

Covid-19 Crisis: In sighting Facts and Figures with Possible Solutions

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Received: April 13, 2023; Accepted: July 29, 2023; Published Online: August 4, 2023

How to cite: Farooq R., Rasheed N., Saleem M., Saad M., Farooq M. and Hussain S.. Covid-19 crisis: In sighting facts and figures with possible solutions. *BME Horizon*, 2023; vol1(2). DOI: [10.37155/2972-449X-0102-6](https://doi.org/10.37155/2972-449X-0102-6)

Abstract: The Covid-19 pandemic has become a huge global health crisis. Whole world is suffering from this virus and yet we are unable to find any evident solution of this virus. This paper summarizes the experiences (facts and figures) of the first, second and third waves of Covid-19 across various regions of the World like Asia, Africa, Europe and South America along with detail of how they have utilized the resources/technologies/ methods in order to overcome the effects. Furthermore, solutions (what should be done) are discussed as different regions of the world are already facing the third wave of this deadly virus. More specifically, the large-scale behavior changes, vaccination and adoption of technological assistance from artificial Intelligence and robotics are considered as the possible solutions. This paper has been focused on the work of most advance forms of recent technologies in exploring their role for controlling the pandemic virus like robotics and artificial intelligence. The findings prove that artificial intelligence technique “EVA” helped to track or detect the virus in the people 1.85 times more efficiently than traditional means, whereas robotics including swab robots, aimbots, droid teams and germ zappers are most advance version of controlling spread of virus. This paper also suggests the advent technologies and techniques to be employed for better countering and avoiding the spread of covid-19 in different regions.

Keywords: COVID-19; Psychological and Behavioral Sciences; Vaccination; Artificial intelligence; Robotic technology.



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1. Introduction

The Covid-19 is one of the deadliest pandemics ever faced by the humanity. Covid-19 broke out in December 2019 in Wuhan, province of China^[1,2]. Different names were used for this deadly disease caused by this particular virus. Generally this disease is known as Covid-19—“Co stands for corona Vi for virus and D for disease”. This is also termed as novel coronavirus “Which means new type of virus which was not identified or discovered previously”. Many diseases caused by this family of viruses that range from common cold to the very severe diseases e.g. Severe Acute Respiratory Syndrome (SARS) it is also known as SARS-COV-2^[3,4].

This deadly virus can be transmitted from one individual to the other via different modes such as physical contact, hand shaking, airborne, blood borne, mother to child, animal to human transmission etc^[5]. The symptoms of this deadly virus are fever or chills, Muscles or body itches with loss of sense of taste or smell, diarrhea, shortness of breath or difficulty breathing, cough, vomiting, fatigue. Sometimes this virus can also effect the individual without having any sort of symptoms^[6].

This virus has largely affected the human life and has severe impact on the world population and has changed human life. The impacts can be concluded as economic impacts, social impacts, regional impacts, statistical impact. If we narrow down the impacts of this pandemic on worldwide economy, aviation industry bears heavier weight of consequences than other industries as whole world was in lockdown situation the transportation of goods and people all over the globe was prohibited^[7,8]. Due to the trade tension the global manufacturing production faced further declined and has hugely impacted the economical situation of the world^[9]. While in case of social impact this pandemic situation has affected the 1.6 billion learners across the world due to the nationwide closure of educational institutions^[10]. Similarly due to the discontinuity of the business activities this virus pushed 40-60 million people towards extreme poverty^[11,12].

There have been diverse effects across different regions of the world due to the covid-19 situation. In Middle East and central Asian region they acted quickly but despite to their efforts the pandemic leads them to heavier economical damage^[13]. This region of

the world is recognized as the biggest exporter of the oil facilities but due to this covid-19 they were heavily affected and their exports were declined^[14]. Europe was also affected as they have huge impact on the world's economy due to their large amount of exports all over the world. Due to the lockdown situation people were hugely effected as they lost their jobs, closure of business activities effected a lot and their economic situation caused huge damage to export industry^[15].

The adoptions of latest techniques for combating the adverse effects of the covid-19 are required. In order to help the humanity and encounter the effects of this deadly pandemic, almost all areas of human life have come in front and still struggling^[16]. The community of science and technology also is trying to find solution(s) for this human crisis. At one end social and behavior sciences are investigating/suggesting that how human can overcome negative effects through behavior changes^[17]. On the other side researchers of Artificial intelligence are trying to serve human society through utilizing their domain techniques^[18]. These techniques/roles have beneficial results and they are in great demand world-wide to overcome the effects of covid-19^[19]. There are many applications of AI have been exercised in covid-19 pandemic; techniques related to monitoring the treatment, case projection and Mortality, vaccine development and various drugs, helping in reduction of workload of workers specially frontline workers, Tracking and tracing of individuals, Infection diagnosis and early detection^[7].

