






■ Review Article

Combating COVID-19 Pandemic in Bangladesh: A Memorandum from Developing Country

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ABSTRACT

This paper is purposed to delineate the current situation of coronavirus disease 2019 (COVID-19) pandemic in Bangladesh as well as how the people in this country are encountering this threatening crisis. COVID-19 is a global pandemic that has rapidly spread throughout different countries of the world to date. After its emergence in China different continents started to get aware of COVID-19 though, due to its high transmissibility several countries have been quite deteriorated preventing it. All the countries are moving forward to the best of their abilities to find out any solution so that the whole world could get rid of this horrifying situation as soon as possible. The authors here have reported an overview of how the outbreak of COVID-19 has impacted Bangladesh and how the people of this country have been tracing the way to tackle this havoc. Also, authors tried to enunciate the changes that have brought around due to the crisis have offered us some fertile lessons. To conclude, the observation and current knowledge of the pandemic in Bangladesh so far suggest that special considerations might be anticipated to be highlighted pertaining to the COVID-19 outbreak in Bangladesh.

Keywords: COVID-19, Bangladesh, SARS-CoV-2, outbreak, pandemic

INTRODUCTION

The COVID-19 has infected more than 5.3 million people during the time of writing and caused several thousand deaths around the world and intimidating to harm to world population further with a high alarming risk. Among the infected ones, 1.99 million people have recovered while 336 thousand infected individuals have already passed away. Hence, to date, the recovery and death rates are respectively

reported 38.49% and 6.60% (Source: Johns Hopkins Coronavirus Research Centre; <https://coronavirus.jhu.edu/>).

COVID-19 is a communicable disease which is caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) strain of beta coronavirus (a subfamily of coronavirus). It is a newly emerged strain that binds to the ACE-2 receptor of ciliated bronchial epithelial cells as well as type-2 pneumocytes of the human lung [1]. The COVID-19

was first identified in Wuhan, Hubei province, People's Republic of China. After the analysis of the phylogenetic tree and multiple sequence alignment, it was estimated that pangolin acted as an intermediate host in transmitting the novel coronavirus from bat to human.

The disease is transmitted to healthy individuals from the respiratory droplets which are generated during sneeze or cough of infected persons. Also, direct respiratory tract contact or other respiratory secretions may cause this disease with an incubation period of 2-14 days [2]. The virus may stay for 2-3 hours in the air and 72-48 hours in the surfaces like plastic, stainless steels. In addition, infected persons may transfer the virus to any surface or object like a phone, table, doorknob, laptop when they touch it where the virus survives for 8 hours [3,4]. Novel coronavirus infects the upper and lower respiratory tract and can cause variety of severities. Some mild symptoms of this disease are initially cold, cough, sore throat, mild muscle pain, appetite loss, fever, and diarrhoea. The critical symptoms of this disease are pneumonia, shortness of breathing, and organ failure that may lead to death. People with comorbidity (having diabetes, blood pressure, heart disease, and kidney disease) or acute respiratory disease like asthma, are more vulnerable to its infection [5,6]. In order to confirm whether a symptomatic or asymptomatic person is infected or not, diagnostic tests including RT-qPCR, serological test, CRISPR-CAS-12 are performed. Among them, RT-qPCR is the most frequently used test worldwide [7].

Bangladesh, a lower-middle income country (LMIC) of Southeast Asia with more than 160 million people, confirmed the first infected case on March 08, 2020 and experienced first death on March 20, 2020. As of May 05, 2020, the disease was reported to infect all 64 districts, and the country was considered as the third highest country in the number of people who died among the South Asian countries to date [6]. With notable limitations, the country's Institute of Epidemiology, Disease Control and Research (IEDCR) commenced the test for COVID-19 through the method RT-qPCR and it became widespread across the country. However, a mandatory lockdown was declared by the Bangladesh government to prevent the severe community transmission in this densely-populated country but unfortunately, being an LMIC with people under the poverty line, the lockdown is hardly maintained by day labourers, beggars, garment workers and so forth. Hence, social awareness about COVID-19 is found barely satisfactory in Bangladesh which should be brought immediately under sincere concern by the government of Bangladesh.

COVID-19 OUTBREAK IN BANGLADESH

After almost three and a half months of the first COVID-19 patient detected in China, three coronavirus cases (including two men and one woman) were detected positive for the first time on March 8, 2020 in Dhaka, Bangladesh [8] where two of them returned from Italy and the other one was a relative of one of the returnees. The mean ages were between 20 and 35 years, which was ensured by the Institute of Epidemiology, Disease Control and Research (IEDCR). They were hospitalized in Dhaka but the hospital name was kept secret. Three family members of them were being kept in quarantine after coming in contact with the COVID-19 patients. Total 105586 cases were confirmed worldwide till that time [9]. Two of the COVID-19 patients had recovered after four days of first identified in Dhaka. On March 18th, 2020, a total of 14 cases (including 4 newly diagnosed) were confirmed and the first coronavirus patient died (**Figure 1**) in Bangladesh that was the 11th day of the country's first coronavirus case. The patient was a 70-year-old man who had several pre-existing complications like Chronic Obstructive Pulmonary Disease (COPD), hypertension, heart disease, and diabetes. In the meantime, the world recorded a total confirmed case of 191,127 along with 7807 death tolls [10].

To decrease this viral transmission, WHO suggested some fundamental guidelines i.e. avoiding close contact with people who have acute respiratory infection symptoms, frequently washing hands (particularly if physical contact with patients or their environment), practicing etiquette rules like maintaining social distance, covering coughs and sneezes with disposable tissues, etc., as well as enhancing standard infection prevention and control practices in emergency departments of the hospitals [11].

The spread of coronavirus in Bangladesh commenced from Dhaka city to the rest of the country. Dhaka is the most densely populated and capital city of Bangladesh. Millions of people reside in this city from all over the country for their sustenance. However, the government declared a general holiday due to COVID-19 infection from March 26 to April 4 to control the spread of the virus and ensure social distancing. But millions of people left Dhaka to enjoy the holidays with family and hardly maintained social distancing, many people were found gathering in Railway station, Bus-stand, and launch terminal. That's how the virus was supposed to spread throughout the country due to community transmission. During the time of writing, the Dhaka division holds over 76 per cent of the COVID-19 patients in the country, followed by Chattogram division

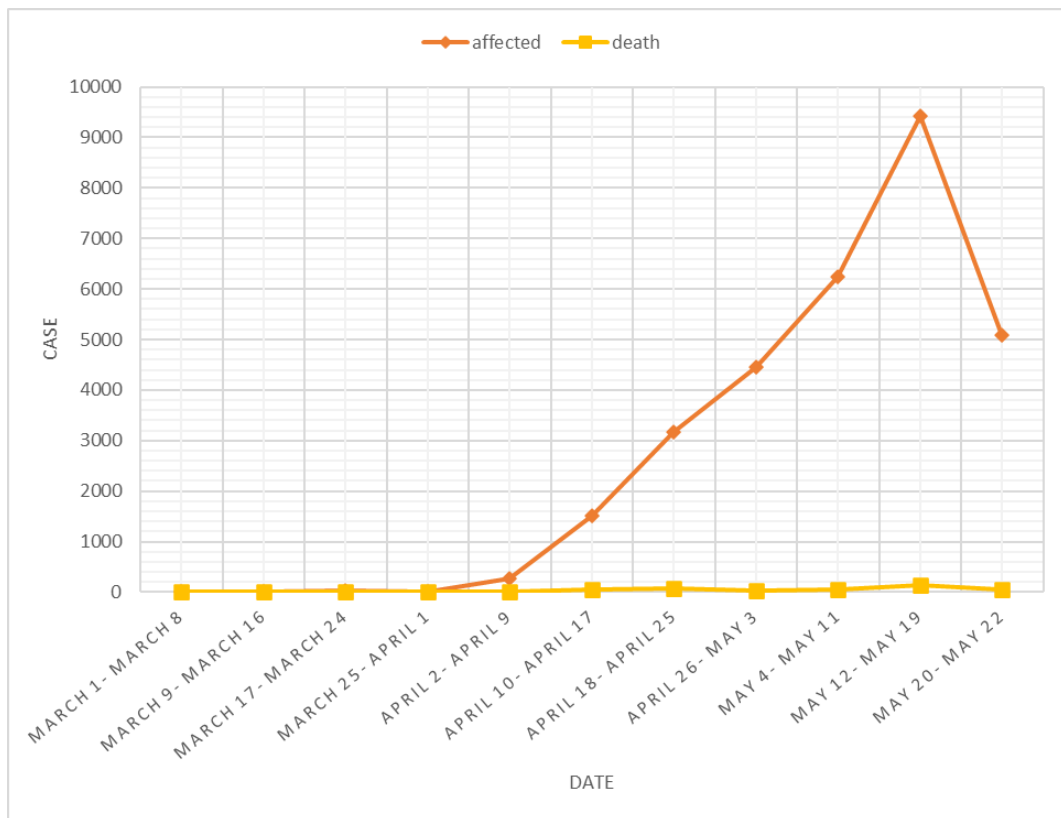


Figure 1. The graph depicts a comparison between total confirmed cases and total deaths due to COVID-19 infection from March 8th to May 22nd 2020, rolling 8 days average in Bangladesh. (Directorate General of Health Service (DGHS))

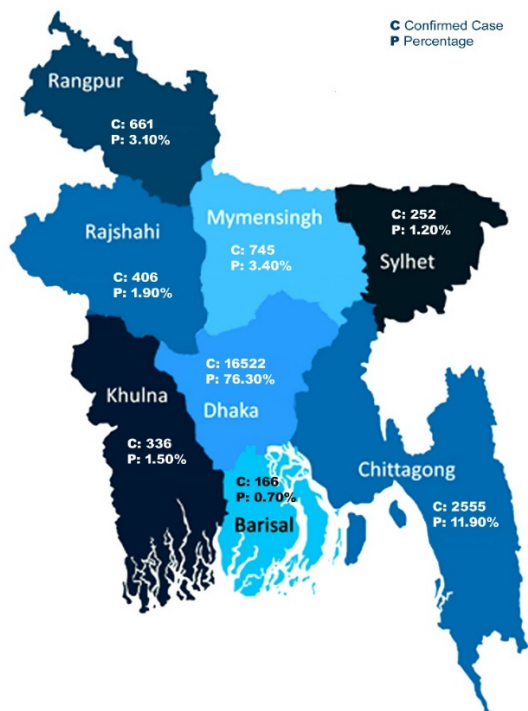


Figure 2. The map illustrates the geographical distribution of COVID-19 confirmed cases till 22 May (from 08 March) in Bangladesh along with percentage. (Source: Institute of Epidemiology, Disease Control and Research (IEDCR))

holding 11.9 percent (**Figure 2**). In fact, the Dhaka district which belonged to the Dhaka division, currently contains

the highest number of COVID-19 patients (79.03%), followed by Narayanganj (**Figure 3**). Narayanganj (9.67%), the neighbouring district of Dhaka city, became the epicentre of coronavirus infection in Bangladesh since the majority portion of the patients started roaming around from here. Coronavirus patients have been detected in many districts who recently returned from Narayanganj.

