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Review and forecasting on COVID-19 outbreak; An insight to *in silico* candidate drug discovery

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A novel virus is discovered recently, named as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). It causes the Coronavirus Disease 2019 (COVID-19), which is spreading rapidly worldwide. The emerging genetics and clinical evidence of the SARS-CoV-2 virus suggest a similar path to those of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Coronavirus causes respiratory illness in humans and infect several other species of animals. It was one of the best interests of researchers as it attracted virologist's attention in last two decades. It was clear from an epidemic in 2002-2003 of Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) that human civilization may have animal coronavirus as its potential threat in the future. However, the mechanism of this virus spreading from one specie to another remained obscure these years. The 2012 Middle East Respiratory Syndrome Coronavirus (MERS-CoV) epidemic of animals, and now this COVID-19 pandemic prioritizes the human coronavirus for further research and exploration. However, General hygiene, social distancing, and disinfection can prevent the person-to-person spread of coronavirus. This review focuses on SARS-CoV-2, which is emerged from China in December 2019 and caused a novel disease named as COVID-19. The current review has an insight to possible treatment COVID-19 followed by a short review of *In silico* candidate drug design and prevention; This systematic review was conducted according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. Databases, including Health Research and Development Information network Plus (HERDIN Plus), Science direct, PubMed and google scholar were visited to search the articles. Further, the forecasting results of the fitted model show a significant decrease in the weekly global deaths from the 51th week of 2020 16th week of 2021 but 95% limit has also shown the potential of

getting the situation worser amid COVID-19 second wave.

Keywords: Wuhan, COVID-19, SARS, MERS, *In silico* drug, ARIMA

INTRODUCTION

On December 31, 2019, 27 cases of unknown etiological pneumonia were found in Wuhan city in the province of Hubei China [1]. Wuhan is the most crowded city in central China, having a population of over 11 million. Most prominently, these patients displayed Clinical symptoms of Dry cough, fever, bilateral lung, and Dyspnea in imaging filtrates. All the cases were related to the Hunan seafood wholesale market in Wuhan city, which trades in fish and a various number of live animal species, including snakes, bats, chickens, and marmots [1]. The causative agent or biological pathogen was identified as extreme Acute respiratory syndrome coronavirus 2 (SARS-COV-2) the samples from throat swab was taken and tested by the Chinese center for disease control and prevention on January 7, 2020. The disease named COVID-19 by World Health Organization (WHO 2020). So far, most patients infected with SARS-COV-2 have developed mild symptoms as well as fever, dry cough, and sore throat. Most cases have resolved instinctively. Some patients developed several lethal difficulties and had organ failure, pulmonary edema, septic shock, severe pneumonia, and acute respiration distress syndrome (ARDS) [2]. Among all, approximately 54% of males are infected with SARS-CoV-2 at an average age of about 56 years. It is evident from the data that patients who have sought of intensive care were older and had numerous comorbidities as well as respiratory illnesses, cerebrovascular, endocrine digestive respiratory diseases [3].

WHO, on January 30, 2020, announced this COVID-19 outbreak as a 6th public health emergency service [4]. Previously, MERS-CoV and SARS-CoV have also declared an outbreak of coronavirus [5] So far, it has affected more than 200 countries around the globe. The USA has the highest number of positive cases, followed by Italy and Spain so far.

2. History of Coronavirus to COVID-19

The identification of human coronavirus was first revealed by Tyrrell and Bynoe in 1965 with human coronavirus strain (HCoV-229E) [6]. However, the disease was first described in 1931. The human embryonic tracheal cell was observed in the culture of which acquired from the respiration tract of a person who suffers from a common cold. Although the existence of infectious agents was demonstrated by infecting humans, enlist volunteers from these cultures and cold were develop in a huge proportion of subjects, Tyrrell and Bynoe at that time could not develop agents in tissue culture [7]. Researchers reported a virus with infrequent properties in tissue culture and collected from cold infected humans. Both the Hamre virus and B814 were called 229E, where Ether sensitive and therefore probably required an infectious coat, covering with lipids. However, those two viruses have not been associated with any known Myxo-or Paramyxoviruses. Employed in Robert chanock laboratory at national institutes of health, McIntosh, and colleagues in 1967 reported multiple strain of other sensitive agents from the human respiration tract is previously using the adopted procedure of Tyrrell and Bynoe.