The field of robotics that was originally came into horizon to assist the human in Dirty, Dull and dangerous jobs is also trying to introduce robots in hospitals, waste management and rescue operations^[20]. The robotic technology has a great potential to tackle the consequences of pandemics. Various traditional techniques of robotics could be utilized to lesser the spread of virus e.g. cylindrical robots could be employed in place of health workers in patient wards for performing different tasks like temperature measuring, blood-pressure and oxygen saturation measurements^[21]. Furthermore, drone robots could be utilized for the purpose of disinfecting buildings, institutions, hospitals, wards^[22]. Other areas where robots could be deployed are delivering meals and medicines to the patients as well as people in quarantine, transportation of patient to and from the laboratories^[20].

As Covid-19 impacts global regions, with Middle East and central Asia experiencing swift response but heavy economic damage, this paper suggests the use of different advent robotic technologies like AI including EVA and robotics like droid team, swab robots, aimbots, germ zappers, as well as adoption of different techniques adopted by different regions of the world to control the spread of this virus, there are different robotic technologies adopted by the developed countries to control this virus. The modern techniques adopted by developed countries of Europe and China has played a vital role in the successful control in spreading of COVID-19 globally. These regions of the world should share their experiences and technologies to the other regions of the world to control the adverse effects caused by COVID-19 Virus.

The overall organization of this paper comprises of the introduction part with all the details of the COVID-19 virus, how it has affected the different regions of the world, further it was discussed the rate

of spread in different regions and its comparison with three different waves in different countries. Lastly it was discussed how different advance technologies like use of robots can be quite useful to tackle the virus and how different countries of different regions employed different techniques to control it, how mass vaccination of people should be carried out to control it.

2. Spread of COVID-19 Waves:

2.1 First Wave of Covid-19

After the discovery of deadly corona virus across the world in December 2019, it spread like a wild fire in different regions of the world; especially it affected the Europe and USA. During the first wave of Covid-19, Italy was the first European country to report the first case^[23,24]. The crude mortality rate (CMR) in Belgium was 86.3/100000, followed by UK with CMR rate of 68.5/100000 and in Spain this rate was 62.1/100000, while Slovakia had lowest CMR of 0.6/100000^[25] as shown in **Figure 1**.

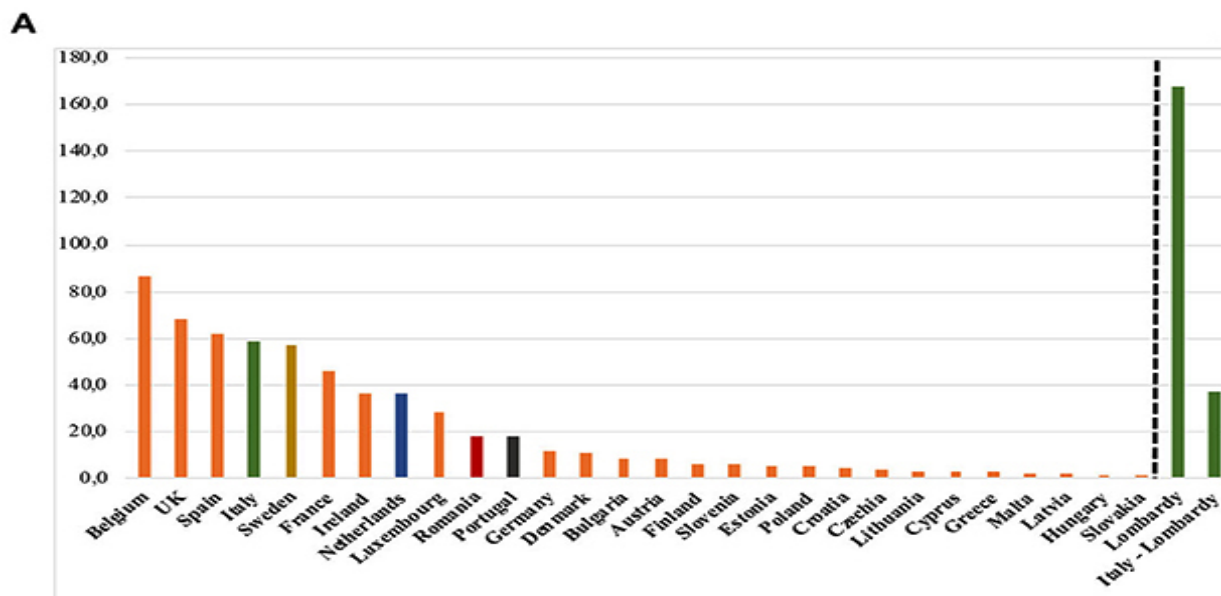


Figure 1. Crude Mortality Rates for COVID-19 in 27 EU Countries plus UK^[25]

