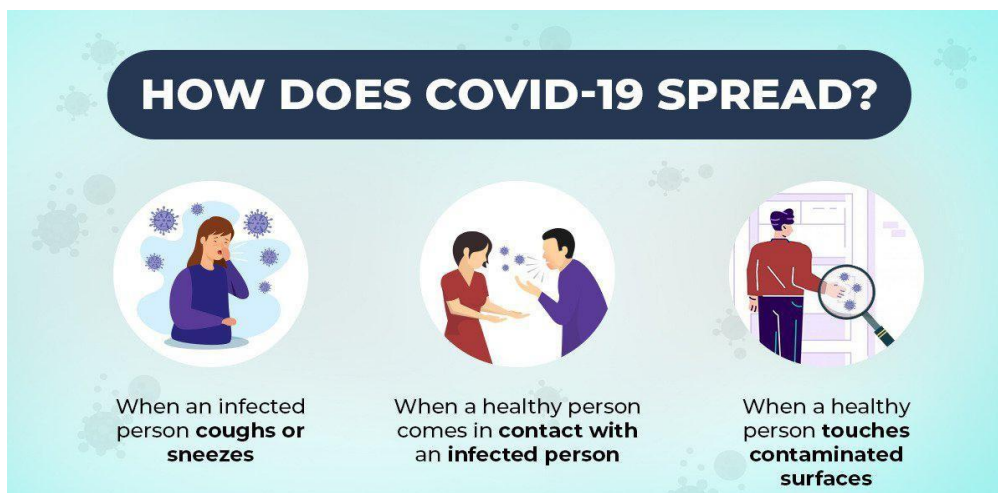
11.1.1 History:

Coronaviruses (CoVs) are a large family of viruses belonging to the family Coronaviridae. The limited number of coronaviruses known to be circulating in humans can cause mild infections and they were regarded as relatively harmless respiratory human pathogens. The emergence of the severe acute respiratory syndrome coronavirus (SARS-CoV) and the Middle East Respiratory Syndrome (MERS) virus revealed that coronaviruses can cause severe and sometimes fatal respiratory tract infections in humans. The first known case of SARS-CoV occurred in Foshan, China in November 2002 and new cases emerged in mainland China in February 2003. The first emergence of MERS-CoV occurred in June 2012 in Saudi Arabia. These events demonstrated that the threats of CoVs should not be underestimated and that it is of paramount importance to advance the knowledge on the replication of these viruses and their interactions with the hosts to develop treatments and vaccines. These successive outbreaks also highlight the long-term threat of cross-species transmission events leading to outbreaks in humans and the possible re-emergence of similar virus infection that should be considered seriously. SARS-CoV and MERS-CoV are two major causes of severe atypical pneumonia in humans and share important features that contribute to preferential viral replication in the lower respiratory tract and viral immunopathology. In December 2019, a typical pneumonia cases emerged in Wuhan, capital of Hubei Province in the People's Republic of China with clinical presentations consistent with viral pneumonia. The cause was quickly identified as being a novel disease, which was named 2019 novel coronavirus (COVID-19). The virus responsible for the infectious disease COVID 19 is called SARS-CoV-2 and named coronavirus in short due to its visual appearance (under an electron microscope) to solar corona (similar to a crown). The novel coronavirus SARS-CoV-2 (previously known as 2019-nCoV) is the seventh member of the Coronaviridae family of viruses which are enveloped, non-segmented, positive-sense RNA viruses. COVID-19 represents a new strain of Coronavirus and presumably representing a mutation of other Coronaviruses.

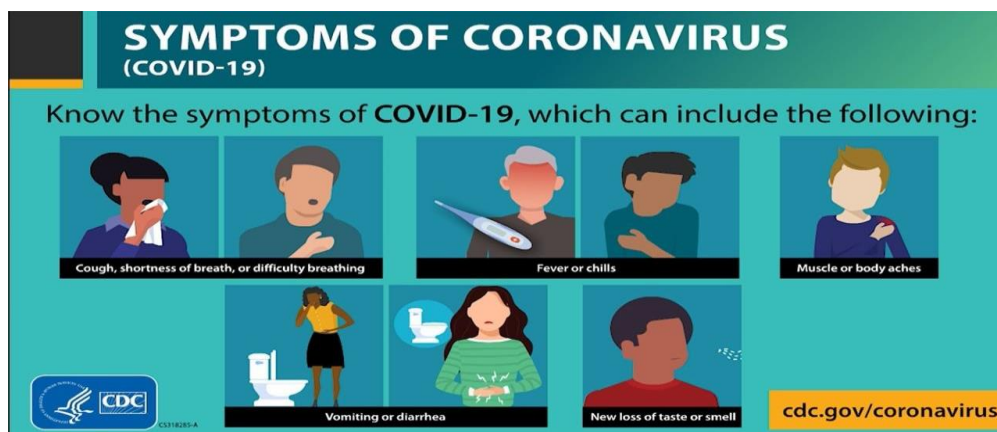
Investigations of the epidemiological, clinical, laboratory and radiological characteristics, treatment, and outcomes of patients infected by COVID-19 demonstrated that the infection caused clusters of severe respiratory illness similar to SARS-CoV. Early clinical investigations showed that although the COVID-19 can cause severe illness in some patients, it initially did not transmit readily between people. However, more recent epidemiological data suggest coronavirus has undergone human host adaptation/evolution and has become more efficient in human to human transmission. Within a short span of time COVID-19 has spread rapidly across the globe, and therefore WHO has declared it to be a pandemic. At the present situation, COVID-19 infections are a major healthcare challenge around the world due to the huge number of infections.