The Coronaviridae family contains a wide variety of human and animal viruses with typical morphology. Coronaviruses are disc or spherical, kidney, rod-shaped particles surrounded by a fringe or corona that reflects the spherical distal ends of embedded glycoprotein envelopes. Before 2003, attention in human coronaviruses was mainly motivated, having a role in mild infection in the upper tract. Shortly after the discovery of SARS-CoV in 2003, two new human coronaviruses are HKU1 in Hong Kong, and HCoVNL63 in the Netherlands were reported [8]. In 2002-03, about 8,098 persons were infected with SARS-CoV and including 744 deaths reported by WHO. After 2003 the virus disappeared due to the evolution of host receptor Angiotensin-converting enzyme-2 (ACE-2) [9]. A similar infection named MERS later emerged in 2012 from camels in the Middle East and now emerged in December in Wuhan city of china called COVID-19. The confirmed COVID-19 takes place in Hubei province, Wuhan city of China. However, the epidemic has rapidly spread and affecting other parts of China. After that, new cases have been identified in different countries. For instance,Australia, Europe, North America, and regions in Asia. The real-time updates have been announced as a worldwide pandemic by world health organization (WHO) in 2020 [10].

Although the WHO officially named it COVID-19 coronavirus, while the international committee on taxonomy of viruses called it the causative virus as SARS-CoV-2. On February 11, 2020,

Coronaviruses developed rapidly and have a long history of harboring among animal species. Researchers/Scientists tried to explore the MERS and its infection in the population. Hence several forms of coronaviruses in nature are not recognized to infect humans. COVID-19, MERS and SARS are highly contagious for their ability to contaminate a range of animals [10].

3. COVID-19 current situation in the world

Globally, COVID-19 is spreading rapidly and has affected more than 200 countries. As of November 21, 2020, COVID-19 has infected more than 58 million people around the world, out of which 1,380,721 died of the virus, and approximately 40.25 million people recovered shown in Fig.1 (https://www.worldometers.info/coronavirus/).

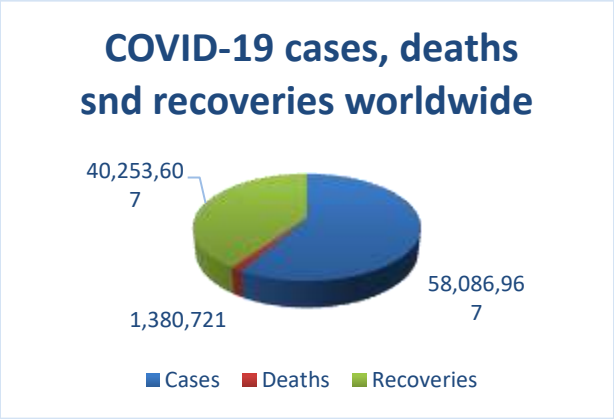

Figure1: Worldwide COVID-19 Pandemic situations

Table 1 shows the summary of cases, recoveries, and deaths of the top 20 most affected countries. The USA is mostly affected by COVID-19 having 12,287,642 cases, 260,427 deaths and 7,319,726 recoveries followed by India, Brazil, France, Russia, Spain, UK, Argentina, and Italy, respectively. Fig. 2, 3 & 4 represents the total number of cases, deaths, and recoveries per one million population of the top 20 countries cases wise, respectively. Belgium has the most cases and Chile the highest number of recoveries occurring per million population. Regarding the number of deaths, Belgium has the highest number of deaths per million. Data used in graphs and tables are collected from worldometers.info.

3.1. Fatality

The seriousness of a pandemic can be understood by Fatality (Cases Fatality rate and Infection fatality) rates defined in Eq. 1 & 2.

$$IFR = \frac{D}{R+D} \quad (1)$$

and

$$CFR = \frac{D}{C} \quad (2)$$

Where D, R and C represents deaths, recoveries, and cases, respectively.

Mortality is not usually used in ongoing pandemic due to its increasing nature and increment in the deaths. Therefore, case fatality and the infection fatality rate are mostly used in an ongoing pandemic. Case Fatality Rate is the proportion of patients who eventually die from a specific disease among all individuals diagnosed with the disease over a certain period. Initially, the mortality rate was estimated as 2% by WHO on January 29, 2020. Still, as the actual deaths and cases were not known, so it was mentioned that the initial estimate might be changed. Later, on March 3, WHO announced that 3.4% of COVID-19 cases had died globally. Fig. 5 represents the Daily deaths of COVID-19 in the world. In November, the highest number of deaths (11,239) has been recorded. Table 2 represents the summary statistics of the Fatality rate of the top 20 countries COVID-19 cases wise. The IFR is highest for Mexico that is equal to 5.61%, followed by Iran, Belgium, Italy, and the France having 3.08% %, 2.61%, 2.6% and 2.14% IFR, respectively. Further, CFR is recorded maximum from Mexico, equal to 9.83%, followed by Iran, Peru, and the UK having 5.27%, 3.75%, and 3.68% CFR, respectively.

Recoveries to Cases ratio determine the proportion of recoveries in the infected cases, i.e., high the proportion better is the control and vice versa. It is worth noticing that the ratio is greatly affected by the number of tests performed. The proportion of recoveries is highest for Chile, (95.41%), indicating control of pandemic and followed by India and South Africa.