If we see the trend of Covid-19 cases across African region, the daily increase in rate was less than 100 before 19th of March 2020. However this rate increased up to 100-500 cases per day during 19-24 march, but this rate further exceeded to 500 cases per day after 24th as shown in **Figure 2**^[26].

If we sum up the average case distribution across African region the northern Africa had 40.59% virus spread rate followed by western Africa with 25% rate

while the central Africa had the lowest rate of 8.76%^[26]. While if we go through the trend of virus spread across south Asian region countries like Pakistan, Afghanistan, Bangladesh, Nepal and India. Among these countries India was the second country which recorded largest number of cases among the world with nearly 9 million cases approximately^[27]. If we compare the death rate in Asian countries India had 11.6% per 100000 people^[28] while Pakistan had 6.0%, Afghanistan had 6.6%,

Nepal had 9.6% and Bangladesh had 5.2%^[29] as shown in **Table 1**. Covid-19 has widely affected the social behavior of the people living in different regions of the world. In normal days average person came into close contact with 17.6 people per day but it reduces

down to 7.1 per day in pandemic period, during the lockdown situation across the world people rarely used transportation leading the number of passengers decrease by 50.0% as they were restricted to stay at their homes^[30].

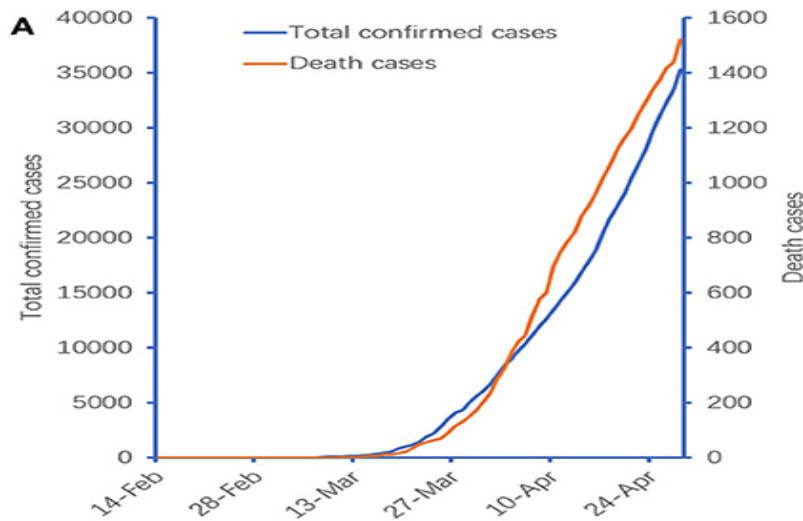


Figure 2. Case Number and Distribution in Africa^[26]

Table 1. Death rate per 100000 across South Asian Countries^[29]

South Asian Countries	Death Rate/100000
India	11.6%
Pakistan	6.0%
Afghanistan	6.6%
Nepal	9.6%
Bangladesh	5.2%

The close contact rate at public transport decreases by the rate of 36.1% while this change rate was high at educational institutes noticed at 66.0%. Due to the lockdown people were forced to stay at their places and they had to use online shopping services to meet their basic requirements and this rate was observed to decrease at 48.6% as compared to normal shopping at malls^[31].

2.2 Second Wave of Covid-19

After the deadly effects of the first wave of corona virus the world faced the second and stronger wave at the end of December 2020 as this virus has evolved itself then the first wave of this virus in different regions of world^[32]. It affected the regions like Asia, Europe, Africa and America. As African region countries faced the second wave of Covid-19 with the average 220000 new cases per day and it has overcome the rate recorded during first wave with 18000 cases per day.

The rate for positive covid-19 cases increased during second wave in countries like Tunisia, Libya, Morocco and South Africa, while this rate was consistently less in Uganda and Ethiopia^[33] as shown in **Figure 3**.