The government took measures to prevent local transmission by locking down the transportation system (including Rail, Water, Air, and Road transport). Bangladesh Police, Army, Navy, and Rapid Action Battalion (RAB) have been working on the frontline to ensure social distancing among the people and to keep an eye on the locked-down houses around the country. All shops, super shops, and kitchen markets throughout the country were declared by the government to be closed by 7 pm, and the grocery stores located in residential areas by 2 pm but drug stores and emergency services remained out of the purview of the orders.

At the end of April, a total of 7667 confirmed cases were reported in Bangladesh with a total of 168 deaths whereas a total of 3,090,445 cases and 217,769 deaths found worldwide. At the beginning of May, 2020, a significant number of cases have been confirmed (on average 1000 per day) in Bangladesh. Even, the virus has recently been spread

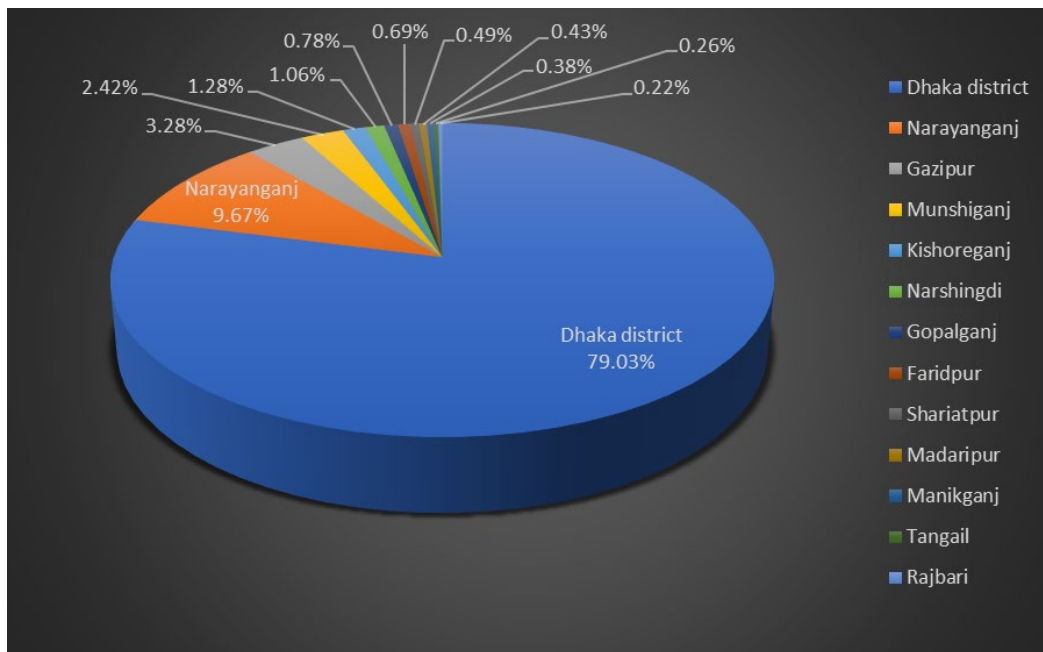


Figure 3. The graph depicts a comparison between total confirmed cases and total deaths due to COVID-19 infection from March 8th to May 22nd 2020, rolling 8 days average in Bangladesh. (Directorate General of Health Service (DGHS))

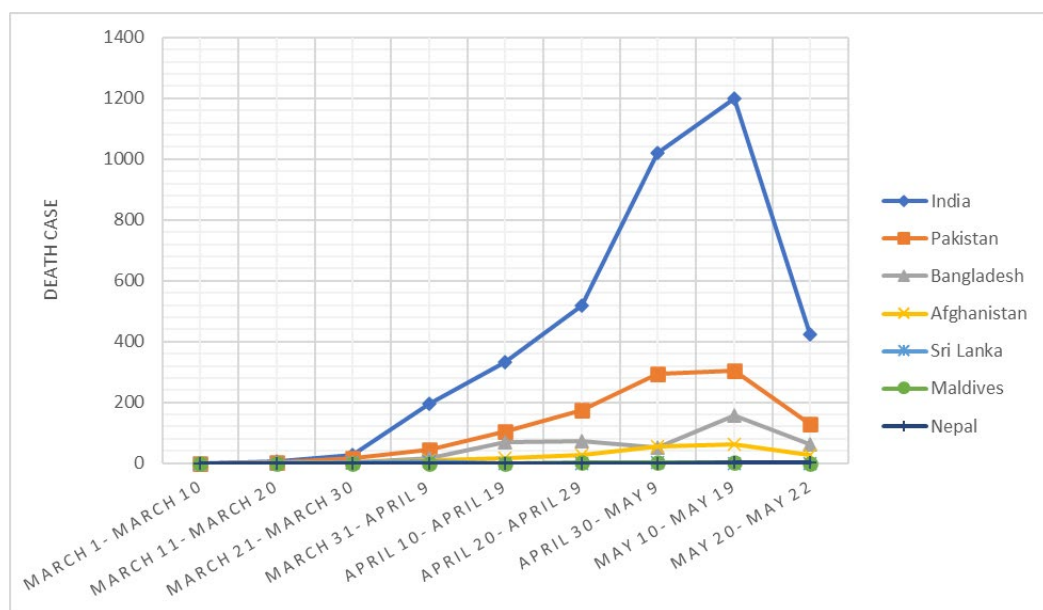


Figure 4. The line graph represents the growth of COVID-19 confirmed deaths on May 22 in South Asian countries starting from the day they confirmed 1st death. (Source: WHO and respective Health Ministries)

over the Rohingya refugees residing in Bangladesh right away. The first COVID-19 case, as a result, was detected in the Kutupalong Rohingya refugee camp on May 14th, 2020. Currently, Bangladesh counts a total of 30205 confirmed cases till May 22nd, 2020 (including 1200 health workers and above 2,000 police) and 432 deaths with 1.43 percent lethality rate. According to data compiled from the World Health Organization (WHO) and respective health ministries, Bangladesh is the 3rd highest country in death in South Asia after India and Pakistan (**Figure 4**) [12].

Evidence data suggests that people of all ages are infected with coronavirus in Bangladesh (**Figure 5**). Data compiled from the Institute of Epidemiology, Disease Control and Research (IEDCR) showed 50 percent of the COVID-19 confirmed cases found in Bangladesh are aged between 21 to 40 years. Surprisingly, young people within age 21-30 are found to be most infected with COVID-19 rather than the older and younger ones whereas COVID-19 kills mostly the older people throughout the world. According to the World Health Organization (WHO), older people and people with pre-existing complications such as chronic respiratory disease, diabetes, heart disease, and cancer appear to be