11.2 Situation Handling During the Pandemic:

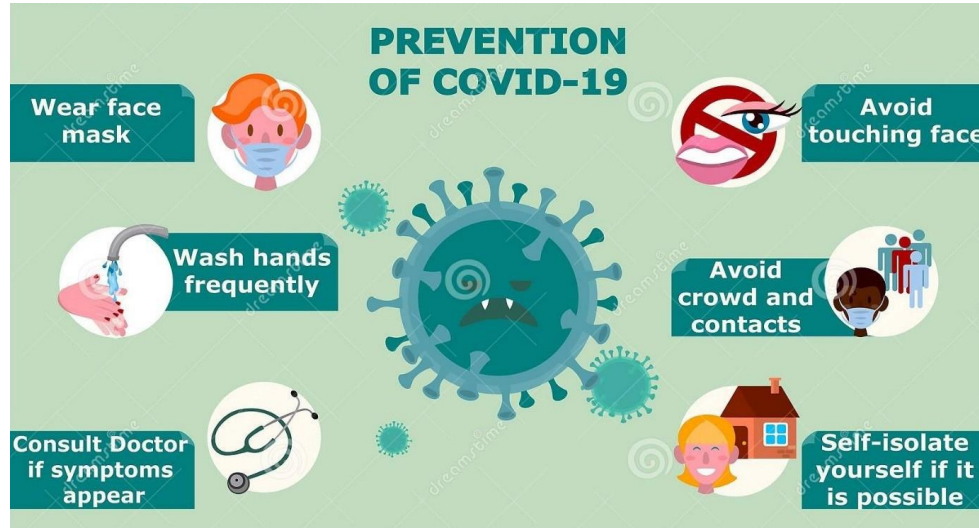
The COVID-19 pandemic has triggered an urgent need to contribute to the fight against an immense threat to the human population. COVID-19 mainly spreads through person-to-person contact during official and unofficial meetings, travel via public transport, and social and religious congregations. The contagiousness of COVID-19 has transformed it into a



(a)



(b)



(c)

Figure 11.1: COVID-19 (a) Spreading methods; (b) Symptoms; (c) Preventive measures (Image Courtesy: Internet source).

Pandemic within a very short period of 2 months. There are no vaccines available for the previously unknown virus and due to the absence of a vaccine or any targeted therapy, the only available preventive methods are non-specific.

For example, testing and isolation, quarantine, prevention/protection of foreigner entry, sanitary cordon, social distancing, etc were the main measures taken during the pandemic. Till the present day in the month of December 2020, social distancing has emerged as the most widely adopted strategy for its mitigation and control.

Social distancing measures should be implemented early in order to mitigate the impact of the epidemic and to delay the epidemic peak. This can interrupt human-to-human transmission chains, prevent further spread, reduce the intensity of the epidemic and slow down the increase in cases, while allowing healthcare systems to prepare and cope with an increased influx of patients.

Such measures should include:

- a. the immediate isolation of symptomatic persons suspected or confirmed to be infected with COVID-19;
- b. the suspension of mass gatherings, taking into consideration the size of the event, the density of participants and if the event is in a confined indoor environment;
- c. social distancing measures at workplaces (for example teleworking, suspension of meetings, cancellation of non-essential travel);
- d. measures in and closure of schools, taking into consideration the uncertainty in the evidence of children in transmitting the disease, need for day care for children, impact on nursing staff, potential to increase transmission to vulnerable grandparents;
- e. cordon sanitaire of residential areas with high levels of community transmission;

The scientific response to combat COVID-19 has been far quicker and widespread. Numerous scientific approaches have been proposed so far, dealing with different aspects to combat the COVID-19 pandemic.

11.2.1 Medical and Healthcare Facilities:

The mortality rate of COVID-19 is 6.30% which is less than that of the severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) coronavirus diseases (10% for SARS-CoV and 37% for MERS-CoV). However, it is highly infectious, and the number of cases has been increasing rapidly. So, it creates a highly challenging task for medical professionals to practically and effectively screen suspected infectious cases from individual households. Such a massive undertaking is time-consuming and labor intensive and is constrained by the availability of testing technologies at this extremely critical time. The existing infrastructure for the detection of COVID-19 positive patients is insufficient and manual detection is time-consuming. The sudden explosion and uncontrolled worldwide spread of COVID-19 show the limitations of existing healthcare systems to timely handle public health emergencies. Hence, dealing with the coronavirus (COVID-19) is one of the major healthcare challenges around the world today. It is seen that even some developed countries like Italy, USA, and France have faced major challenges in providing health care facilities to COVID-19 patients. Whereas, some countries like Taiwan, South Korea, Japan have shown tremendous success not only in providing good healthcare facilities, but also were able to control the contagious disease. In case of India, overall infections all over the country is quite less compared to the overall population. But the case is more severe in some major cities like Mumbai and Delhi.