3.2. The comparison of COVID-19 with other viruses

Comparison to previous pandemic COVID-19 has a small case fatality rate. SARS, known as a severe acute respiratory syndrome which was identified in 2002-2003, had 9.6% CFR. MERS (Middle East respiratory syndrome-related coronavirus) emerged in 2012 had 34% CFR whilst COVID-19 has 3.4% CFR as estimate by WHO as shown in Table 3.

4. Forecasting of weekly deaths of COVID-19

Prediction plays a key role in policymaking by assessing the future scenario of the pandemic. It provides a baseline, not only to policymakers, but also to health authorities, strategic planner, and many others to prepare their organization, people, or government for future situations or goals. Therefore, regarding the COVID-19 pandemic, the researchers are working to predict the future situation to help the government for better future planning. Various approaches may be used to make the forecast better. For instance, time series models, simulation model, multivariate linear regression, backpropagation neural network and grew-forecasting, are the reliable approaches [12,13,14,15,16,17,18]. In this paper, we used the Auto-Regressive Integrated Moving Average (ARIMA) model, a time series statistical model, to forecast future deaths in the world. For model fitting, we used weekly global deaths.

Table 1 : Top 20 most affected countries

Country	Cases	Cases /1m pop	Deaths	Deaths /1m pop	Recoveries	Tests/ 1m pop
USA	12,287,642	37,038	260,427	785	7,319,726	534,216
India	9,061,931	6,542	132,834	96	8,488,436	94,319
Brazil	6,020,164	28,244	168,662	791	5,422,102	102,746
France	2,109,170	32,285	48,265	739	149,521	300,925
Russia	2,064,748	14,146	35,778	245	1,577,435	491,919
Spain	1,589,219	33,985	42,619	911	N/A	443,568
UK	1,473,508	21,661	54,286	798	N/A	591,931
Argentina	1,359,042	29,963	36,790	811	1,177,819	79,875
Italy	1,345,767	22,271	48,569	804	520,022	330,359
Colombia	1,233,444	24,141	34,929	684	1,138,581	116,561
Mexico	1,025,969	7,925	100,823	779	770,728	20,589
Peru	946,087	28,540	35,484	1,070	873,970	147,720
Germany	905,721	10,797	14,125	168	593,100	315,381
Poland	843,475	22,296	13,288	351	407,075	155,992
Iran	841,308	9,967	44,327	525	596,136	68,089
South Africa	762,763	12,798	20,759	348	707,040	87,974
Ukraine	612,665	14,042	10,813	248	282,313	95,217
Belgium	553,680	47,693	15,352	1,322	35,281	485,270
Chile	537,585	28,028	15,003	782	512,927	259,514
Iraq	533,555	13,152	11,925	294	463,040	79,969