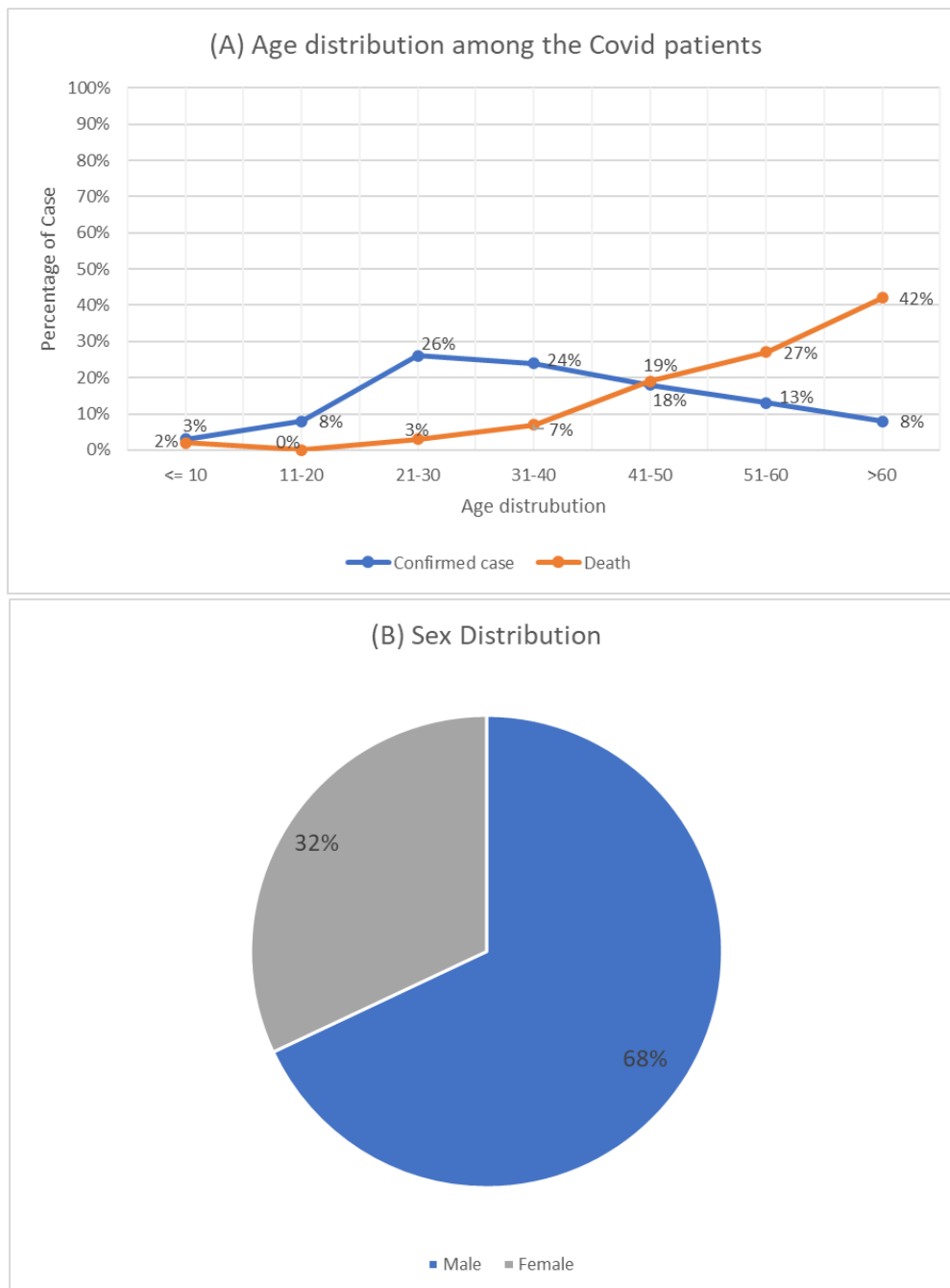


Figure 5. Age (A) and Sex (B) distribution among the COVID-19 patients in Bangladesh. Old people died mostly while young working-age people are more likely to get infected. The mortality rate and infection rate are higher in males than women. (Source: Directorate General of Health Service (DGHS) and World Health Organization (WHO))

more vulnerable to becoming highly ill with the virus [13]. The pattern, however, of COVID-19 death rates in Bangladesh appears to be discrete from that of the confirmed case rates. Death rate compared to age in Bangladesh is seen with a successive improve which depicts that, older people are more susceptible to the viral infection than the younger ones. Thus, when aged people remaining at high risk of dying, people of all ages, especially the younger ones are getting mostly infected which is probably due to their frequent outing or local transmission of the virus. However, when it comes to gender, male proportions

got infected and died mostly with coronavirus than the female proportions. An overall estimate is that 68 percent of total confirmed cases belonged to men and collaterally the death rate was 73 percent. Hence, the virus is supposed to be affecting men more than women in Bangladesh as with worldwide [14]. The actual reason is not revealed yet by the scientists, but they suspect that biological differences between men and women, unhealthy habits like smoking, and underlying health issues among men could be influencing factors for this reason.

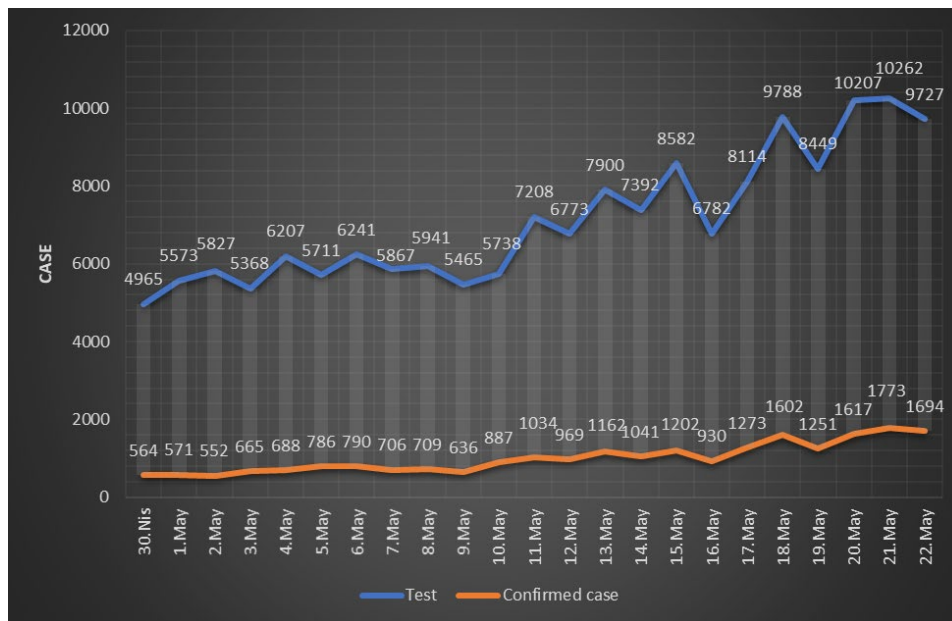


Figure 6. The bar graph shows a comparison between total COVID-19 tests and total confirmed cases from April 30th to May 22nd, 2020. The more tests conducted; the higher number of confirmed cases found



Figure 7. The graph shows a relationship between the days and the total number of active cases, recovered and death patients (source: The Institute of Epidemiology, Disease Control and Research (DGHS))

Till May 22, 2020, a total of 2,23,841 COVID-19 tests were carried out in Bangladesh whereas the total number of confirmed cases were 30,205 so far (**Figure 6**). At the beginning of the outbreak in Bangladesh, few tests were performed due to several limitations and so the positive cases were very low by then. But, since early May, the number of tests as well as the laboratories and involved volunteers raised significantly, and thus, the active cases were also found massive. Till now, Bangladesh has set up 42 medical laboratories dealing with COVID-19 detection across the country [15].

Unfortunately, Bangladesh has recorded the lowest recovery rate within the duration of the first 53 days after COVID-19 outbreak, compared to other South Asian countries. But it started overtopping gradually since the beginning of May and the recovery rate proceeded at a considerably faster pace. However, a sharp and successive increase is shown in the rate of confirmed case and death as well which is also a matter of concern as people aren't getting healed equally with the rate of an active case. As of May 22, 2020, the total amount of recovery had reached around 6100 with 20 percent recovery rate [16] (**Figure 7**).

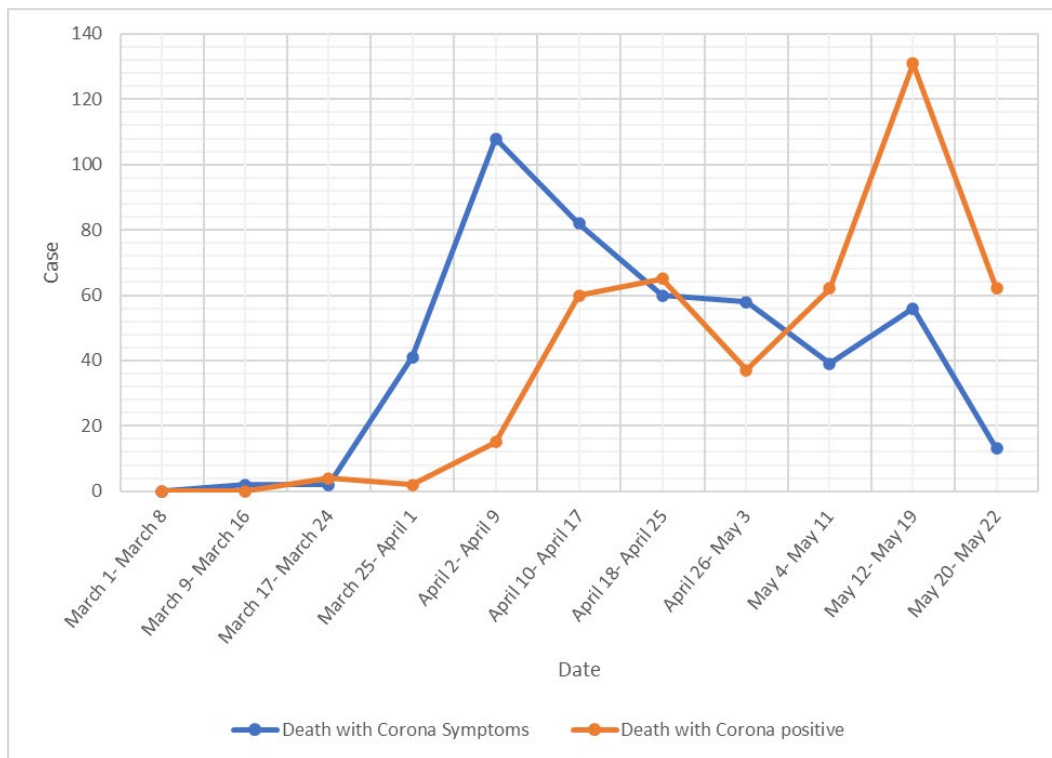


Figure 8. A comparison between corona symptomatic and corona positive death is showing in this graph until May 22nd, 2020. A significant number of patients with corona symptoms died with or without test positive

Furthermore, the death toll has crossed a total of 400 on May 21, and thus, on average, 11 patients have found dying per day in Bangladesh within the first 21 days of May which is quite breath-taking.