Major Healthcare Measures are:

- a. Prevention and control of COVID-19 in hospitals and long-term care facilities is an immediate priority in order to: (1) slow the demand for specialised healthcare, such as ICU beds; (2) safeguard populations vulnerable to severe outcomes of infection (3); protect healthcare workers that provide care; (4) minimize the export of cases to other healthcare facilities and the community.
- b. Countries should identify healthcare units that can be designated to care for COVID-19 cases, to minimize transmission to non-cases and to conserve PPE. The highest priority for use of respirators (FFP 2/3) are healthcare workers, in particular those performing aerosol-generating procedures, including swabbing.
- c. As resources or capacity are limited, rational approaches should be implemented to prioritise high-yield actions, which include: rational use of confirmatory testing, reducing contact tracing to focus only on high-yield contacts, rational use of PPE and hospitalisation and implementing criteria for de-isolation.
- d. National surveillance systems should initially aim at rapidly detecting cases and assessing community transmission. As the epidemic progresses, surveillance should monitor the intensity, geographical spread and the impact of the epidemic on the population and healthcare systems and assess the effectiveness of measures in place.

- e. Ensuring the public is aware of the seriousness of COVID-19. A high degree of population understanding, solidarity and discipline is required to apply strict personal hygiene, coughing etiquette, self-monitoring and social distancing measures.

Science and technology: Compared to the Spanish flu pandemic in 1918, we are now fortunately living in the age of exponential technology. Science and technology has been applied successfully in almost every corner of humans' lives. When every individual, every organization is struggling in this battle, in such contexts, government must try their best to fully explore and employ innovative technologies to support humans to encounter this battle against the deadly coronavirus pandemic. Governments of many countries have proposed policies to mitigate the impacts of the COVID-19 pandemic.

Science and technology have contributed significantly to the implementations of these policies during this unprecedented and chaotic time. For example, robots are used in hospitals to deliver food and medicine to coronavirus patients or drones are used to disinfect streets or public spaces. Many researchers are rushing to produce drugs and medicines to treat infected patients whilst others are attempting to investigate vaccines to prevent the virus. On the other hand, many others have tried for early detection of infectious patients using techniques that can process and understand medical imaging data such as X-ray images and computed tomography (CT) scans. A framework for COVID-19 detection using data obtained from smartphones' on board sensors such as cameras, microphones, temperature and inertial sensors is also proposed. With the advancement of Internet of Things (IoT), technical report and travel history of persons having contact with probable and confirmed cases of COVID-19 can be made available through contact tracing apps on demand of public health management.

Preventive Measures: Given the current epidemiology and risk assessment, some preventive measures has to be taken by each and every individual as given below:

- a. Wash hands frequently while indoor or use hand-gloves while outdoor.
- b. Avoid touching eyes, nose and mouth with hands.
- c. Practice respiratory hygiene by covering mouth and nose by mask.
- d. Bent head or cover nose and mouth with elbow or tissue while coughing or sneezing.
- e. If you have fever, cough and difficulty in breathing, seek medical care at the earliest.
- f. Stay well-informed and follow the advice given by healthcare provider.
- g. Always maintain social distancing.

A strategic approach based on early and rigorous application of these measures will help reduce the burden and pressure on the healthcare system, and in particular on hospitals, and will allow more time for the testing of therapeutics and vaccine development.

11.3 Impact of COVID-19 on Global Village:

The coronavirus disease has terrifically affected lives of people around the globe. At this moment, insecurity takes on new meaning and along several axes.

The novel coronavirus disease (COVID-19) has created tremendous chaos around the world, affecting people's lives and causing a large number of deaths. COVID-19 is also going to change the international relations in a big way.

11.3.1 Economic Impact on Global Village:

The virus spread has caused the global economic a massive shock with the interruptions of many sectors such as supply chain, industry, insurance, agriculture, transport, and tourism, forcing governments and owners to shut stop operations on a worldwide scale [4].

According to the Organisation for Economic Cooperation and Development (OECD), the global economy could grow at its slowest rate since 2009 in this year due to the coronavirus outbreak [5]. The insecurities of many under- developed as well as developed countries are clear in recent reports by the IMF, UN and World Bank among others.

As the number of infections rises, many governments around the world have instituted drastic lock-downs and curfews and called for social distancing and work from home to reduce the rate at which the virus spreads.

11.3.2 Global Recession:

Amid the coronavirus pandemic, several countries across the world resorted to lockdowns to “flatten the curve” of the infection. These lockdowns meant confining millions of citizens to their homes, shutting down businesses and ceasing almost all economic activity.

The pandemic has pushed the global economy into a recession, which means the economy starts shrinking and growth stops. According to the International Monetary Fund (IMF), the global economy is expected to shrink by over 3% in 2020 – an outcome “far worse” than the 2009 global financial crises. Advanced economies have been hit harder, also emerging markets and developing economies are expected to contract.

In the US, COVID-19-related disruptions have led to millions filing for unemployment benefits. Similar situation prevails in many European countries like Italy, France, Spain, and Germany and Asian countries like China, South Korea and India.

There are various sectors and economies that seem most vulnerable because of this pandemic, such as, both the demand and supply have been affected by the virus, as a result of depressed activity Foreign Direct Investment (FDI) flows could fall between 5 to 15 percent.

Besides, the most affected sectors have become vulnerable such as tourism and travel-related industries, hotels, restaurants, sports events, consumer electronics, financial markets, transportation, and overload of health systems.

11.3.3 Global Transport, Tourism and Hotel Industry:

Due to the pandemic, global transport and global tourism came to a halt where tourist hotspot countries like Thailand, Indonesia, many European countries were affected most along with other countries.

Most international carriers including flight and ships/cruises were cancelled except some lifting aircrafts to take citizens to their home countries. One of the worst hit sector due to the pandemic is tourism and its closely related industries like hotel industry.

