Covid-19 Pandemic Forecast and Predictive Analysis

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***Abstract* - This paper studies the transmission mechanism for CoronaVirus Disease 2019 (COVID-19), based on the official data modeling. There is a fairly small error between the model and the official data curve. At the same time, it realized the pandemic situation's forward prediction and backward inference, and the relevant analyzes help relevant countries to make decisions.**

Many relevant methods are proposed during to detect covid-19 using various deep learning approaches which results in efficiency and also by which medical science is getting a great help. In this paper we modeled the live tracker for covid-19 cases around the globe.

Key Words - Covid-19, predictive analysis, pandemic control, time series Forecast, world health organization (WHO).

I.I. INTRODUCTION

The World Health Organization had declared Corona virus Disease, or COVID-19 a pandemic. This is a highly infectious disease caused by the Novel SARS-CoV-2 Corona virus for which no vaccine has yet been created. This disease is spread by inhalation or contact with contaminated droplets or fomites, and the time of incubation can vary between 2 and 14 days. The World Health Organization (WHO) states, on average, a person recovers from Covid-19 within 14 days, based on evidence from China. It spreads rapidly across the globe and has already caused the destruction of an unprecedented scale, economically, physically and socially.

COVID-19, or more commonly known as the Novel Corona Virus, is associated with the human respiratory disorder declared a global epidemic and pandemic by the World Health Organization in the first quarter of 2020. According to the latest statistics (14th June 2020), there are reportedly more than 7.55 million individuals globally affected with the Novel CoronaVirus and about 423 thousand deaths reported from various parts of the world. The top countries with the highest number of confirmed deaths are USA, Brazil, UK , Italy, France and Spain. India ranks in the world's top 5 largest confirmed cases. Mortality rate is smaller than world average but the spread pattern is progressing gradually towards an exponential rise that will lead to significant loss of life and infrastructure. India contains approximately one-fifth of the world's economy, and is the world's second largest nation in terms of GDP. India is a major contributor to the world's GDP and one of the world's [7] most prominent developing countries with fairly strong percentages of economic growth. The study of COVID-19 outbreak in the Indian region is also closely watched and tracked by the world, and there is a need for detailed scientific studies focused on different approaches taken from time to time by Indian administrators.

With no cure in the near future and no possible[10] likelihood of vaccine production, India's government had to focus on suppressive steps to control the virus, such as national lockdown. The question that seems most important to all policymakers at this point of time is when will be the right time to lift the lockdown [5]. We modeled the corona virus distribution in this paper to address this issue. The forecasts should be used to shape policy strategies to control the epidemic, and to be best prepared for emotionally, physically, and economically what is to come [6].

The accuracy of traditional forecasting largely depends on the availability of data to base its predictions and [13] estimates of uncertainty. In outbreaks of epidemics there is no data at all in the beginning and then limited as time passes, making predictions widely uncertain.

India is likely to witness a steady rise in Covid-19 cases in June with the daily increase crossing 15,000-a-day by the middle of the month, a global forecast model for the corona virus pandemic prepared by Chinese researchers has predicted. Also, after the analysis and with the observed pattern it is predicted that there might be a highest peak in late June but also there are chances of getting decreasing in an increasing number of cases and as the recovery rate is rising with the good efficiency then this would turn out to be good for India said by researchers.

"The spread of the virus is affected by many factors, including population density, quarantine measures, and of course the environmental factors," Huang said.

According to the research, usually the temperature most conducive for the spread of the novel coronavirus is between 5 degrees Celsius and 15 degrees Celsius, with 60 percent of the Covid-19 cases around the world reported within the temperature scope. Our previous study found that 60 percent of the confirmed cases of Covid-19 occurred in places where the air temperature ranged from 5 °C to 15 °C, with a peak in cases at 11.54 °C and approximately 73.8 percent of the confirmed cases were concentrated in regions with absolute humidity of 3 g/m3 to 10 g/m3.

II. LITERATURE SURVEY

A. *About the Dataset*

In response to the COVID-19 pandemic the COVID-19 Open Research Dataset (CORD-19) was created by the Allen Institute for AI, White House and a consortium of international research organizations. CORD-19 contains more than 47,000 scientific articles, including more than 36,000 with full text on COVID-19, SARS-CoV-2 and related corona virus.

The CORD-19 dataset currently serves as the most extensive machine-readable collection of corona virus literature ready for data mining. The Allen Institute, in cooperation with Microsoft Research, the Center for Security and Emerging Technology at Georgetown University, Chan Zuckerberg Initiative, and National Institutes of Health, produced this dataset for AI in collaboration with the U.S. White House Office of Science and Technology Policy. The World Health Organization (WHO) has also gathered, and organizes it in a database, the latest scientific verdicts and knowledge on COVID-19. WHO updates the collection on a regular basis through bibliographic material discovery, manual searches of the table of contents of related scientific journals, and the introduction of other applicable scientific articles. Database entries aren't fixed, and additional research is added daily.