The observed trends for the second wave in Asian region for Covid-19 spread rate showed that second wave hugely effected India as the rate for positive cases increased and it spread more rapidly as compared to the first wave with 11.1 million recorded during second wave till February 2021. Maharashtra is reported as the highest active cases state among other states of India^[34].

The government of Pakistan announced a second spell of covid-19 on October 28, 2020 with daily increased rate of positive patients reached 750 per day compared to 400-500 per week. Suddenly positive cases increased from 6000 active cases to 11000 and at the end of February the total number of active cases in Pakistan reached 21000^[35].

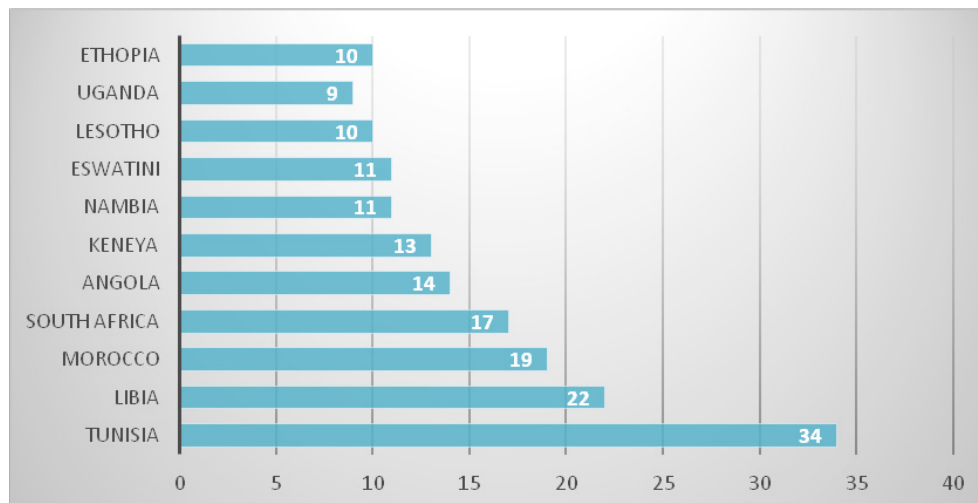


Figure 3. Positive Cases during Second Wave across African Region^[33]

In case of Europe the second wave has already effected a lot the people of this region however these countries have learned a lot from their first wave experiences and comparatively controlled the spread of virus but in some of the countries like Italy, UK, France the positive cases rate was high. The western European countries like Italy, Belgium which were badly affected in first wave also suffered badly during second wave^[36]. Portugal faced bad situation then the first wave. The central and the Eastern Europe faced more alarming situation and death rates. Approximately 105000 people died due to this covid-19 in 31 countries reported in November 2020^[37].

In case of American region this second wave is even stronger then the first one and death rate and number of positive cases are increasing each day. The highest number of deaths during first wave was recorded below 2800 per day but now in the second wave this limit has passed 3000 deaths per day in US^[38]. Now the US death rate toll stands at 300000 at this moment which is the highest figure in the world and US stand at the fifth global total confirmed death rate due to covid-19^[39].

The second wave of Covid-19 has affected the people of the globe same as it effected during the first period. The social behaviors of the people changed but people learned from their experiences and they utilized them to combat during second phase. People were more conscious and they acted more responsible upon the instructions of authorities by maintaining social distance, avoiding physical contact and hand shake^[40]. Before the start of the second wave people followed the instructions but latterly they got relaxed

and they stop following SOPs which was the reason behind the increase in cases during second phase of the virus as a result the death toll and average positive case rate per day increased^[41] all over the globe and once again the authorities of different regions of the world recommended a complete lockdown during the second wave. Still different regions of the world are facing the effects of this wave.

2.3 Third Wave of Covid-19

The countries all over the world are still trying to cope with the consequences of first and second wave of this virus now the bigger problem is to control the outburst of third wave as it has already started to spread in various regions of the world. Many regions of the Europe, Asia, Africa and America are supposed at the start of the third wave of this virus, the spread ratio of this third wave is 35-40% faster than the previous ones. The positive ratio of this this UK variant wave is 54% of the total cases registered all across the world. Due to this high spread rate many countries including Poland, Italy, and Germany have extended their lockdown duration and take all the possible precautionary measures to prevent the spread of this third wave^[42].