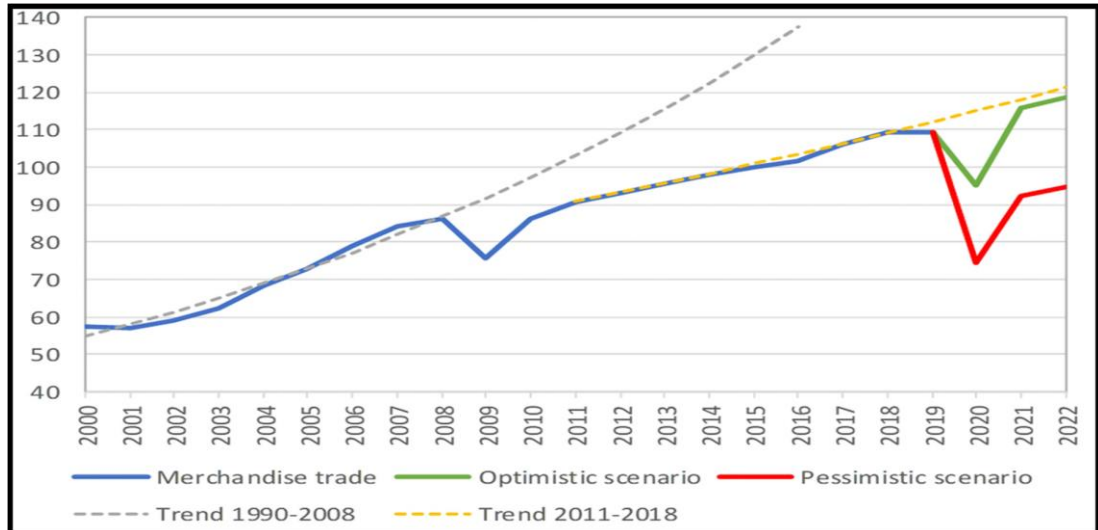


Figure 11.2: The state of merchandise trades around the globe in different years (source: WTO Secretariat). A sharp down is seen during this COVID-19 pandemic period.

11.3.4 Oil and Natural Gas:

Due to the fall in travel and global industrial activity, oil industry has been affected. Oil prices fell further to reach a negative value at some point of time as the transportation section, which accounts for 60% of the oil demand, was hit due to several countries imposing lockdowns.

Not only oil, early this year in China, due to COVID-19 related containment measures, the demand for natural gas fell, as a result of which many Chinese LNG buyers halted their imports as storage tanks filled.

11.3.5 Automobile and Other Manufacturing Industries:

Along with tourism, another tourism related industry is worse effected and that is automobile industry.

All kinds of manufacturing industries had to stop during this pandemic.

11.3.6 Industrial Metals:

Due to lockdowns in China, followed by in the US and Europe, the demand for industrial metals reduced as factories shut down. As per IMF, China accounts for roughly half of the global demand for industrial metals.

11.3.7 Food and Beverages:

IMF projects a decrease in food items by 2.6% in 2020, caused by supply chain disruptions, border delays, food security concerns in regions affected by COVID-19 and export restrictions. Further, all these have put an upward pressure on the prices of different food items.

11.3.8 Food Supply Chains and Taxi Services:

These two facilities came to a halt during this period and the drivers and delivery persons faced tremendous discomfort. After-effect is also going to affect many such persons related to these services due to the loss of their jobs. Apart from the above mentioned sectors, this COVID-19 pandemic has affected almost each and every sector including banking and finance. The information technology (IT) industry tried to cope up with the pandemic through work-from-home model to deliver its services. This economic slowdown is caused by a pandemic and not due to some other economic fault. Now, as some countries have lifted restrictions and gradually restarted their economic activities, so it is expected that economy will try to grow slowly. But for many countries it may require 1-3 years to attain its stable state as before.

How have countries tried to cope with the situation?

World trade is expected to fall by between 13% and 32% in 2020 as the COVID 19 pandemic disrupts normal economic activity and life around the world. According to an assessment by the World Economic Forum (WEF), supporting Small and Medium Enterprises (SME) and larger businesses is crucial for maintaining employment and financial stability. Many advanced economies in the world have rolled out support packages. While India's economic stimulus package is 10% of its GDP, Japan's is 21.1%, followed by the US (13%), Sweden (12%), Germany (10.7%), France (9.3%), Spain (7.3%) and Italy (5.7%).

In Asia, countries including India, China, Indonesia, Japan, Singapore and South Korea account for about 85% of all the COVID-19 cases on the continent. South Korea stands out, since business and economic activities were not completely stopped and therefore, their economy was not severely affected. China recently lifted its lockdown and has since then been gradually reopening its economy without an aggressive second wave of infections so far.

In India, Prime Minister has announced a package of 20 Lakh Crore to help Medium, Small and Micro Enterprises (MSMEs). He also asked citizens to help local industries to grow by becoming "vocal for local" to mark our country as "Atmanirbhar Bharat". The Finance Minister has announced some details of the "Atmanirbhar Bharat Abhiyan" package, to provide relief to MSMEs in the form of an increase in credit guarantees.

Further, even as economic activity resumes gradually, the situation will take time to normalize, as consumer behaviours change as a result of continued social distancing and uncertainty about how the pandemic will evolve. For instance, in its World Economic Outlook report for 2020, the IMF mentions that firms may start hiring more people and expanding their payroll only a gap of period, as they may not be clear about the demand for their output.