Many people infected with novel coronavirus may not show symptoms and many of them died asymptotically [17]. Interestingly, till May 22, 2020, around 550 people died in Bangladesh with COVID-19 symptoms including fever, cough, or pneumonia whereas the number of people died with no COVID-19 positive test (**Figure 8**). However, through conducting a pilot survey via collecting news from national newspapers and electronic media, some cases have been found where patients tested negative before death but positive results have found revived after recollecting samples from dead patients. This may be an indication that many of the patients who died with COVID-19 symptoms might die of the disease without being tested. Henceforth, the fact could be further analysed and highlighted as well.

THE MYSTERY OF SARS-CoV-2 GENOME ISOLATED IN BANGLADESH

The process of genome sequencing is simply the identification or determination of the whole DNA sequence of any organism which conveys the information about how genes are arranged within. It is quite important to understand the complete physiology of any organism or

viruses as well i.e. novel coronavirus and to track down the pathway of the virus by associating it with other metadata, thus to think about future prevention or treatment methodology against the virus [18].

As of now, eighty countries have collected more than 24,000 genome sequence of SARS-CoV-2, which include countries like Nepal or Vietnam where the coronavirus pandemic is relatively less violent. Though, the first infected case was reported early in March, 2020 by the country's Epidemiology Institute - IEDCR, due to several limitations, it took time to sequence the entire genome of the novel coronavirus from the sample of any Bangladeshi patient. However, for the first time in Bangladesh, from the Child Health Research Foundation (CHRF), Dr. Senjuti Saha, Dr. Samir Kumar Saha & their team have broken the ground revealing the whole genome sequence of the coronavirus through using Illumina iSeq 100 NGS platform which has put a heavy influence on the research purview of the country. Accordingly, the news of the layout of genome sequence data became available on May 12, 2020 [19]. Hence, researchers started to explore it following the extraction of the sequence and information from the public repository GISAID and CNCB.

However, according to genome data available till now, this virus has acquired nine mutations by now whereas seven mutations were very common among the sequenced

Table 1. Differences between different SARS-CoV-2 isolates found in Bangladesh

Position	Reference Base	Mutated Base	Mutation Type	Protein: Amino Acid Change	Mutation Frequency (10984)
241	C	T	Upstream Gene Variant	Non-coding	7080
1163	A	T	Missense	Orf1ab: 300I>F	1
3037	C	T	Synonymous	Orf1ab: No Change	7104
14408	C	T	Missense	Orf1ab: 4715P>L	7120
17019	G	T	Missense	Orf1ab :5585E>D	1
23403	A	G	Missense	S: 614D>G	7145
28881	G	A	Missense	N: 203R>K	1735
28882	G	A	Synonymous	N: No Change	1731
28883	G	C	Missense	N: 204G>R	1730

viruses so far but surprisingly, this genome has got two new mutations which have not been seen among the viruses reported to date [20]. This depicts that, the virus has already acquired these new changes during its incubation in Bangladesh which is quite horrifying.

Again, when observed closely, among those nine mutations within the viral genome, one was found which results in a non-silent mutation in its Spike protein. The mutation utterly leads to an amino acid change i.e. Aspartate to Glycine at the 614th position of the Spike protein (D614G). It is predicted that this mutation of the virus has the potential for spreading out quickly among the European and American populations. This creates an extra serine protease or elastase cleavage site close to the Open Reading Frame (ORF) S1 and S2 junction of the Spike protein (**Table 1**).

Furthermore, the phylogenetic tree analysis with 350 sequences from different countries and reference sequences delineated that, Bangladeshi SARS-CoV-2 genome isolate is familiar to the European cluster which means that, perhaps the person got infected by someone who returned from Europe [21].

However, afterwards, researchers across the country started retrieving more sequences incessantly e.g. on May 20th, 2020 Bangladesh deposited another sequence from the National Institution of Biotechnology (NIB) under the lead of Dr. Md Salimullah. Interestingly, their sequence has shown to be compatible with that from the United States, Spain, and Italy [22]. Successively, Bangladesh Jute Research Institute & Chittagong Veterinary & Animal Sciences University (CVASU) has deposited another sequence by May 21st, 2020, under the lead of Dr. Abdul Razzak which showed its uniformity with the sequence of Saudi, Arabia, Russia, Australia, and United States. Again, on the next day, Dhaka University has further added another one under the instruction of Sharif Akhtaruzzaman.

Hence, researches are concerted going on across the country to explore the genome and thus trying to come to an end. So, this issue should immediately bring under sincere concern by the government as soon as possible.

IMPACTS OF COVID-19 THROUGHOUT BANGLADESH

Impact on the Overall Economy

The economy of Bangladesh has a high dependency on garments and the agricultural sector. Being a LMIC, it may face an economic crisis due to the COVID-19 pandemic. Last year, the garments industry contributed to 84% of the country's exports that worth \$40 billion. But this year due to lockdowns, this industry has to cancel numerous orders and hold off orders worth nearly \$3 billion. At present, 450 spinning mills, 850 weaving mills, and 250 dyeing factories which are directly linked to the Garment industry are at risk of loss. Around 10 lack people are employed in these mills. The garment sector is also related to the packaging industry which is also affected by the COVID-19 pandemic.

Moreover, 59 banks and 46 general insurance companies count on the garment sector for running their business. As a poverty alleviation scheme, the government has declared over 1.0 trillion BDT (over 11 billion USD) which is nearly 3.6 percent of Bangladesh's gross domestic product (GDP) for various sectors including agriculture and garments. This will provide soft bank loans and aid people that are victims of this viral outbreak.

The transport sector is having difficult times during this continuing crisis. The number of trucks and lorries had surged remarkably with the pace of the country's nearly \$100 billion exports and imports. As a result of the extended lockdown, many workers of this sector may become jobless in this hard situation.

According to the estimation of Dhaka University Health and Economy Institute, from 26 March to 26 April, the total loss

in the economy was around 100,000 crores Bangladeshi taka (BDT). There is a loss of about 3300 crores BDT in agricultural (200 crores), industrial (1131 crores) and service (2000 crores) sector, and the loss will increase with the extension of lockdown.

The experts found out that export and import economy has come to a standstill. Bangladesh will get poorer if the lockdown continues for a long time. In town hawker, a rickshaw puller, auto-rickshaw driver, bus driver, waiter, day labourer, and in the village, farmer, fisherman, trucks, and lorries are static due to lockdown measure. There is a chance that 1 million people related, shopkeeper, emigrants will face hardship in their daily lives. 40% of the poultry industry is driven by women and it may face a loss of 3350 crores BDT according to the Bangladesh Poultry Industries Central Council.

During the COVID-19 outbreak, unemployment of Bangladeshi emigrants is reflecting a negative impact on remittance. The remittance has reduced by 36 crore dollars within the last 2 months which is also hampering the overall economy of Bangladesh. World Bank (WB) has recently reported that, due to COVID-19 and shutdown, remittance may decline by almost 22 percent in this financial year of 2019-2020 in Bangladesh and thus, it could come down to \$1,400 crore in 2020, which was \$1,830 crore in 2019 [23].

Besides all these, the price hike of daily commodities has also been added to the economy. Daily essentials are subjected to price hike amid COVID-19. Due to supply disruption and scarcity of the kitchen market, the prices of oil, rice, flour are surging. The price of edible oil has witnessed an 8-10 % rise. Moreover, 38-70 BDT per kg of rice is being sold in markets. However, government is about to launch a special open market sale of coarse rice at 10 BDT per kg across city corporation for the poor people.

Impact on Agricultural Sector

Agriculture is the backbone of the economy of Bangladesh. According to the World Bank, it is the income source of 87% of rural people. In fact, 11% of city dwellers are also directly related to the agricultural sector. Around 45.7% of labour-power are recruited in farming. Not only that, the contribution of agriculture on the GDP of Bangladesh is 16.6%. This information indicates the importance of agriculture for Bangladesh. The national lockdown strategy is imposing a bad impact on the overall economy. Many farmers are unable to work on their lands, also, are not accessible to some markets for selling their agro products. Moreover, severely hampered transportation, the

inadequacy of labour, and a price hike can act as impediments in the fresh food supply chain.

In the poultry industry, 83000 poulterers with an investment of 42000 crores are facing heavy loss due to ongoing country-wide lockdown for COVID-19 pandemic. Their daily egg production is 4.25 crore and because of the fall of demand, they have to sell 1/3 of total eggs at a 45% lower price. In overall poultry farms, 3500 tons of broiler chicken production/day takes place. According to the Bangladesh Poultry Industries Central Council, the price of broiler chicken has fallen to 55 BDT (0.65 USD) per kilogram. The demand for broiler chickens dramatically dipped in lockdown situation and 1.65 crores 1-day old chicks are discarded every week to mitigate loss. More importantly, jobs of 4.7 million workers in the poultry industry are endangered right now.

The country's dairy and fish producers are facing a huge number of economic loss. The total number of dairy farms country-wide is about 250 thousand. Per day milk produced and supplied for selling is 1.5 crore litres. But due to the lockdown implementation, the transportation has become limited and also customer demand plummeted. Milk price has dropped by around 35 percent and 2.5 million litres are remaining unsold. The employment of 1.2 crore people is at risk in the dairy sector [24].

The demand for fish substantially plunged. Consequently, many hatcheries are closed down. Also, crab, shrimp, and fish producers are facing frequent trade embargo that is resulting in economic loss. For example, Bangladesh exports 70% of the crabs in the Chinese market. Lockdown has stopped the exportation. Hence the crab industry of Bangladesh is going to face a significant loss. Production of dry fish has also reduced by 40 percent due to the corona epidemic.

In order to sustain food security and socio-economic development, the vulnerability of farming communities should be lessened by the Government and non-government organisations.