According to the national command and operation center (NCOC) the positive rate in Pakistan has been increased with 10.15% all over the country during this third wave of Covid-19. The number of cases reached 640988 all over the country with active cases at 37985. Recently, NCOC has recommended smart lockdown in areas with having high positive rate ratio, maybe country has to move towards a complete lockdown situation as number of cases are rapidly increasing in

the country^[43].

Asian countries including Pakistan, India, Bangladesh which had somehow reported drop in cases during second wave are now badly effected with third wave with hundreds and thousands of new cases are being registered each day with India alone reporting over 500000 new cases during this phase^[44]. India is hugely suffering from this situation of pandemic and it is hard to comprehend as average number of cases each day are 378000 with more than 222000 deaths as of May 4 and it is believed that hospitals are overwhelmed with health care workers are also exhausted and becoming infected^[45]. The third wave across Europe spread due to the UK variant first noted in England (B.1.1.7) strain of virus. It has effected France with rise of 55% to about 38000 cases per day in Germany since mid of March about 1000 more people were admitted in ICU, the English variant has also deteriorated the Spain and Italy^[46]. In US region the third wave is also effecting despite vaccination is also under way, they are reporting nearly 200000 cases and 2000 deaths per day

from this virus despite maintain social distancing this virus is appearing to revving up and number of people being hospitalized is highest as it's ever been^[47].

2.4 Fourth Wave or Delta Variant of Covid-19

During the end of July 2021 updated guidelines were issued by the Centers of Disease Control and Prevention (CDC) for urgently increasing number of Covid-19 cases and it was recommended to those living in areas of high transmission of Covid-19 virus to wear mask in public places even though they if they are fully vaccinated against previous waves of this deadly virus. It was observed that during first 7 days of July average number of cases reported were about 12000 but on July 27 the 7 days moving average cases reached over 60000. It was evident that this delta variant is more infectious and it has high transmission rate as compared to the other previous variants of covid-19^[48] (**Figure 4**).

- Delta variant is more contagious.
- This variant cause more severe illness as compared to previous variants among unvaccinated people.

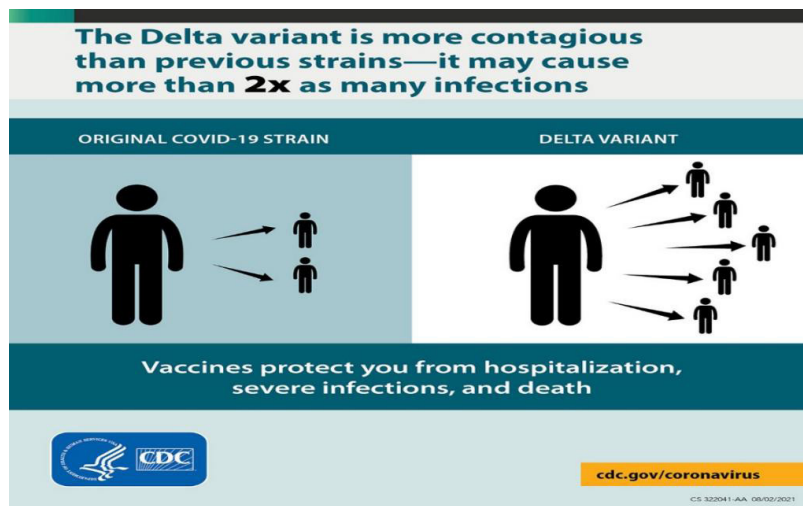


Figure 4. Delta variant vs original covid-19 strain comparison^[48]

Delta variant was originally originated in India and it was referred as SARS-COV-2 delta variant, this deadly variant is now dominant in many regions of European countries. WHO has warned regional offices and ECDC for prevention of transmission efforts must be reinforced. According to the data from European center for Disease prevention and control (ECDC) shows that from June 28 and July 11, 2021 the delta variant was dominant in 19 countries of the total 28 European countries. In this region previously dominant

Alpha variant was 23.3% of those who were isolated and it is detected that among this region delta variant is 68.3% of the median proportion of all nationally sequence virus isolates. Based on this proportion it is evident those in coming months the delta variant will be globally dominant strain among all the countries in Europe^[49]. Confirmed cases are rising in all European countries with this new variant of covid-19 European drug regulator said this delta variant by end of August in the European union will account for 90% of strain

in circulation^[50,51].