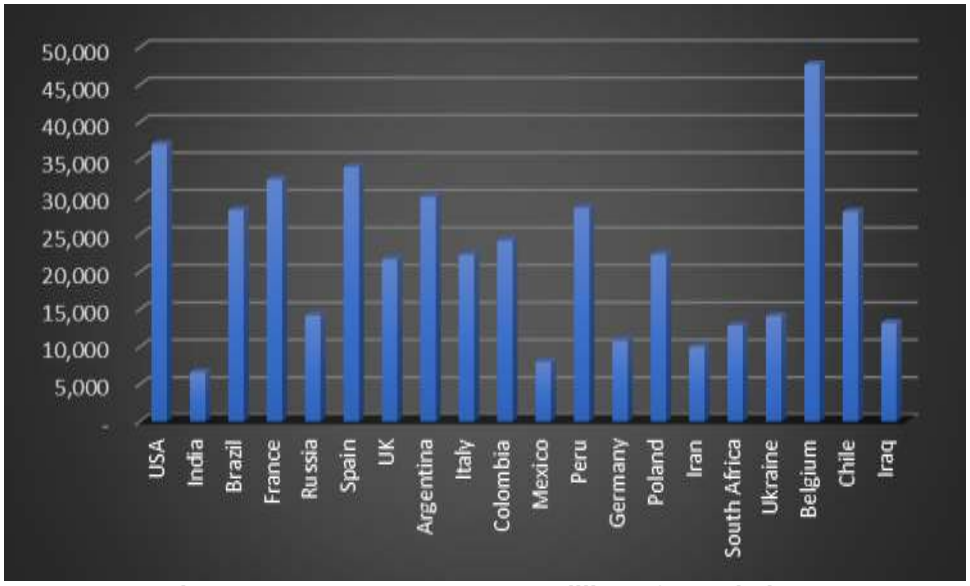

Figure 2: COVID-19 cases per million of population

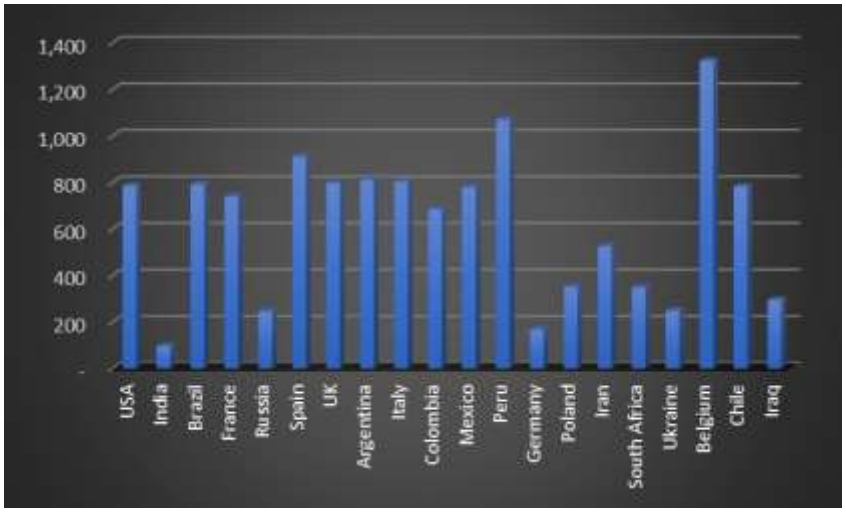

Figure3 : COVID-19 deaths per million of population

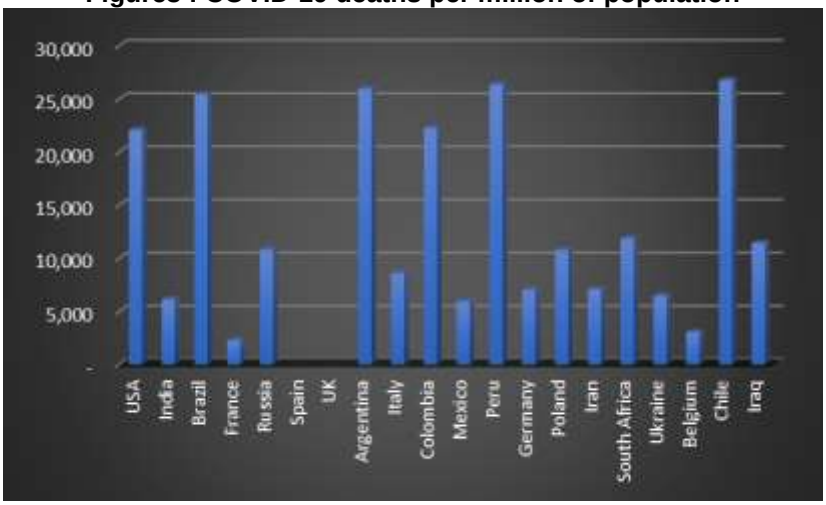

Figure 4: COVID-19 recoveries per million of population.

Table 2: Summary statistics of COVID 19

Country	IFR (%)	CFR (%)	Recovery (%)
USA	1.33	2.12	59.57
India	0.76	1.47	93.67
Brazil	1.47	2.80	90.07
France	2.14	2.29	7.09
Russia	0.98	1.73	76.40
Spain	N/A	2.68	N/A
UK	N/A	3.68	N/A
Argentina	1.45	2.71	86.67
Italy	2.60	3.61	38.64
Colombia	1.47	2.83	92.31
Mexico	5.61	9.83	75.12
Peru	1.95	3.75	92.38
Germany	0.94	1.56	65.48
Poland	1.06	1.58	48.26
Iran	3.08	5.27	70.86
South Africa	1.41	2.72	92.69
Ukraine	1.21	1.76	46.08
Belgium	2.61	2.77	6.37
Chile	1.43	2.79	95.41
Iraq	1.20	2.24	86.78