Impact of COVID-19 on Mental Health of the Patients

The mental health of a person includes emotional, psychological, and social well-being. For a COVID-19 patient, the negligence of surrounding people and social discrimination is worse than COVID-19 disease itself [25]. In Bangladesh, in several cases, if a person is confirmed as COVID-19 positive, he including his family members are subjected to harassment of neighbour and society and sometimes they are ostracized or forced to leave the society.

Besides all these, a COVID-19 patient remains overstressed and in nervous conditions. After getting admitted into the hospital, the patient may witness deaths every day in his ward which may affect his mental strength badly. To encourage patients of COVID-19, the doctor, nurses should be compassionate to them. Sometimes courage can help the patient in early recovery [26].

Influence of COVID-19 on Education System

The total number of students in Bangladesh is approximately 23907151. Among them, primary, secondary, and post-secondary level students are consecutively 16230000, 7400000 and 277151. To tackle the breakout of COVID-19, the government declared closing down of all educational institutions on March 18th 2020. Not only that, the Higher Secondary Certificate (HSC) examination was postponed by the Ministry of Education.

Prime minister Sheikh Hasina also declared that if COVID-19 situations don't get better, all institutions will remain closed until September, 2020. This closure for a long period can cause some problems including huge learning gap.

The public and private universities may face session jam if the classes and exams are not taken on time. Some universities have a semester system, which means six months per session. So, there is an immense possibility of session jam in almost all universities.

Many schools, private universities, and a few public universities are taking online classes in order to prevent the session jam. But this is not a fair way of taking classes according to many students and teachers. Bangladesh does not have a strong platform for taking online classes. Teachers are using meeting applications such as ZOOM for taking classes. Moreover, the internet access requires data purchase or Wi-Fi connection. Students who live in remote areas do not have a stable network. Also, data purchase is not possible for students who are under the financial crisis due to the COVID-19 pandemic. As a result, some students of a specific class are deprived of online classes which may result in inequalities in education. Also, some students are indifferent to joining online classes due to a lack of social interaction between students and teachers. HSC examination has been postponed which may delay the admission of college students in universities and other institutions [27].

Bangladesh government has planned for steps like keeping the universities, schools, and colleges open on holidays that means taking classes for all 7 days of the week after the lockdown in order to compensate the education loss. Also,

UNICEF is working along with the Bangladesh government to offer fruitful remote learning programs through TV, mobile phone, and Internet platforms for 42 million school students. UNICEF has also aided in producing guides to help teachers performing online classes. Notwithstanding, the Bangladesh government and educational institutions should come forward to provide proper facilities for online classes, i.e., ensuring financial support for students.

Impact of COVID-19 on Culture and Religious Beliefs

The lockdown strategy taken by the government due to the COVID-19 outbreak has been extended several times. Religious gatherings have been proved to be a medium for spreading the COVID-19.

Performing janazah salah at a large-scale gathering is prohibited by the government. But violating it, around 100 thousand people gathered in the janazah of Maulana Jubayer Ahmed Ansari, a popular Islamic scholar of Rahmania madrassa. In addition, millions of people had expectations to congregate in mosques for performing tarabi prayer during Ramadan. Similar to the order of the Saudi Arabia government, the Bangladesh government allowed only 12 people in a mosque including mosque officials and advised the majority of people to perform prayer at home.

Moreover, many people go to market for shopping during one of the largest festivals of this country i.e., Eid-ul-Fitr which may pose the chance of increasing the community spread. In order to prevent community transmission, most of the markets and super shops such as Bashundhara, Jamuna Future Park, Newmarket, and shops all over the country decided together to keep shops closed during Ramadan. In spite of all these, a small group of people is still going to market by neglecting the COVID-19 situation. Furthermore, any kind of arrangement of iftar (evening meals that mark the breaking of the fasting) party or any gathering on Eid day has been banned by the government. Conversely, a minority of the people are still returning their village home from the town and thus getting crowded at the docks which have recently brought under concern by the government. Hence, docks have been closed and transport availability has been lessened in greater amounts by the law-enforcement forces.

Impact of COVID-19 on Lifestyle

According to a recreational point of view, various concerts, shooting for movies, telefilms, and drama on the occasion of Eid has been cancelled for reducing public gatherings. People are spending time on social networking sites and

interacting with dear and near ones. The lifestyle of people has changed because of a long-time lockdown. Some people are working online and those who are on leave or students, are spending time on television and online applications like YouTube, Facebook, etc. Besides all these, family members are spending time with each other previously which was difficult for their tight work schedule. Thus, their relationships are getting stronger. Most people are shopping online whether it's household commodities, food items, or clothing for Eid. Right now, some online streaming services like Netflix, Amazon Prime Video have become very popular among people worldwide.

In short, this pandemic has brought about changes at every phase of regular life.

HOW BANGLADESH IS TACKLING COVID-19

"30,205 confirmed cases and 432 deaths"- this is the report of IEDCR till May 22nd, 2020. At the beginning of diagnosis, that means in the second week of March, the Government declared a shutdown of all educational institutions. Observing the deterioration of conditions day by day, the Bangladesh government later announced lockdown except for pharmacy, banks, food markets, and hospitals. However, 20.5% of people in Bangladesh live under the poverty line. Hence, most of them can hardly maintain lockdown orders throughout the country. Moreover, some people are socially unaware of the gruesomeness of this disease worldwide. By not taking the COVID-19 outbreak seriously, they are unnecessarily violating the lockdown rules. Again, due to the inadequacy of COVID-19 diagnosis per day, suspected COVID-19 patients (according to symptoms) are dying without treatment also, risking the lives of their family members and relatives. Many non-infected patients are also deprived of treatments. If they have COVID-19 symptoms, no hospital is getting them admitted without diagnosis report, consequently, they are dying untreated.

Diagnosis Status of Bangladesh

Inadequacy of test

To date, no specific medicine or licensed vaccine is available to treat this highly contagious virus. Hence, COVID-19 diagnostic testing has become indispensable to isolate the patients and provide non-specific medical supports. Diagnosis of suspected COVID-19 patients, contact tracing, ensuring quarantine (if necessary, aided by police) for people who came in contact with confirmed patients and isolation of patient-these are the remedy for preventing community transmission of COVID-19 right now. But, the

number of tests conducted by IEDCR and other 42 institutions or labs of Bangladesh is not sufficient. To be more clarified, the population of Bangladesh is more than 160 million and an estimated 1313 per million people are being tested (until May 22nd, 2020). On the other hand, India is populated with around 138 crore people and the total conducted test per million is 1,540. Total test conducted by India is more than 2 million whereas it's 223,841 for Bangladesh till May 22nd, 2020. Both the Asian countries are LMICs, yet India is far much ahead in case of the testing capability of COVID-19 than Bangladesh. It is a matter of concern that a huge number of patients may be remaining undetected every day which may worsen the situation day by day. However, the number of detections is increasing every day and synchronously positive cases are also rising. Unfortunately, the test of all the suspected cases per day cannot be performed and they need to wait for call helplessly for days or weeks. Meanwhile, some undetected people die with COVID-19 symptoms, and later their samples are tested to ensure the cause of death [28].

However, the suspected and asymptomatic as well as those who came in contact with the patient should be tested without any delay by increasing the number of tests. This insufficiency of tests is due to a lack of experienced individuals for detecting COVID-19. Also, different universities and research organizations holding PCR machines are involved in COVID-19 detection that is not adequate to run the test of all the patients altogether. Some machines are also previously damaged, which may not show results with accuracy. However, the collaboration of more institutions (research and educational) and laboratories (public and private) should be ensured by the government for a rapid test of COVID-19 as early as possible.

The paucity of protective equipment

In order to prevent infection caused by SARS-CoV-2, specialized garments are required which are collectively called Personal Protective Equipment (PPE). It includes a face shield, glove, gown, goggle. According to WHO (till May 18th, 2020), the stocks of PPE were 1,375,232, and the number of masks and gloves were sequentially 2,515,110 and 691,386 [29]. The number of PPE was inadequate for doctors, nurses, COVID-19 diagnosis volunteers, and other health service providers. Again, police and the army are also in need of PPE who are controlling the lockdown. Reusing these PPE is also a matter of great risk and requires caution during cleaning. Already many of the health workers including doctors and nurses are infected with COVID-19. Insufficiency of safety equipment is somehow affecting the treatment facilities of Bangladesh. These health workers are

the frontline fighters who are in need of PPE for the treatment of COVID-19 patients and general patients as well. So, the Government should take immediate steps for increasing the production of PPE garments nationally for ensuring the health of health workers that are working relentlessly.

Lack of skilled manpower

From collecting samples to testing, the laboratories of institutions and hospitals that are involved in COVID-19 detection, are facing difficulties at each step. The reason behind it is a deficiency in skilled manpower and relevant logistics. According to a virologist of Dhaka Medical College, One RT-PCR thermal cycler that is placed at the Dhaka Medical College (DMC) virology lab has the capacity to conduct 188 tests per day, which is the maximum amongst other RT-PCR cyclers in Bangladesh. Notwithstanding, virologists need to collect more than 300 samples each day in order to handle the pressure of patients. Properly collected samples are mandatory for the accuracy of the result. But there is a scarcity of human resources for collecting samples from nose and mouth. Also, if the samples are not collected and preserved properly, the report may show a false positive or false-negative result.

According to health experts, some semiskilled technologists are working at different lab setups outside Dhaka since there has been no recruitment of technologists for a long period. Example of a negligent: The result of 30 samples turn out to be positive in tests conducted in Jessore and Kushtia. But their further test that was carried out in Dhaka demonstrated negative results. So, this incidence raises a question over the capability of the lab setups and their semi-skilled technologists at some districts. Only a few skilled workers have been recruited with a short-term contract [30].

Sample preservation is hindered due to a lack of sophisticated refrigeration (-80°C required). If preservation is improper, it can degrade the sample quality and affect the test result.