Highest submissions of delta variant samples in past 4 weeks

Countries that submitted sequenced coronavirus samples to GISAID

	Delta variant cases in past 4 weeks	Cumulative delta variant cases
U.K.	58,268	208,266
U.S.	16,662	45,818
Denmark	12,684	15,847
Germany	4,778	9,237
France	3,171	6,101
Italy	2,951	5,444
Sweden	1,950	4,970
Belgium	1,922	3,704
Netherlands	1,734	4,536
Spain	1,642	5,221

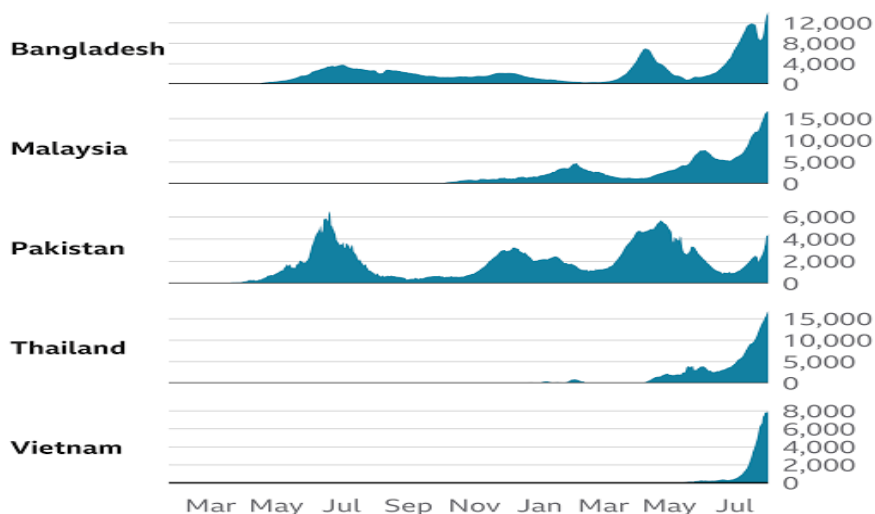
Figure 5. Highest submission of delta variant samples in past 4 weeks^[52]

In Asian countries, delta variant is spreading at a rapid rate and is putting strain at health infrastructures. Due to the fact that vaccination rate is lower in many Asian countries, it is feared that the rise incases due to delta variant will continue to increase. This situation is particularly concerning as the delta variant is known to be highly transmissible and can lead to severe illness.

Efforts are being made to accelerate vaccination campaigns and implement stricter preventive measures to curb the spread of the variant and alleviate the pressure on healthcare systems^[53]. Malaysia has become one of the hotspots in Asia, on July 30 a new record of 17,786 new cases was registered and death toll rises to 219 on August 2^[54].

Shape of the pandemic in parts of Asia

Number of cases per day from Jan 2020 to 1 Aug 2021, seven-day rolling average. Each country on its own scale



Source: Johns Hopkins University



Figure 6. Shapes of Delta Variant toll rises in different parts of Asia^[54]

Pakistan is also facing adverse effects of delta variant and daily count for new cases and death rate is increasing at a rapid rate^[55]. Pakistan is recording 4000

above new cases of delta variant each day and fatalities at highest point in almost 50 days. Since April 30 a total of 4497 more cases were registered in past 24 hours

highest daily count since April 30, pushing the count to 1.02 million according to ministry of health. Karachi a largest city of Pakistan recorded 22% positivity rate on Wednesday and 26.32% a day earlier. Health officials warned that this delta variant is highly transmissible strain first identified in India and is spreading rapidly across globe^[56].

This delta variant was originated in India and it has now rapidly affected the different countries of the globe^[57]. It was first detected in India in October 2020. The rapid delta variant cases in India are due to the lack of mass vaccination, a susceptible population and reduce vaccine effectiveness in blocking transmission. Additionally, the high population density and inadequate healthcare infrastructure have contributed to the rapid spread of the delta variant in India. Furthermore, the emergence of new variants with increased transmissibility has further complicated containment efforts. 61 samples of delta plus variant were detected in country so far^[58].

Bangladesh is also facing diverse effects of delta variant and so far nearly 950000 infections were reported and more than 15000 related deaths were administered^[59]. It also reported the highest no of positive cases at a rate of 9964 per days during last few days. Government of Bangladesh has imposed a country

wide lockdown and has extended it till July 14, police and military patrols in empty streets and hospitals are struggling to cope with the growing no of cases each day. Some rural areas reported 70% infection rate underlining the magnitude of health system facing problems^[60].

3. Possible Solutions to Lessen the Effect of Covid-19

In the above section, the fact, figures and consequences of the Covid-19 crisis (faced by the different regions globally during three waves) discussed. In this section the possible solutions/practices will be discussed that could be effective in controlling as well as to tackle the problems and consequences raised during this outbreak of corona virus^[61].