11.3.9 Indian Economy and Its Efforts for Revival:

The economic impact of COVID-19 pandemic in India has been largely disruptive. The World Bank and rating agencies had initially downgraded India's growth for fiscal year 2020-21 with the lowest figures India has seen in three decades since India's economic liberalization in the 1990s. During the lockdown, an estimated 14 crore (140 million) people lost employment [6]. Within a month, unemployment rose from 6.7% on 15 March to 26% on 19 April [6].

More than 45% of households across the nation have reported an income drop as compared to the previous year. The Indian economy was expected to lose over 32,000 crore (US\$4.5 billion) every day during the first 21-days of complete lockdown, which was declared following the coronavirus outbreak. In India up to 50% of businesses in each and every sectors including automobile, aviation and tourism, real-estate and construction, agriculture, manufacturing, e-commerce and stock-markets, have specified a certain amount of impact of shutdowns caused due to COVID-19 lockdown operation (FICCI survey).

The Government of India has announced a variety of measures to tackle the situation, from food security and extra funds for healthcare, to sector related incentives and tax deadline extensions. On 12 May, the Prime Minister, in an address to the nation, said that the coronavirus crisis should be seen as an opportunity, laying emphasis on domestic products and "economic self-reliance", an "Atmanirbhar Bharat". India's overall economic package is worth 20 lakh crore (US\$280 billion). This is 10% of India's GDP. The package, though announced on 12 May by the Prime Minister, included previous government actions, including the RBI announcements of 8 lakh crore liquidity ^[7].

The Government of India is also aiming to attract companies that wish to move out of China or are looking for an alternative to China. States like Karnataka and Gujarat are also following a "Compete with China" cluster strategy forecasting "large-scale manufacturing". More than 1000 US-based companies are willing to move their plants to India. In mid-May, the German footwear brand, Von Wellx, decided to shift its entire operations out of China and into India. While competing with China, India is also facing numerous difficulties including issues with China boarder as well as also trying to balance the economic situation in light of China–United States trade war.

During this lockdown period the Government of India faced another big challenge related to the migrant workers. Due to the lockdown, daily-wage workers (the urban poor and migrant labours) working in different parts of the country were left with no work. At the same time, the lockdown restrictions put a stop on the movement of buses and trains. Large numbers of migrant workers ended up walking back to their villages.

The decisions around how to respond to the COVID-19 are particularly complicated for these migrants as well as the families they leave behind. The lack of preparation for the corona virus pandemic, and the unknowns that surround COVID-19 become an existential threat to these migrants. Soon after a central government directive in late March, state governments set up 21,000 camps to house over 6,60,000 migrants and stop the exodus.

Over 500 hunger relief centres were set up by the Delhi government by the last week of March. By 5 April, 75 lakh people were being provided food across the country in food camps run by the government and NGOs. As of 12 April, 37,978 relief camps and 26,225 food camps had been set up. Migrants in such camps in Kerala, Karnataka and Maharashtra and other parts were provided with medical essentials such as masks, sanitizers, and medicines. Railways transported around 31 lakhs migrants back to their homes in the special trains allocated for them between 1 and 21 May. The central government paid some amount of the fare. Soon after the nationwide lockdown was announced in late March, Finance Minister announced a 1.7 lakh crore (US\$24 billion) spending plan for the poor. This consisted of cash transfers directly to the migrant labours, steps to ensure food security and to help provide jobs and wages to workers through different schemes like MNREGA.

11.4 Political Impact and International Relations among Different Countries:

The COVID-19 pandemic has also affected international relations among countries. Two major power of the world, USA and China, were indulged in economic war game in pre-COVID time. As coronavirus originated in China, this war game was accelerated through “blame-game” between the two countries.

Many other countries are also offended and want to blame China for corona virus. This clearly shows deteriorating international relations among different countries, particularly rival countries.

Moreover, many countries have understood that every country has to try to be independent as much as possible by reducing dependencies in manufacturing super-hub like China. India has also supported this call by a “vocal for local” message by the Prime Minister.

Many US and European based industries have agreed to shift their plants to India and other Asian countries like Bangladesh and Vietnam where cheap labour is available.

This has also escalated a war game between India and China. During August-September China increased their boarder activity and troops near Ladakh territory in Indo-China boarder area. In response, India also deployed military troops in the region. All these created unnecessary tensions between the two neighboring countries.

Concerning the serious and worsening conditions all over the world, nations need cooperation and coordination among themselves including the help and mature as well as sensible behaviour of people to effectively fight against coronavirus. Otherwise, because of the globalized and connected world, wrong actions and policies taken by any state will leave a severe impact on other countries as well.

This is not the time of political point- scoring and fight with each other rather it is high time for states to cooperate, coordinate, and help each other to defeat this fatal pandemic first for saving the global economic and financial structure.

11.5 Vaccine Development:

The contagiousness of COVID-19 has transformed it into a pandemic within a very short period of two months. There was no vaccines available for the previously unknown virus and there was little evidence on the effectiveness of potential therapeutic agents for at least six months of the outbreak.

Understanding even the tiniest details of the pathogenesis of viral infections, like interactions between viral proteins and receptors on human target cells, the broad complexity of the immune responses and the functioning of the labyrinth of the coagulation system are very crucial for vaccine production.

If these pathogenic puzzles had been arranged earlier, the general scenario of this pandemic could have been completely different. Viral genomes can quite easily be manipulated which creates major obstacle in production of vaccine for new viral diseases.

But the quest of science to unveil these mysteries desperately and to bridge the lacking of understanding of virus mutation can change the affect in our lives in a broader perspective.