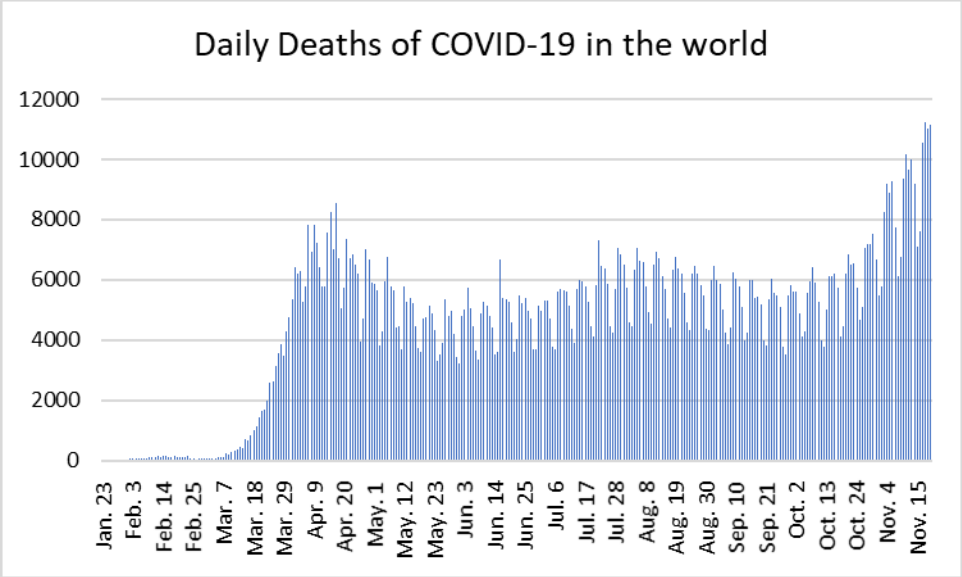

Figure 5: Worldwide COVID-19 Daily Deaths

Table 3: CFR of different viruses

Virus	CFR
COVID-19	3.4%
SARS	9.6%
MERS	34%

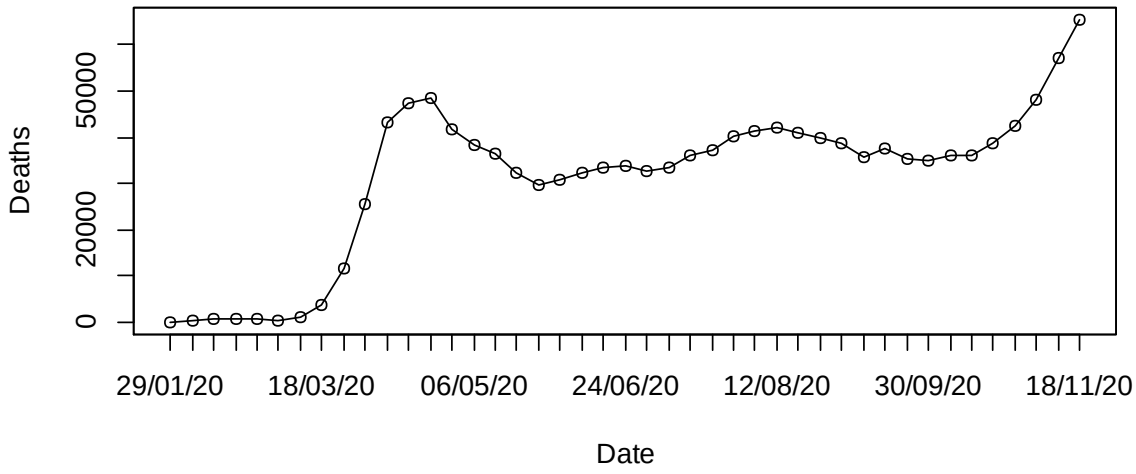

Figure 6: COVID-19 Weekly Deaths

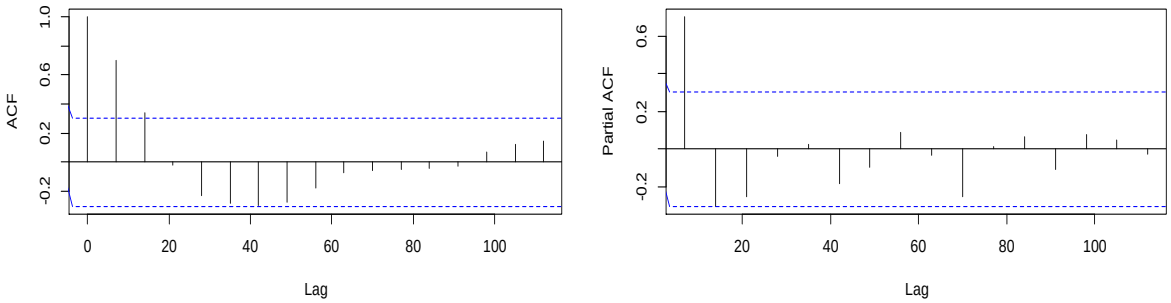

Figure 7: ACF and PACF of weekly deaths ca used by COVID-19

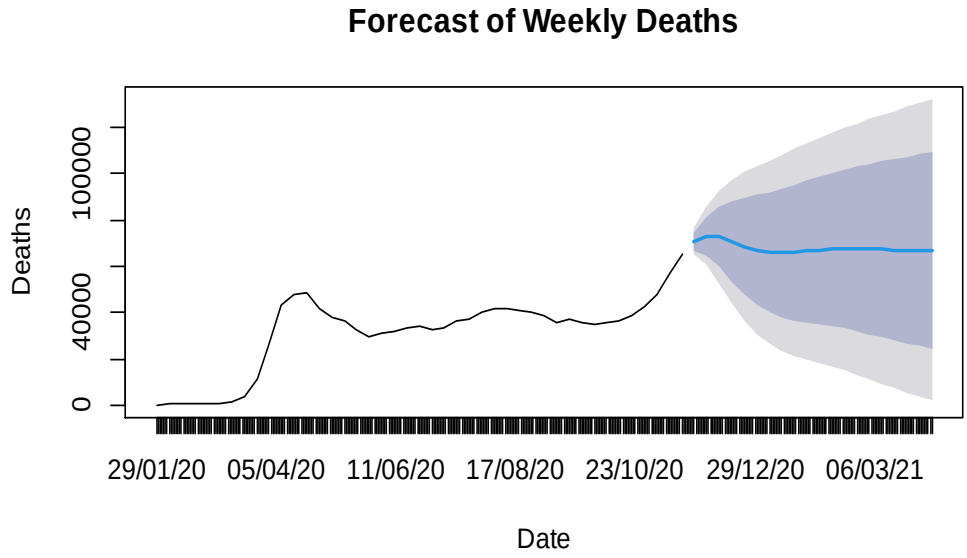

Figure 8: Forecasts of COVID-19 Weekly Deaths up to April 07, 2021.

The data is insufficient to assess seasonality. Therefore, non-seasonal ARIMA models are used.

During the first three weeks of 2020, there were no deaths recorded. However, an increase, with minimal growth rate, was observed for the next eight weeks. After eight-week exponential growth was observed for next seven weeks and now again amid COVID-19 second wave deaths are increasing exponentially Fig. 6 shows graphical representation of the weekly global deaths in the year 2020. As can be seen in Fig. 6, for 38-45 weeks, a dramatic increase was recorded with the highest growth rate with a maximum number of deaths in the 44th week, equal to 65,377. However, from week 15th to 35th, the number of weekly deaths was observed decreasing.This may be due to the strict lockdown and precautions observed in most countries of the world. The stationarity of the data was achieved by taking the first difference. Hence, d=1 for ARIMA (p, d, q). Further, the p, q terms are taken by taking ACF and PACF into consideration, as shown in Fig. 7. The final best-selected model was ARIMA (3, 1, 0).

Using the fitted model, it may be forecasted that the weekly deaths will be further increasing in the next few weeks until the 50th week of 2020. During the 50th week, the predicted global deaths are equal to approximately 70,776. It can further worth noticing that no significant decrease is expected in the weekly deaths after the 50 weeks of the year 2020 to 16 weeks of 2021. Moreover, as the data is limited for weekly; therefore, the forecasting power of the fitted model is lowest for making predictions for the weeks after 16th week of 2021.The point forecast did not showed any alarming sign but 95% limits has shown that situation may get worse and worse if no

precautionary measures are taken to control the pandemic. The forecast of weekly deaths of COVID-19 is shown in the Fig. 8.

5. Possible recommended treatments