3.1 Social Practices

Social and behavioral sciences proposed that we can minimize the negative effect of this pandemic by targeting the negative emotions and fear among the people, in order to face the fear of this pandemic people

have to exhibit stable emotion and use the optimistic approach this will help people to efficiently face it^[62,63].

Various social practices can be quite helpful in controlling the spread of Covid-19 as we know that is deadly virus is transmitted from person to person with physical contact and by not following the social distance between the people. There the several practices that can be performed and will be proved helpful in this situation^[63,64].

Recent medical reports declared that the infective people with no symptoms are supposed to be major source of transmission of Covid-19. This is important to adopt social distancing to avoid the further spread. People should stay at homes and limit their physical contact as possible as they can in order to minimize the virus transmission^[65]. As there is high risk of transmission in areas with lot of gathering such as markets, grocery stores, restaurants, airports, parks people should avoid gatherings at such places^[66].

3.2 Vaccination

From last century, vaccination has remained one of the most significant public health interventions protected millions of people from infectious diseases^[67].

With the invention of multiple vaccines that are effective in combating this deadly virus the people all around the world are to be vaccinated and this is the major break through achieved by the medical science^[68]. To develop an efficient vaccine for Covid-19 approximately 200 researches were conducted globally. There are various vaccines available now and are recommended for use by the WHO after their clinical trials proved that they are quite effective and safe for the people of different ages. Different regions including Asia, Europe, Africa and America have allowed their authorities to use different vaccines on rapid bases. There are different vaccines available to the world invented by medical experts of China, Russia, Oxford and USA and all of them are approved by the WHO and are proved effective^[69,70]. So every country of the world is trying to vaccinate their major part of population to control the spread of this deadly virus. Vaccines are considered as the way of prevention to transmission of virus, if it does not fully prevent this transmission it can significantly lower the risk of transmission^[71]. "You could potentially vaccinate your way out of the epidemic" Dr. Peter Hotez^[72].



Figure 7. Corona virus Vaccine^[73]

3.3 Use of Artificial Intelligence

To reduce the transmission of corona virus use of AI has been employed to limit the one to one contact of doctor to patient as well as health workers to patient^[22,74]. AI powered thermal cameras are used to carry out the basic work of front line health workers.

These are used to measure the temperature of patients/people by the help of hand held scanners. These cameras are used to monitor the temperature of the visitors as well as the employees working at health care facilities^[75].