In February 2020, the World Health Organization (WHO) said that it did not expect a vaccine against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative virus, to become available in less than 18 months [8].

Organizations like WHO, Coalition for Epidemic Preparedness Innovations (CEPI), and the Gates Foundation are committing money and organizational resources to support rapid development of vaccines to prevent COVID-19 infections. Federal governments those are dedicating resources for national or international investments include Canada, China, European Union, Australia, United Kingdom and United States.

For large production, Gates Foundation has collaborated with large-scale vaccine manufacturing Indian entity Serum Institute of India (SII) situated in Pune. SII is also trying to develop its own vaccine by collaborating with different organization and universities all over the world.

Previous attempts to develop a vaccine against the coronavirus diseases like SARS and MERS, established considerable knowledge about the structure and function of coronaviruses – which accelerated rapid development for COVID-19 vaccine during middle and late 2020 with varied technology platforms.

With each passing day, the race towards finding an effective COVID-19 vaccine is intensifying. Companies have been racing to find a vaccine for the coronavirus, which has killed over 1.5 million people and infected more than 65 million since it emerged in China in December of last year.

With more than 200 coronavirus vaccine candidates in development around the world in early December, 2020, a few have emerged ahead of the others, and are already in final phase trials, or have filed for emergency use authorization. Three COVID-19 vaccine candidates are leading the race to become available to immunise populations.

Two of the vaccines that recently released results from phase III trials using new cutting edge technology. Both US pharmaceutical company Pfizer with Germany's BioNTech and US biotechnology company Modern's vaccines, use messenger RNA (mRNA) technology, a technique that involves injecting genetic instructions into the body.

This stimulates the cells to produce a protein that will help create antibodies to prevent further infections. This new mRNA type vaccine uses a tiny fragment of genetic code from the pandemic virus to teach the body how to fight Covid-19 and build immunity. Though mRNA vaccine has never been approved for use in humans before, but both the mRNA vaccine candidates released results showing high efficacy. Both are around 95% effective, the companies said this month.

Experts say that this is much higher than expected but it remains to be seen for how long the immunity will last. The Pfizer vaccine was most recently authorized for emergency use in the United Kingdom, which will begin.

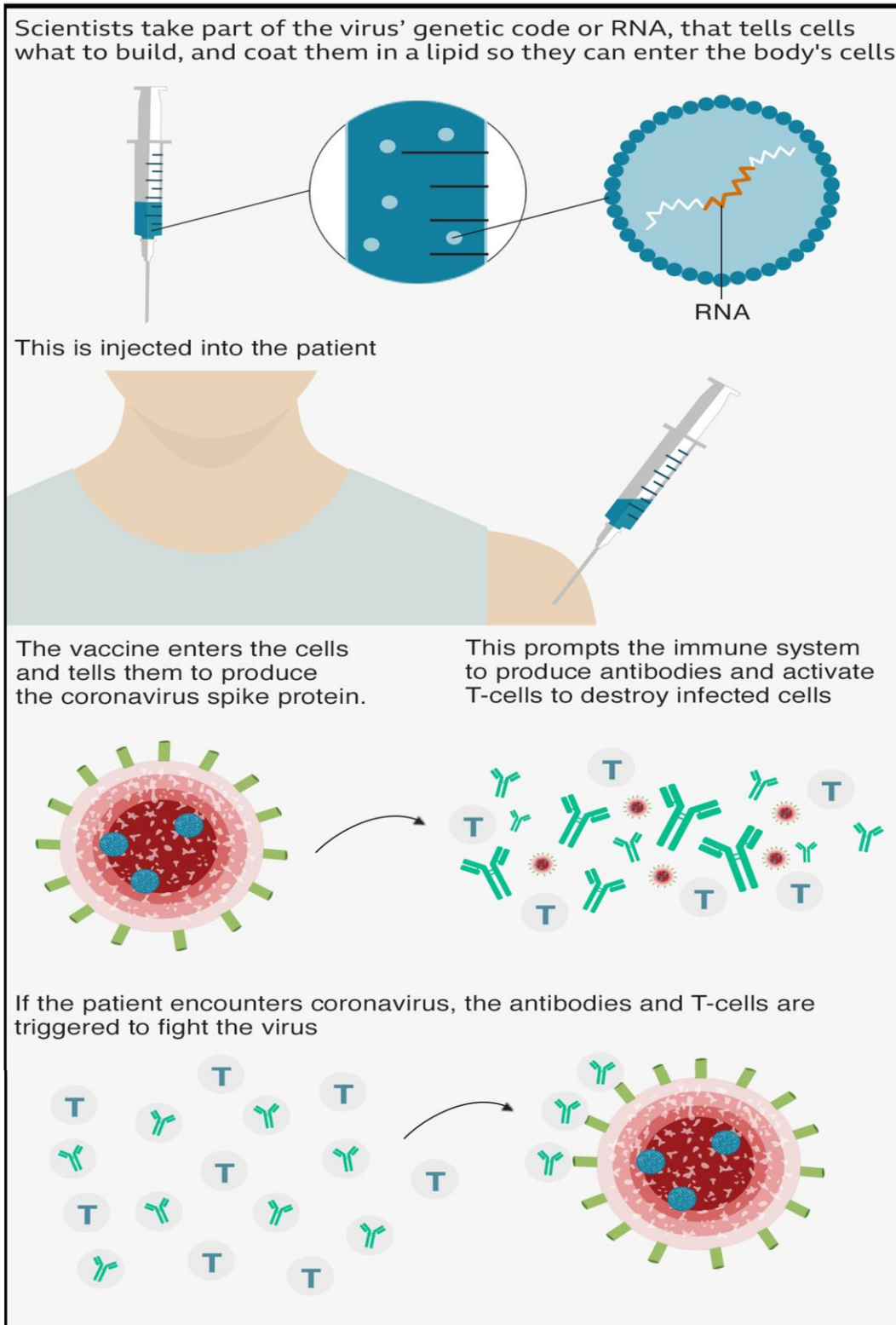


Figure 11.3: How an RNA vaccine would work (Image Courtesy: BBC).