The precautions like use of face masks, washing hands for 20 seconds with soap, use of gloves, use of sanitizers, stay at home, social distance, self-isolation, quarantine of relatives of infected persons, and screening achieved best results to control the virus and further dissemination of the virus. In a few cases, the recovered patients also shared remedies like gargling with saline water, steam inhalation, and the use of vitamin C rich food to increase their immunity. Supporting care, such as ventilation, is at the heart of COVID-19 patient management.

6. Treatment

We are fighting two simultaneous fights against the newly emerged virus (COVID-19), identified late last year in Wuhan China. The world, at the same time, struggles to discourage the propagation of the disease and trying urgently find effective therapies. There are growing numbers of clinical trials underway to evaluate possible COVID-19 treatment or vaccine. Presently, the number of trials is being performed worldwide, out of which most of the research was on to reuse widely used drugs, like variants of anti-influenza, antimalarial, and anti-HIV. Here are several research compounds which have shown successful results up to a certain limit and practiced as a trial basis for fighting against COVID-19.

6.1. Chloroquine or Hydroxychloroquine

Chloroquine is a repurposed medication that has high-quality potential for COVID-19 remedy [19]. It is an effective substance globally considered for its possible activity against COVID-19 [20]. In the lack of definitive proof of their efficacy for COVID-19, the FDA approved its use for COVID-19. Although the drug has been revealed to hinder the virus replication in the lab, it is thought that the necessary dose is very high in humans and may lead to serious toxicity. Besides, it can cause multiple secondary events, like cardiomyopathy, which can be restored by decreasing its use in some patients [21]. Chloroquine can inhibit PH-based replication of a couple of viruses, with a potent impact on and unfold SARS-CoV as well as COVID-19 infection [22]. A mixture of remdesivir and chloroquine has been reported to inhibit the recently emerging COVID-19 in vitro effectively. It was reported that in a COVID-19 patient in Korea β-coronavirus, viral masses had been decreased significantly by giving ritonavir remedy [23]. The degree of its effectiveness as a remedy remains still under discussion.