Skilled biotechnologists and students of life science background came forward as volunteers for detecting COVID-19 by RT PCR assay. They should be provided with proper PPE for ensuring their protection as they are fighting on the frontline during this pandemic. Again, more biotechnologists, biochemists, microbiologists and virologists should be trained properly so that they can contribute to the critical moment of the nation by detecting COVID-19 patients. Biosafety levels of lab, contamination, etc should be taken under deep observation.

Treatment facilities all over the country

Bangladesh is an overpopulated country compared to the number of its health care providers. Modern treatments are also not available in each corner as Bangladesh is not much developed. There exists a lack of availability of necessary equipment and machines required to deal with the COVID-19 pandemic. As a result, there is a possibility that many COVID-19 patients may die without treatment.

Death of Health Service Providers: Currently, the doctor to patient ratio in Bangladesh is 1: 2500, which is the 2nd lowest among South Asian countries according to the WHO. Around 2,000 doctors and 6,000 nurses were appointed for the treatment of COVID-19 by the health ministry. However, some doctors and nurses in different hospitals are not feeling secure due to the lack PPE, hence showing less willingness to work. In addition, many patients hide their location and symptoms from doctors for fear of being hospitalized which becomes a matter of risk for doctors and nurses. The most horrifying news is, over 1200 health workers were detected positive in the COVID-19 tests till May 22nd, 2020. To date, 3 doctors died due to COVID-19 infection.

Therefore, there is a scarcity of doctors and nurses due to their unwillingness for least security. Again, many of them are being infected daily due to exposure to confirmed or suspected COVID-19 patients. As a result, non-infected patients are also dying without treatment.

However, incentives are declared by the government for doctors and nurses who will treat the COVID-19 patients. Not only that, training programmes are also arranged for health workers for aiding and treated COVID-19 patients of distant areas.

Availability of Hospitals and Equipment: Some public and private hospitals are approved by the government for the treatment of COVID-19 as listed below.

1. Kuwait Bangladesh Friendship Government Hospital
2. Kurmitola General Hospital
3. National Chest Infectious Diseases Hospital
4. Dhaka Medical College Hospital
5. Bangladesh Railway Hospital
6. Mohanagar General Hospital
7. Sheikh Russel Gastro Liver Institute & Hospital
8. Sajida Foundation Hospital

9. Mirpur Maternity Hospital
10. Jinjira Specialized Hospital
11. Amin Bazar Hospital
12. Kamrangirchar Hospital
13. Chittagong Medical College Hospital
14. Bangladesh Institute of Tropical and Infectious Diseases
15. Bashundhara COVID-19 Isolation Hospital (second largest COVID-19 hospital in the world)
16. Government Mugda Hospital
17. Nitor Hospital

Apart from the above hospitals, some other hospitals are also involved in the treatment but on a small scale.

In Bangladesh, the COVID-19 infection rate is 177 per million people. Unfortunately, Bangladesh doesn't possess an adequate number of ICU, Isolation beds, ventilators, dialysis unit for treating the increasing number of patients. Bangladesh has only 1,240 ICU beds (432 in govt. Hospitals and 808 in private hospitals). On calculation, only 0.73 beds are available per 100 thousand people and a total of 9134 isolation beds and 102 dialysis units are available in this country. Besides all these, only 1,840 ventilators are available in Bangladesh which indicates that 1 ventilator is available for 92,391 people to support the emergency condition. Most of the hospitals that have ICU and ventilators are situated in the capital city.

However, the government and non-government organisations should come forward to ensure the importation of more ventilators and instalment of ICU in order to increase the survival rate of critical COVID-19 patients.

Newly emerged treatments

Plasma Therapy: Plasma therapy is providing a light of hope for COVID-19 patients. This procedure involves collecting a blood sample from a fully recovered COVID-19 patient and transfusing plasma to a critically ill patient. Blood cells are absent in plasma and it contains only antibodies and other proteins. The immune system of an infected person produces natural antibodies in order to fight the virus (antigen). The antibodies increase in number over time in the plasma of an infected person and the patient gets cured. With plasma therapy, the antibodies generated in prior infected patient are used to treat present infected patients [31]. Currently, Dhaka Medical College Hospital

(DMCH) has started collecting plasma from COVID-19 recovered patients for clinical trials of Convalescent Plasma Therapy (CPT). Dr. Md Dildar Hossain, a medical officer at the Shaheed Suhrawardy Medical College and Hospital's kidney diseases department was the first donor of plasma. He was diagnosed with COVID-19 on April 25, 2020 and later fully recovered on May 9, 2020. Finally, he voluntarily donated his plasma along with another physician was also reported to donate plasma at DMCH for saving the lives of COVID-19 infected patients.

The breakthrough of Possible Discovery of Treatment: The World Health Organisation has chosen an antiviral drug called Remdesivir after a couple of experiments which is an antiviral drug that was used for the effective treatment of Ebola [32]. This drug showed positive results against SARS-Cov-2 in an experiment conducted on model animals [33]. However, in Bangladesh, hospitals are using some non-specific medicines such as Hydroxychloroquine, Chloroquine, Azithromycin as the treatment option for COVID-19. Beximco Pharmaceuticals has launched the first generic version of antiviral drug Remdesivir, named Bemsivir for the first time on May 21st, 2020. Remdesivir is a drug that inhibits viral RNA synthesis and thus it stops replication of SARS-CoV-2 [34]. U.S. FDA has allowed it as "Emergency Use Authorisation" for the treatment of COVID-19 patients.

Another approach was from Professor Dr. Tarek Alam, head of medicine of Bangladesh Medical College and Hospital, who along with his team frequently used antiprotozoal medicine named Ivermectin in a single dose with an antibiotic called Doxycycline that demonstrated an astounding result in curing some COVID-19 patients. Around sixty COVID-19 positive patients with respiratory issues were prescribed the drug by Dr. Tarek and his medical team. After the second test of those patients in IEDCR, it was confirmed that the patients who were under the research turned out to be COVID-19 negative. According to Dr. Tarek and his medical team, they were recovered within 4 days after applying the combination of medicine. These drug combinations were stated not to cause any side effects. According to them, the overall cost of medicine is approximately 30 BDT. For the approval of their medicine, they have contacted DGHS (Directorate General of Health Services) and other government organizations. Also, the trials and study for success rate and side effects have already been commenced by (DGHS). If it turns out to be successful, it will be a global breakthrough discovery by Bangladeshi doctors in the history of corona treatment.

Social awareness status in Bangladesh

Community Transmission is Difficult to Prevent: To date, there are 30,205 confirmed cases of COVID-19 according to IEDCR. All 64 districts of Bangladesh had COVID-19 patients as of May 22nd, 2020. According to many positive cases, none of them were immigrants nor any of their family members or relatives returned from abroad. Hence, it is a vivid indication that community transmission has begun. Many people are not concerned about the dreadfulness of this disease. They are unnecessarily going out of the house to the markets for shopping and are not abiding by the WHO protocols properly [35]. The community transmission exceeded in Dhaka, Narayanganj, and Chittagong because people of these districts however violate the lockdown and many emigrants did not obey the quarantine order. Also, social distancing is a very difficult task in a densely populated country like Bangladesh. As a result, the number is increasing exponentially day by day. Again, some people died who were suspected to be infected with COVID-19. Later, many of their results turn out to be positive for COVID-19 as mentioned earlier. Some deaths were recorded in the district isolation centres. In the beginning, tests of suspected ones were only conducted in IEDCR. Later, the government-provided with testing facilities in other divisions. In order to decrease the community transmission, there is no alternative to increasing the test for COVID-19. So, the test facility should be ensured for people all over the country for prohibiting the community transmission as soon as possible.

Reasons behind the Vulnerability of Bangladeshi People throughout the Country: Bangladesh is one of the most densely populated countries in the world which may leave the country more vulnerable to community transmission. Beside this, according to the Bangladesh Bureau of Statistics, 34 million people are poor in Bangladesh and 17.5 million among them live below the poverty line. Poverty is a root cause indicating why people are violating lockdown i.e., increased movement for want of food. People who are at high risk of COVID-19 infection are elder people (age group more than 50) and people with comorbidities. Reports suggest that more than 13 million people in this country are aged more than 60 which may increase the risk of severe complication. Therefore, they may require intensive care and ventilators once get infected. A great portion of the poor people live in slums which is not a clean place and might increase the possibility of infection due to reduced hygiene. Moreover, lack of knowledge about the severity of the disease, personal hygiene, presence of malnutrition among the vast majority of the people possesses additional challenge.

As a result, aged people should not go outside for working in offices, factories, shops because every day they might come in contact with their colleagues and others. Imperative support such as fundamental daily needs such as food, relief, rehabilitation for deprived people may abate their hardship and decrease the possibility of getting infected or infecting others. Consequently, the government has announced over \$11 billion stimulus package for various sectors including the agriculture and garments to provide soft bank loans and to aid people that are victim to COVID-19.

Bangladesh Has Rohingya Refugee: Bangladesh has more than 1.1 million Rohingya refugees only in Cox's bazar. They are living in a camp which is constrained and there is a risk that if a few refugees are infected, it will be devastating for the whole camp. Again, 3.3 million local people abide in Cox's bazar [36]. A horrifying news is that, one confirmed case of COVID-19 till 14th May, 2020 was reported in the camp. If somehow community transmission takes place, the number of patients will exceed and many people will be succumbed to death. Again, there is only 10 Intensive Care Unit (ICU) beds are available for 1.1 million people in one local hospital in Cox's Bazar. However, social awareness should be raised properly in Rohingya camps and the number of ventilators and ICU should be increased in nearby hospitals to tackle any worsening situation.