Distributing the vaccine to vulnerable people next week. Bahrain also announced that it had approved the emergency use of the Pfizer-BioNTech coronavirus vaccine, becoming the second country after Britain to green-light the drug.

A third vaccine candidate that has released results is the Oxford University/AstraZeneca vaccine. AstraZeneca, the company that is producing the Oxford coronavirus vaccine candidate will likely get results of its U.S. COVID-19 vaccine trial in late-January, 2021 and could potentially file for an emergency authorization. This vaccine is expected to show efficacy between 62% and 90% depending on the dosing regimen. This vaccine is based on a modified version of an adenovirus that causes the common cold in chimpanzees. The weakened virus does not grow in humans. The Serum Institute of India (SII) is conducting trials for the vaccine in India. Recently, a Chennai-based participant sent a legal notice to the pharma company, alleging that he developed neurological and psychological symptoms due to the vaccine. The company has denied all claims citing the symptoms are incidental and have nothing to do with the vaccine and also filed a counter case.









Back in August, Russia first registered a COVID-19 vaccine called Sputnik-V for emergency use although it had only been tested on a few dozen people. But Sputnik V is still in the midst of trials to check that it's safe and actually works, making some Russians wary of receiving it yet. India's home-grown COVID-19 vaccine, Covaxin, is being developed and produced by Bharat Biotech, in partnership with the Indian Council of Medical Research (ICMR). Covaxin phase 3 trials are being conducted at multiple locations around the country like Kolkata, Ahmedabad and Karnataka etc.

A vaccine for an infectious disease has never before been produced in less than several years, and no vaccine exists for preventing a coronavirus infection. From an unknown virus at the start of the year to a vaccine development and approval by the regulator and ready to use in early December is an unprecedented timescale. The pace has been breath-taking. The WHO also mentioned that the vaccine would not replace the other measures "for a number of months, even a year, so we'll have to keep doing physical distancing, mask wearing, hygiene and isolating ourselves when we're sick".

How are these vaccines stored and distributed?

There are substantial differences among different vaccines, including their composition, price and distribution capacity. Here's a look at the three coronavirus vaccines for which we've received preliminary trial results. Oxford's vaccine is much cheaper, at just around €3 per dose. Pfizer is likely to cost around €16 per dose while Moderna's could cost up to €31 for each of the two doses a person needs.

The storage and transportation conditions also benefit the Oxford/AstraZeneca vaccine as it can survive for six months in a standard refrigerator. The Pfizer/BioNTech vaccine however is much more complicated to manage. It needs to be stored at ultra-cold temperatures around -70°C. Because the vaccine must be stored at around -70C, it will be transported in special boxes of up to 5,000 doses, packed in dry ice. Once delivered, it can be kept for up to five days in a fridge. And once out of the fridge it needs to be used within six hours. The Moderna vaccine can remain stable for 30 days at between 2° C and 8° C. But over a longer period of time, it would need to be stored in standard freezers at -20°C.

Company	Type	Doses	How effective*	Storage	Cost per dose
 Oxford Uni-AstraZeneca	Viral vector (genetically modified virus)	x2 	62-90%	Regular fridge temperature	£3 (\$4)
 Moderna	RNA (part of virus genetic code)	x2 	95%	-20C up to 6 months	£25 (\$33)
 Pfizer-BioNTech	RNA	x2 	95%	-70C	£15 (\$20)
 Gamaleya (Sputnik V)	Viral vector	x2 	92%	Regular fridge temperature (in dry form)	£7.50 (\$10)

*preliminary phase three results, not yet peer-reviewed

Figure 11.4: Comparison of different COVID-19 vaccines (Image Courtesy: Respective companies, WHO).

11.6 Some Positive Effects:

But at the same time, some good signs were also noticed especially in environmental and climatic conditions. The global account of greenhouse gases has decreased to a noticeable amount due to the shut-down of industries globally. Major factory oriented countries like US, China has slowed down their factory productions which has positive effect on environment. Strict lockdown measures has also cleared skies as well as rivers. In India, the pollutants in rivers like the Ganges and the Yamuna has decreased significantly. The hole of the ozone layer got recovered to a great extent during this lockdown situation. Many wildlife and endangered species were able to roam around feely without any human intervention.

11.6.1 Impact on Education System:

Another major change that has been noticed is in the education system. COVID-19 has forced educational system to go online as much as possible since almost all the educational institutes has to close during this pandemic. Lots of institutes were adopting online classes along with Massive Open Online Courses (MOOCs).

So, people were seen adopting various online study methods like online classes, online study materials, webinars leaving behind traditional offline practices. Moreover, conferences and meetings were being held through video conferencing mode both in institutes as well as other organizations.