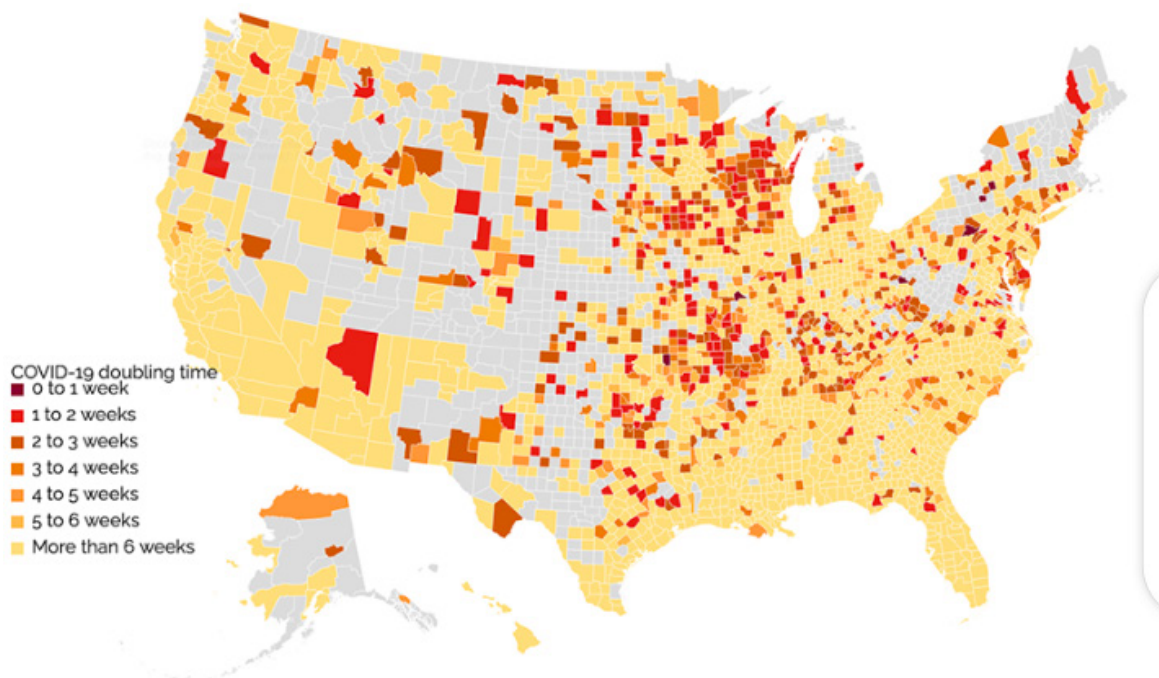


Figure 8. Covid-19 doubling time hotspots^[76]

There are many areas in which AI can be used during his pandemic, these areas include diagnosis and prognosis, social control, data dashboards, tracking and prediction, alerts and warnings, treatment and cures^[77,78]. AI can be used to develop database to have the information and health condition of the patient in order to help the health care personals or organizations for future as well as for diagnosis^[79].

AI can be used to diagnose the covid-19 by identifying hotspots of the areas with higher positive rate as well as help to predict the progress of this virus in patients^[80].

AI and machine learning is used to limit and detect the virus especially in the international passengers at the Greek border. This technology is named as “EVA”. It helped to track or detect the virus in the people at 1.85 times more Artificial intelligence can be employed to

reduce the potential of this corona virus transmission by protecting the health care workers, by reducing the contact of humans and by protecting public by tracing the hotspots as shown in **Figure 5**^[76]. It adds values to tackle patients by helping health care workers, medical staff and administrative staff efficiently than other testing techniques. It works on the algorithms of machine learning and AI^[6].

3.4 Use of Robotic Technology

With the advancement in technology the robotics has been playing a keen role in the improvement in lifestyle of mankind. There are several robotic technologies have been employed to help the people that are working in different industries including the health, medicine, education, and manufacturing^[81].

In this pandemic keeping in mind the precautionary measures the robots could be employed instead of direct human interaction. Robotics can help in combating covid-19 situation by employing them in order to sanitize the public places especially hospitals and other health facilities^[82,83]. The robots can be used to help out the health care workers to smartly and efficiently deal with covid-19 positive patient in medical wards where there is high risk for the health workers to be affected. Some of the role that robots are already performing to serve the humanity in this pandemic^[84].

3.4.1 Droid team

Droid team (a group of robots developed to check the temperature of the people entering the medical facility (**Figure 9**). These robots also recall the people to wear masks and hand wash^[84,85].



Figure 9. Droid Team^[84]

3.4.2 Say “Ahh” swab robots

These special swab robots are used to collect samples from person’s throat in order to test the infection

caused by Covid-19 (**Figure 10**)^[86]. These robots are very helpful to avoid person to person interaction^[84].



Figure 10. SAY “AHH” Swab Robots^[84]

3.4.3 Germ zapper

These machines are developed to carry on the process of sanitizing the hospitals and other public places (**Figure 11**)^[87]. This helps us to limit the direct use of human resources in this pandemic^[84].



Figure 11. GERM ZAPPER^[84]

3.4.4 Aimbot

This robot is designed to walk in the public places and remind people to wear mask and keep social distancing rules (**Figure 12**). It also spray the disinfecting solution^[84,88].



Figure 12. AIMBOT^[84]

4. Conclusions

In this paper, the facts/figures /experiences of different

parts of the world during first, second and third waves of Covid-19 have been reviewed. Furthermore, different potential solutions and practices are also discussed to cope with this crisis. While efforts to develop pharmaceutical solutions for this pandemic are under way, the social and behavioral sciences and use of robotics and Artificial intelligence technologies can provide important aspects for managing the pandemic and its outcomes. In this paper different topics have been discussed that are broadly relevant to many stages of the current as well as for the future to help policy-makers, leaders and the public to better understand how to manage these threats, how technology can be utilized to upgrade our health systems and how we can learn from our previous experiences to tackle the future treats of this pandemic. This paper presented a comparison of the different waves faced by different regions as well as it has presented a wide analysis of how different advent robotic technologies i.e. Swab robots, aimbots, germ zappers and droid team and other AI based techniques i.e. “EVA” were proved quite beneficial in copping the spread of COVID-19 in different countries of different regions. This paper also suggests the advent technologies and techniques to be employed for better countering and avoiding the spread of covid-19 in different regions globally.

Conflict of Interest

Declaration of conflict of interest.(Please add this part)

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