SPECIAL MEASURES FROM THE GOVERNMENT OF BANGLADESH

Due to this pandemic, not only the governmental organizations but also the non-governmental or private organizations are trying altogether to fight against this novel pandemic concertedly. Moreover, the government was concerned since the outbreak was commenced in Bangladesh and still trying to fight this pandemic in different probable ways.

Government, on January 22, 2020, initiated the screening of all the travellers from China at Hazrat Shahjalal International Airport in Dhaka, Bangladesh by the thermal scanners immediately after the news of the pandemic had just spread out. Following that, on-arrival visas for all the Chinese visitors were revoked. On March 8th, 2020, due to the abrupt spread of the pandemic, government cancelled the grand inauguration ceremony of the father of the nation of Bangladesh Bangabandhu Sheikh Mujibur Rahman's birth centenary celebration program to avoid public gathering and it was planned to be held on March 17, 2020.

Educational institutions were enunciated, on March 16, 2020, to remain closed until March 31, 2020, which is still

continuing. Accordingly, the first lockdown was declared at Shibchar of Madaripur district on March 19th, 2020 which is still in effect. Consequently, all the state public programs including the celebration of 50th Independence Day and Bangla New Year were announced to be closed this year.

On March 22, 2020, the Prime Minister of Bangladesh determined to generate a 'SAARC COVID-19 emergency fund' and also committed to contributing 1.5 million USD to fight against novel pandemic COVID-19 among SAARC regional countries. After that, all the public examinations were cancelled. Government and private offices except the emergency services were strictly ordered, on March 23, 2020, to be closed immediately from March 26 until April 4, 2020 [37].

As the situation remained unchanged, on March 24, 2020, the government announced a 10-day initial ban on all the public transports from March 26th, 2020 till April 4th, 2020 which was further extended and still ongoing. Accordingly, on March 27th, 2020 Civil Aviation Authority of Bangladesh suspended all their domestic and international flights with 15 countries till May 30th, 2020. The government also announced several stimulus packages to different sectors that are jeopardized due to the pandemic.

Economic Stimulus Measures Taken by the Country

In response to COVID-19 pandemic, Bangladesh Bank (BB) reduced the required Cash Reserve Requirement (CRR) of other banks from 5.5% to 4% on a bi-weekly average basis and 5% to 3.5% on daily basis feasible from 15 April, 2020. Repo interest rate also reduced from 6% to 5.25% that was effective from 12 April, 2020. The banks were instructed not to deduct any charges against the late payment of credit card bills during the pandemic. BB postponed charging interest on loans from customers. BB permitted foreign-owned companies to take short-term loans from their parent companies.

The Financial Packages Enunciated by the Government

Package-1

A loan facility of approximately USD 3,529 million, with the interest rate of 9%, generated to provide working capital facilities to the affected industries and service sector organizations in the short term through the bank system. Half of the interest on the loan is to be paid by the client whereas the rest will be paid by the government.

Package-2

A loan facility of approximately USD 2,353 million, with the interest rate of 9%, is created to provide working Capital

Benefits to Small (Cottage Industries) and Medium Enterprises. 4% loan is to be paid by small and medium enterprises and the remaining 5% will be paid by the government to the concerned bank.

Package-3

The current size of Extending the Benefits of Export Development Fund (EDF), under the Block to Block LC, is declared to be increased from USD 3.5 billion to USD 5 billion for the purpose of increasing the import of raw materials. Subsequently, an additional approximately USD 1,500 million will be added to the EDF fund. However, the current interest rate for EDF will be reduced from 2.73% to 2%.

Package-4

Bangladesh Bank generates a new loan facility of approximately USD 589 million named Pre-shipment Credit Refinance Scheme with the interest rate of 7%.

Package-5

i) For the agricultural sector, the government has announced a package titled 'Special Incentive Re-financing Scheme for Agriculture Sector of approximately USD 589 million to provide financial support to the farmers in rural areas.

ii) Another package of approximately USD 1060 million has been allocated to boost up crop production amidst the pandemic.

iii) Approximately USD 15 million to rehabilitate the farmers during or after the pandemic, while approximately USD 6 million for the farmers already affected by natural inversions and cooperatives agriculture and approximately USD 9 million have been allocated to expand new crops and for technological advancements in agriculture [8].

Besides these, many local companies as well as international financial institutions like World Bank, International Monetary Fund (IMF) are providing emergency funds to strengthen efforts to battle the corona pandemic in Bangladesh. Recently, the World Bank has approved \$100 million in financing to prevent and respond to the outbreak in Bangladesh.

LESSONS TO BE LEARNED FROM COVID-19

The recent horrifying situation created by the COVID-19 pandemic has shaken the whole world with great intensity. This pandemic somehow drastically changed the life of approximately 7 billion earth-dwellers. However, this situation is not different for Bangladesh too. It has halted the

way of life people used to have before the outbreak. The industries have almost come to a stand-still, businesses and trades are jeopardized because of lockdown. All these incidents are hampering the national and, in a word, the world's economy. Yet, COVID-19 has taught us about some amazing as well as momentous facts that previously we were unaware about.

- **The practice of Frugality Is Highly Important**

In this COVID-19 situation, the thing for which we are going to crave the most is money. We need to learn the art of frugality whether it is about our clothing or foods or daily commodities. Buying unnecessary things should be avoided by hook or by crook. In this situation, spending money to buy the luxury of life is nothing but irresponsibility as we don't know where the end of this lockdown is! Rather, wealthy people can donate some money for the poor, sick, and health workers that are fighting for our lives.

- **Biodiversity Can be Recreated by Changing People's Lifestyle**

Bangladesh was losing its natural beauty day by day because of amplified pollution, mismanagement of tourist spots, and so forth. Surprisingly, the disappearing beauty is almost reappearing amidst the COVID-19 pandemic. The credit of this miracle solely goes to lockdown held due to pandemic. Spell bounding scenarios are depicted in the womb of Cox's Bazar sea beaches: dolphins are seen roaming fearlessly, thousands of tiny red crabs are seen washing ashore on the beach, deer are seen wandering here and there, turtles are roaming in the Saint Martin beach and so forth. It's not just about Cox's bazar, the same thing is applied for Sundarban, Sylhet, Hillside areas, Sanctuary, etc.

In fact, deforestation has declined at a great rate by refilling the nature with greenery. Plastics are no more polluting the water and diversity of fishes is re-established. Many industries are closed, as a result no more producing smokes to pollute the air of our country. The traffic jam is drastically reduced to almost null in the towns and so the carbon emission. Nature is enjoying its fullest while we are stuck at home. To recapitulate, nature has got back its beauty giving us a strong and true message that how badly it was treated by us earlier.

- **Field of Medicine Should Be Brought Under Greater Concern**

Another lesson we have learned from the pandemic is how crucial doctors and nurses are for this world to survive. They are working day and night relentlessly to save people by

endangering their own lives. So, it is high time we honoured them for their work from now and respect them wholeheartedly. Again, looking at the world's state, one should not think twice to choose medicine as their subject of study. Also, funding in biological research should be a matter of concern to be highlighted to save the next decades.

- **'Work from Home' Method Could Be Inaugurated in Workplaces**

Lockdown has made it compulsory to close down all the offices and companies in the country. So, many of the companies have started working online so that employees can be able to work from their home. If we look at the online banking fact, most of the banks are supporting working from home. Another example is, in the companies like Google, Facebook, YouTube, etc their officials don't need to come to office and continue their work from home. Now the head of offices and companies are planning to create virtual offices instead of traditional ones. Subsequently, the companies will no longer need to pay office rent every month of the year and they can smoothly run their business either. People with a strong internet connection can work from home and won't need to come to the office.

- **Online Businesses Will Get More Popularity**

Development of applications for online businesses such as shopping, food, etc will become available because people in lockdown have become habituated to online shopping (i.e. daraz, alibaba.com) and ordering food online (i.e. food panda). So, even after lockdown, there is a possibility that online shopping and ordering food will have the same demand and attention as it is getting right now. There is a possibility that entrepreneurship through online food or clothing or selling products can be a source of income for women and men both.

- **COVID-19 Will Reduce the Rush of Big Cities and Towns**

Internet-based jobs or businesses offered by different offices and companies will be made available for people all around the world. People won't need to have a physical presence for the job as they can work easily from home. In fact, many people will move from city to small towns in order to reduce their daily costs. They will realize that living and working in traffic free, peaceful village area surrounded by natural beauty is better than staying in expensive apartments of big towns. They may establish a strong Wi-Fi connection for working from their home town.

Furthermore, any international company from any corner of the world can hire people. The term 'globalization' will be broader in sense by the blissful action of the internet. Companies can hire any talented people from any place in the world and also that person won't need a visa or immigration to work for that company. For example, a person in Bangladesh can work for the Google of America if he/she has a strong internet connection, laptop, IT skills and a degree.

All these events are pointing out that people with computer skills who are annoyed with the noise, pollution, and traffic of the city may soon immigrate to small towns for living a happy life with family. Therefore, a huge change will be visible in the city after this COVID-19 situation.

So, it's clear that we should develop IT skills, freelancing, video editing, etc if we want to lead a decent life when life will be free from COVID-19.

- **Educational System Should Professionally Include Online Classes**

Some national and international universities, medical colleges, schools, colleges, and other institutions, etc are arranging online classes to prevent session jams. Most of the Bangladeshi students are not habituated to online classes, however this pandemic has made it mandatory for many of them to continue online classes. However, this procedure may stay long due to lockdown. Even after lockdown, Institutions will continue arranging online classes, courses, sessions, etc to ensure proper education for students. Hence, to lead an upgraded life and for a better future after COVID-19, we could upgrade our way of regular life. Again, our compassion for relatives, neighbours, friends as well as for the whole nation is an obligation to fight the after-effects of COVID-19.