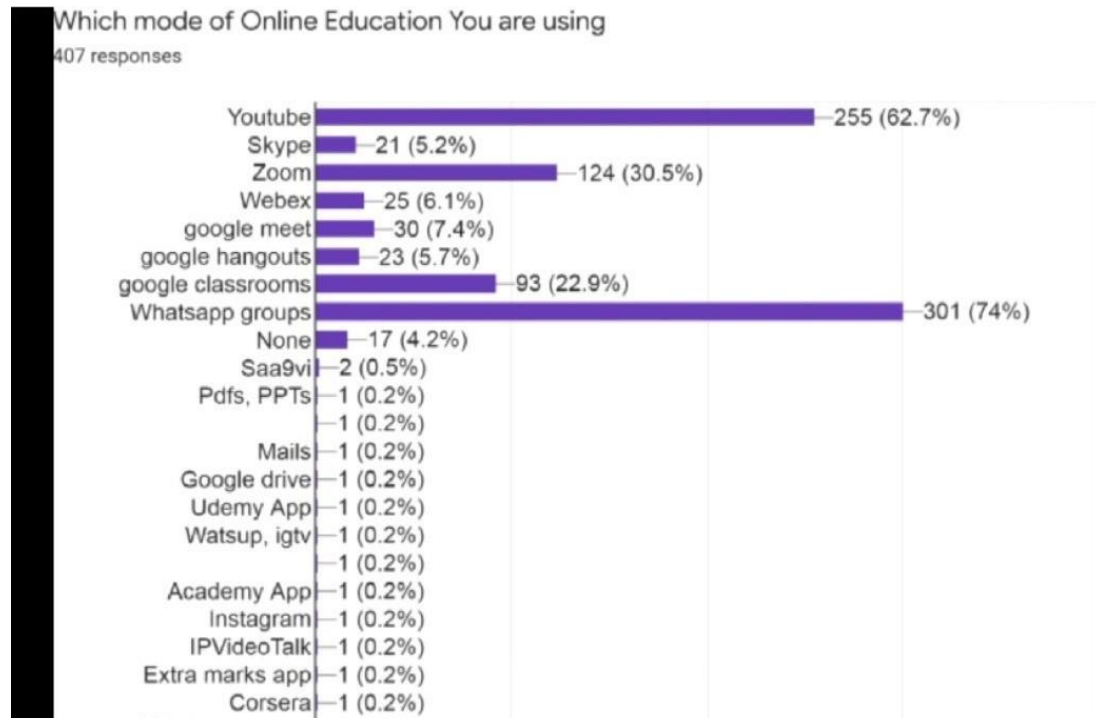


Figure 11.5: Mode of e-learning tools during the pandemic (Courtesy: Internet source).

In India also it is seen that numerous private as well as government institutes also adopted various online mode for teaching and learning. Again, with the introduction of information technology in higher education has shown a new paradigm change in philosophical and pedagogical approach. Thus the pandemic has transformed the countries' old chalk-talk teaching model to one driven by technology.

11.6.2 Lessons Learnt From The Pandemic:

Reflecting on 2020 one feels that COVID-19 is a lesson for life, that combined many learnings in one i.e. the fragility of life & uncertainty of future, the power of nature, what really matters and what does not in life and above all, the need to move on. The experience of this episode shall not only shape our social behavior going forward but will also impact how corporates and economies operate for years to come. It is well known that COVID-19 has not only been a public health crisis but has also severely impacted the economy in near term. However, the good news is that situation is improving. Here, we are going to list out some important lessons learnt in this pandemic from the perspective of India. More items can be added to the list from individual perspective which is most welcomed.

- a. Health and education should be our first priority. Children, elderly and patients with comorbidity should be in place and in practice in proper health care system.
- b. War like preparation is required on healthcare front. Future healthcare systems should be war-prepared to battle pandemics whenever they breakout.
- c. We need to set 'early warning systems' in place in the society: Unlike in the past, viruses in the 21st century not only are 'hyperactive', but also leave their tales of devastation with 'viral speed' due to globalization.
- d. Social distancing and hygiene should become a norm and part of our regular habits.

- e. “Swachh Bharat” should become a norm for each and every Indian.
- f. Need to promote original research and development (R&D) activities and strengthen our Drug & Vaccination Development Programme further.
- g. Push our indigenous diagnostics manufacturing to make it sufficient for Indian needs.
- h. Government need to make appropriate provisions for supporting the balance on payments among population in case of such calamities.
- i. Try to be independent as much as possible as a country. This can be done by promoting local brands.
- j. The bottom line is that India has to have a robust action plan when a pandemic strikes – a plan that is creative, disciplined and, above all, sensitive.

11.7 Conclusion:

The coronavirus (COVID-19) outbreak in late 2019 comprises a serious threat around the world. The severity of the epidemic was so huge that the World Health Organization (WHO) was compelled to declare it as a pandemic within a few months of its wide-scale expansion. It is seen that COVID-19 has some adverse effect on small kids, elderly people and people with less immune system caused by different illness like cancer, HIV, heart diseases and they have more mortality rate. Various measures has been mentioned here that are taken at individual as well as organizational levels to combat COVID-19. But due to the lack of proper pathological method, the suppression of social contact in workplaces, schools and other public spheres is the major one of such measures. Due to strong social distance measure, it is also noticed that mortality rate and infection rate is quite suppressed in many countries with huge population like India. We believe our brief overview will shed valuable light on the research of various domains of COVID-19 fighting as well as motivate interested researchers and stakeholders to put more efforts using promising technologies to combat future coronavirus-like epidemics.

11.8 References:

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