6.2. Atazanavir/Ritonavir

It is a combination of proper doses of protease inhibitors used for HIV treatment [24]. The usage of this combination has been shown to have potent antiviral activity against the extreme SARS virus [25]. The drug has additionally been proven to be effective as prophylaxis in opposition to different viral illnesses consisting of breathing syndrome (MERS) in the center east. Although, current combination clinical effect of lopinavir/ritonavir in 199 patients with COVID-19 validated lab did not show any benefits relative to standard treatment [26].

6.3. Remdesivir

Remdesivir is adenosine like mono phosphoramidate prodrug [27]. It is a wide range of experimental antiviral drugs in vitro tested for its effectiveness against multiple RNA viruses along with Ebola and COVID-19 [28]. The animal test results showed promising results in the inhibition of other families of corona like SARS and MARS respiratory syndrome in the middle east [29]. Given the lack of strong clinical trials, many patients with COVID-19 infections were administered the drug [30]. Several ongoing clinical trials are currently underway to examine the possible antiviral efficacy of remdesivir against COVID-19 in China and the Remdesivir 2020 clinical trials in the USA. Although this compound does not respond to a significant effect on Ebola patients during a recent outbreak [31]. Reportedly, Remdesivir successfully treated the primary US case of COVID-19 [32].

6.4. Tocilizumab

Tocilizumab is a cultured IgG1 antibody that prevents the inflammatory cytokine receptor interlukine-6 (IL-6) receptor that results in immunosuppression [33]. The drug is officially approved for the treatment of rheumatoid arthritis, giant cell arteritis, and juvenile idiopathic arthritis [34]. The medicine is studied with cytokine pushed hyper inflammation, which is a systematic inflammatory reaction that can be caused by infections like COVID-19 [35]. Recent Chinese findings have indicated that mortality of the current pandemic may be a result of hyper

inflammation triggered by virus activity. In this situation, immunosuppressants are not suggested in viral infections because it may intensify COVID-19, the drug is likely to be helpful in the case of cytokine storms [36]. The medicine has currently been recommended in China in patients with COVID-19 illness and raised IL-6 receptor [37]. Therefore, it is recommended to screen extreme COVID-19 patients for possible hyper inflammation effect and to recognize those patients who treated by this medicine.

6.5. Camostat mesilate

Camostat mesilate is another substance accepted for the pancreatic inflammation treatment in Japan as it is a protease inhibitor [38]. The entry of coronavirus to the cell occurs by linking of viral proteins S to ACE2 receptor present on cell and host protease readying of S proteins (TMPRSS2) [39]. Recently, it has revealed that COVID-19 attachment to cells is blocked by camostat mesilate by preventing TMPRSS2 [40]. The mechanism describes the entering of the virus. Although it needs more trials before, it can be suggested as a significant COVI-19 therapy. The newly identified COVID-19 virus is without adequate medication or vaccine. Therefore, this devastating virus urgently needs a safe and effective treatment. These drugs are purposed frequently for other viral diseases and significant in a limited number of COVID-19 patients.Although it is premature to presume its efficacy for COVID-19. Any of the possible treatments that are currently under review in clinical trials are summarized which will certainly provide background for further antiviral research to treat COVID-19 and other related viruses

7. Bringing 2019-nCoV under control

The 2019-nCoV pandemic is currently out of control and spreading continuously around the globe. To bring this outbreak under control, it needs international collaboration, which used conventional health strategies in the case of SARS and ended up that. The 2019 nCoV clinical network should be thoroughly characterized. Epidemiologists need to perform a comprehensive investigation on contacts, and researchers need to push rapidly towards the creation of clinical countermeasures. WHO convene multidisciplinary committee against this pandemic to make strategies for coping up with virus and to devise a global action plan, that includes investigation of the virus, surveillance, diagnostics and treatment, cooperation from the public, to share transparent scientific information and to motivate and encourage academia and industries to develop antiviral agents and vaccines Pakistan is also adversely affected by this deadly virus, other different issues emerged which needs immediate concerns of authorities [41].Different healthcare practices are carried out to treat affected patients. As the doctors, nursing and paramedical staff is fighting in the frontline with the coronavirus, and it is therefore mandatory to provide the proper and efficient masks, hand gloves, sanitizers, safety suits and kits to them to avoid the infection of healthcare workers from COVID-19 [42].