The facts mentioned above are however the lessons of COVID-19 for us. This pandemic is going to make a huge difference in the upcoming world economy and the majority of people will be afflicted with severe poverty. After this pandemic, the world will be facing a revolutionary change. Not only that, this change will last for a long time. Many of our lives will be fully different. To adapt ourselves to this change, we must modernize our perceptions of traditional lifestyle as well as take some fruitful steps.

CONCLUDING REMARK

COVID-19 has greatly changed the global environment right away as well as revealed some disguised issues that need to be highlighted. According to WHO, the Coronavirus will

never leave this planet, similar situations will cling us ever and anon. To tackle the crisis not only in Bangladesh but also in other countries we are moving forward to, we should get prepared with the necessary measures taken. Biomedical research should be widespread and more funded. Health issues are to be paid with much more priority and its high time countries around the world approached concertedly with compassionate international cooperation established.

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REFERENCES

1. Valencia DN. Brief review on COVID-19: the 2020 pandemic caused by SARS-CoV-2. *Cureus*. 2020 Mar;12(3). (doi: 10.7759/cureus.7386).
2. Mbae N. COVID-19 in Kenya. *Electron J Gen Med*. 2020; 17(6): em231. (doi: 10.29333/ejgm/7896).
3. Van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, Tamin A, Harcourt JL, Thornburg NJ, Gerber SI, Lloyd-Smith JO. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *New England Journal of Medicine*. 2020 Apr 16; 382(16): 1564-7. (doi: 10.1056/NEJMc2004973).
4. World Health Organization. Getting your workplace ready for COVID-19: How COVID-19 spreads, 19 March 2020. World Health Organization; 2020 Mar 19. Available at: <https://www.who.int/publications/m/item/getting-your-workplace-ready-for-covid-19-how-covid-19-spreads> (Accessed: 24 May 2020).
5. Islam H, Rahman A, Masud J, Shweta DS, Araf Y, Ullah MA, Sium SM, Sarkar B. A Generalized Overview of SARS-CoV-2: Where Does the Current Knowledge Stand?. *Electron J Gen Med*. 2020; 17(6): em251. (doi: 10.29333/ejgm/8258).
6. Zu ZY, Jiang MD, Xu PP, Chen W, Ni QQ, Lu GM, Zhang LJ. Coronavirus disease 2019 (COVID-19): a perspective from China. *Radiology*. 2020 Feb 21:200490. (doi: 10.1148/radiol.2020200490).

7. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, Guan L. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet*. 2020 Mar 11. (doi: 10.1016/S0140-6736(20)30566-3).
8. Islam MT, Talukder AK, Siddiqui MN, Islam T. Tackling the Pandemic COVID-19: The Bangladesh Perspective. (doi: 10.20944/preprints202004.0384.v1).
9. World Health Organization. Coronavirus disease 2019 (COVID-19): situation report, 48. Available at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200308-sitrep-48-covid-19.pdf?sfvrsn=16f7ccef_4 (Accessed: 3 June 2020).
10. World Health Organization. Coronavirus disease 2019 (COVID-19): situation report, 58. Available at: <https://apps.who.int/iris/handle/10665/331596> (Accessed: 3 June 2020).
11. Santacrose L, Charitos IA, Del Prete R. COVID-19 in Italy: an overview from the first case to date. *Electron J Gen Med*. 2020; 17(6): em235. (doi: 10.29333/ejgm/7926).
12. UNICEF in South Asia, COVID-19 Situation Report No. 10. Available at: <https://www.unicef.org/media/79791/file/ROSA-COVID-19-SitRep-13-May-2020.pdf> (Accessed: 24 May 2020).
13. Statement – Older people are at highest risk from COVID-19, but all must act to prevent community spread. *Euro.who.int*. 2020. Available at: <https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/statements/statement-older-people-are-at-highest-risk-from-covid-19-but-all-must-act-to-prevent-community-spread> (Accessed: 15 July 2020).
14. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, Liu S, Yang JK. Gender differences in patients with COVID-19: Focus on severity and mortality. *Frontiers in Public Health*. 2020 Apr 29;8:152. (doi: 10.3389/fpubh.2020.00152).
15. World Health Organization. Novel Coronavirus (2019-nCoV): situation report, 12. Available at: <https://apps.who.int/iris/handle/10665/330777> (Accessed: 24 May 2020).
16. IEDCR. Bangladesh COVID-19 Update. Available at: <https://iedcr.gov.bd/> (Accessed: 3 June 2020).
17. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship. (doi: 10.1101/2020.02.24.20027649).
18. Whole-Genome Sequencing. Illumina. Available at: <https://www.illumina.com/techniques/sequencing/dna-sequencing/whole-genome-sequencing.html> (Accessed: 15 July 2020).
19. Saha S, Malaker R, Sajib MS, Hasanuzzaman M, Rahman H, Ahmed ZB, et al. Complete Genome Sequence of a Novel Coronavirus (SARS-CoV-2) Isolate from Bangladesh. *Microbiology Resource Announcements*. 2020 Jun 11;9(24). (doi: 10.1128/MRA.00568-20).
20. Hasan S, Khan S, Ahsan GU, Hossain MM. Genome Analysis of SARS-CoV-2 Isolate from Bangladesh. *BioRxiv*. 2020 Jan 1. (doi: 10.1101/2020.05.13.094441).
21. Parvez MS, Rahman MM, Morshed MN, Rahman D, Anwar S, Hosen MJ. Genetic analysis of SARS-CoV-2 isolates collected from Bangladesh: insights into the origin, mutation spectrum, and possible pathomechanism. *bioRxiv*. 2020 Jan 1. (doi: 10.1101/2020.06.07.138800).
22. Moniruzzaman M, Hossain MU, Islam MN, Rahman MH, Ahmed I, Rahman TA, et al. Coding-Complete Genome Sequence of SARS-CoV-2 Isolate from Bangladesh by Sanger Sequencing. *Microbiology Resource Announcements*. 2020 Jul 9;9(28). (doi: 10.1128/MRA.00626-20).
23. Tapash Chandra Paul. COVID-19 and its impact on Bangladesh economy. *The Financial Express*. Available at: <https://thefinancialexpress.com.bd/views/opinions/covid-19-and-its-impact-on-bangladesh-economy-1592580397> (Accessed: 15 July 2020).
24. RR. Mitigating Covid-19 impacts on food and agriculture. *The Financial Express*. Available at: <https://thefinancialexpress.com.bd/views/mitigating-covid-19-impacts-on-food-and-agriculture-1585932264> (Accessed: 15 July 2020).
25. Singh R, Subedi M. COVID-19 and Stigma: Social discrimination towards frontline healthcare providers and COVID-19 recovered patients in Nepal. *Asian journal of psychiatry*. 2020 Jun 13. (doi: 10.1016/j.ajp.2020.102222).
26. Cullen W, Gulati G, Kelly BD. Mental health in the Covid-19 pandemic. *QJM: An International Journal of Medicine*. 2020 May 1;113(5):311-2. (doi: 10.1093/qjmed/hcaa110).

27. Begum M, Farid S, Barua S, Alam MJ. COVID-19 and Bangladesh: Socio-Economic Analysis Towards the Future Correspondence. Preprints. 2020 Apr 25. (doi: 10.20944/preprints202004.0458.v1).
28. The Financial Express. Covid-19 testing shortages, long wait times for results trigger concerns. The Financial Express. Available at: <https://thefinancialexpress.com.bd/national/covid-19-testing-shortages-long-wait-times-for-results-trigger-concerns-1592972068> (Accessed: 15 July 2020).
29. World Health Organization. Shortage of personal protective equipment endangering health workers worldwide. Available at: <https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide?fbclid=IwAR1CCiHqpYiYv7QkmsxNYNxyn72tUT7tUtJUyZ4RZ28IAPjOpi-KbEckRku0> (Accessed: 15 July 2020).
30. Nahar K. Covid-19 tests: Technicians to be trained on PCR machines. The Financial Express. 2020. Available at: <https://thefinancialexpress.com.bd/health/covid-19-tests-technicians-to-be-trained-on-pcr-machines-1585971746>
31. Bloch EM, Shoham S, Casadevall A, Sachais BS, Shaz B, Winters JL, et al. Deployment of convalescent plasma for the prevention and treatment of COVID-19. The Journal of clinical investigation. 2020 Jun 2;130(6):2757-65. (doi: 10.1172/JCI138745).
32. Tchesnokov EP, Feng JY, Porter DP, Götte M. Mechanism of inhibition of Ebola virus RNA-dependent RNA polymerase by remdesivir. Viruses. 2019 Apr;11(4):326. (doi: 10.3390/v11040326).
33. Aljofan M, Gaipov A. COVID-19 Treatment: The Race Against Time. Electron J Gen Med. 2020; 17(6): em227. (doi: 10.29333/ejgm/7890).
34. Cao YC, Deng QX, Dai SX. Remdesivir for severe acute respiratory syndrome coronavirus 2 causing COVID-19: An evaluation of the evidence. Travel Medicine and Infectious Disease. 2020 Apr 2:101647. (doi: 10.1016/j.tmaid.2020.101647).
35. Transmission of SARS-CoV-2: implications for infection prevention precautions. World Health Organization. World Health Organization. Available at: <https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions> (Accessed: 15 July 2020).
36. UNICEF. Bangladesh: Humanitarian Situation report No. 14 (Rohingya influx). Available at: <https://reliefweb.int/report/bangladesh/bangladesh-humanitarian-situation-report-no-14-rohingya-influx-10-december-2017> (Accessed: 15 July 2020).
37. Bangladesh. KPMG. KPMG; 2020. Available at: <https://home.kpmg/xx/en/home/insights/2020/04/bangladesh-government-and-institution-measures-in-response-to-covid.html> (Accessed: 15 July 2020).