8. *In silico* COVID-19 candidate's drugs discovery

The virus SARS-CoV-2 spreads rapidly, which created an alarming situation worldwide. Researchers from around the world are working to make strategies and to solve this pandemic. Several researchers attempted to study the nature of the virus deeply and to find the best method for managing the disease. For this purpose, numerous *In silico* approaches were proven successful for discovering drugs against COVID-19. Angiotensin-converting enzyme (ACE2) has been reported to be the primary cell receptor of SARS-CoV and SARS-CoV-2 for cause the final infection. Claudia et al identified 193 genes, 222 interactions, and 36 potential drugs with a crucial role in COVID from the construction of the protein-protein interaction network [43]. In another *in silico* study, Shah *et al.* are also investigated therapeutic targets of COVID-19, and their study was conducted using 61 molecules, previously used in clinical trials. Among these 61, 37 molecules were found to interact with > 2 COVID-19 protein structures confirmed by docking studies. Additionally, according to them, HIV protease inhibitors exhibited remarkable binding interactions with COVID-19 enzyme. Hence, from the result of docking and other *in silico* analysis, they recommended that Angiotensin AT2 receptor could be a possible drug target in the future for COVID-19 also uses the bioinformatics method of drug repurposing to classify possible effective COVID inhibitors. [44-45]. They identified 19 potent inhibitors of thousands of compounds from the library. Their study indicated that Rhein, with anolide D, Nelfinavir, Enoxacin, Withaferin A, and Aloe-emodin might be used as potential COVID-19 inhibitors. Consequently, we would have some possible drug targets from these studies that can be used to treat COVID-19.

Considering the virus-receptor recognition

mechanism responsible for the infection, pathogenesis, and host range of COVID-19 provides direction for developing antiviral therapy to counter and cure this global 2020 pandemic. There is no vaccine or antiviral therapy against SARS-CoV-2 to date, and it is time-consuming to make molecules that can eradicate the virus. Besides, the WHO has already declared infection with COVID-19, a global pandemic problem, so in this need, repurposing drugs available for other diseases would be beneficial, as these can be tested directly as anti-SARS-CoV-2 drugs and can be processed for COVID-19 testing. Viral life cycle contains entry into the host cell after attachment to the host cell receptor, release of genetic material inside the cell, synthesis of structural and non-structural proteins and genomic RNA, assembly of mature virus particles followed by budding to exit from the host cell [46]. In this way, RNA viruses such as chikungunya virus, dengue virus, Ebola virus, SARS, MERS and Sindbis virus can be aimed at each of these life-cycle steps to combat infections caused by them [47]. Antiviral drugs that block virus entry or function on the replication stage were documented against dengue, chikungunya, and other similar RNA viruses [48-49]. A study suggests that targeting the capsid synthesis stage might also prevent a virus from budding [50]. Also, antiviral drugs against SARS-CoV-2 can be identified by targeting the virus at these life-cycle stages. Treatment of COVID-19 with herbal medicine has also been reported *in silico* [51]. Very limited data is available of ongoing assessment of potential therapeutic agents to the public, including clinical trials, invitro and *in vivo* drug activities so far [52]. SARS-CoV and COVID-19 main proteases have 96 percent similarity, in several studies main protease of SARS has been used to model main protease structure of SARS-CoV-2 [53,54,55].

CONCLUSION

Coronaviruses are pathogens of upper and lower respiratory regions, affecting the human population badly. SARS and MERS previous outbreak were not much severe as the current COVID-19. Mostly virologists are concerned with human coronavirus these days. Other outbreaks of newly emerged strains of the concerned human viruses may have drastic effects and can endanger global public health like the current COVID-19 outbreak or that of SARS and MERS. The pathogenesis of human coronaviruses needs to be studied to have an insight into the field of research against it and to produce its protective vaccines and antiviral drug. Spread and transmission of SARS-CoV-2 is the main priority of researchers these days over the world not only to avoid it but also to monitor it strictly, and to establish intervention approaches, improved prevention, and control policies. Effective vaccines and treatments need to be developed for the threatening diseases in the future to keep away any second phase or other pandemic situation that would otherwise occur. Scientists are in a race to combat COVID-19.The researchers/scientists in China, the USA, France, Germany, South Korea, UK, and other countries are struggling hard to develop the vaccine to save human civilization across the globe. Pfizer-Biotech vaccine has been made and passed phase iii trials. Still, there is a big hope for other effective vaccine development soon. Health strategies will be fruitful to play an important role in the battle of COVID-19 and other diseases in the future.

Moreover, the results of the statistical analysis indicate that Belgium is the most affected country in the world with the highest Fatality rate and maximum number of deaths per one million populations. Further, Chile and India have effectively tackled the situation and has the highest proportion of recoveries and lowest Fatality rates. The forecasting results of the fitted model show a significant decrease in the weekly global deaths after the 50th week of 2020.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Authors FA, MK, NA, FA, SA, and MY conceived and designed research. MY, IH, FZ, MZ, MHJ, ZS and FK conducted experiments. FA, SB, FS and MZ, MY analyzed data and wrote the manuscript. All authors read and approved the final version.

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