B. *How this turns into a Pandemic/Epidemic.*

The new corona virus (COVID-19) spread widely in China by the end of 2019, and infected a significant number of people. Currently the domestic outbreak has been effectively controlled while the new corona virus is rapidly spreading to other areas. Today, Europe has become the focus of the latest new pneumonia epidemic. Meanwhile, the World Health Organization (WHO) called a new pneumonia epidemic a "global pandemic" on March 11.
Due to its tremendous spreading ability and possible damage, the new corona virus has posed a significant[1][4] threat to the health and safety of people all over the world. The research on the domestic and international epidemics and the future development trend has become a hot topic of current research[3].

Fig 1: World Statistics for confirmed cases.

Scientists in Germany provided evidence on Tuesday that people with the current corona virus could be able to infect others even though they have no symptoms, as speculated by disease experts. Their results, published in a letter in the New England Medicine Journal, revealed that people could spread the disease before they realized they were sick.

Statistical models on the spread of SARS-CoV-2 suggested that 40-70% of the population may be infected due to lack of herd immunity in the population and the highly contagious nature of the virus, unless strong containment measures are taken in a timely manner.[9] Based on past experience with various epidemics and pandemics, as well as current understanding of SARS-CoV-2, the WHO suggested.

C. *How Outbreak Trends*

Fig 2 and 3 are Showing latest COVID-19 outbreak patterns as seen on Corona Tracker [12] in early stages between march, 2020. In the analytics dashboard, the recorded cases are visualized to display the pattern of outbreaks for confirmed, recovered, and death cases for all regions and countries. It aligns with our objectives to demonstrate the progress of the outbreak over the time span for each chapter. It was found that the total number of confirmed cases for all countries and regions is steadily increasing,[9] but the huge increase was discovered on day 24, with 15,000 differences. This is because of the change in how the confirmed cases were measured in China. Fig 8 is plotted using the Leaflet open source mapping library [8].

Fig 2 : Outbreak trend over time

Countries around the world are starting to implement measures to slow the corona virus, from national quarantine to school closures from March,2020. More than a third of the planet's population is under some form of restriction. The World Health Organization, which has officially declared this situation as pandemic, has called on all countries to continue efforts that have been effective in limiting the number of cases and slowing down the spread of the virus.

D. Containment Measures Taken.

Corona virus can live on different surfaces for a long time – plastic (72 hours), stainless steel (48 hours), cardboard (24 hours), and copper (4 hours)[10],[11] Concerning the dissemination of touch, the virus can be effectively inactivated by surface disinfection with 70 % isopropyl alcohol, 0.5% hydrogen peroxide, or 0.1 % sodium hypochlorite[10],[11]. It is recommended that health care facilities use personal protective equipment (PPE) with triple-layered masks or N95 masks and educate staff about proper disposal of equipment[2]. It is also recommended that respiratory precautions be taken during aerosol-generating procedures.[2] It is recommended that anyone with fever , cough, and breathing problems seek medical attention.[2] Social distance (minimum one meter) is recommended at both individual and community level.

At the community level, the most important measures to reduce the spread of infection rely on case detection, isolation, and contact tracing of positive cases , followed by quarantine for those who are exposed. Many approaches include the closing of public gathering areas, such as classrooms , libraries, worship sites, malls and cinemas, and the cessation of all social activities , such as sports, parties, and meetings. Temperature inspection was implemented at airports , train stations, and bus stations, as well as at the entrance to the main community buildings (such as hospitals, banks, or law courts). The limitation of temperature screening is that it misses a significant number of asymptomatic carriers, estimated at around 46 percent.[8] More restrictive measures have been put in place in countries with a lower rate of infection, such as travel bans, reductions or interruptions of internal and overseas flights, and boundary closures; curfew and lockdowns are also being implemented.

Both of the above steps seek to reduce the rate of transmission of diseases, thus delaying the timing and raising the epidemic peak height. This enables the healthcare system to gain time from one side to plan an effective response to the pandemic, and from the other side to develop possible new drugs and vaccines. In Wuhan, it was calculated[8][2] that the most effective strategy was physical distancing with a staggered return to work at the beginning of April rather than March, with a projected reduction of the median number of infections by 92 per cent (interquartile range (IQR) 66-97) and 24 per cent (IQR 13-90) in mid-2020 and end-2020 respectively.

Some of the countries were successful in flattening the curve, including Singapore, Taiwan, Hong Kong, and South Korea. One of the key factors in the success of these countries was ongoing testing, isolation of infected persons, and quarantining contacts. In Singapore, the temperature screening of all travelers arriving at the airport from Wuhan began on January 3rd, even before sequence SARS-CoV-2 was identified. Strong monitoring of communication and quarantine of contacts from reported incidents, travel advisories and entry restrictions were enforced for people who had traveled to China during the previous 14 days.
At community level, people were encouraged to work from home and record their temperature twice a day; to make quarantine less onerous, the government was offering SGD $100 per day to self-employed people. Respiratory and hand hygiene and social distancing have been strictly followed.[23].

E. India's Response to COVID-19

In India the first case of COVID-19 was reported on January 30th, 2020, followed on February 2nd and 3rd by two similar cases. Both three had a tradition of moving to Wuhan , China. Two new cases were registered on March 2nd a month later- one each from New Delhi and Hyderabad. Then came a sharp rise in numbers.
To prevent the spread, the Ministry of Health and Family Welfare (MoHFW) took urgent action and released a travel advisory, as travel restrictions had previously proven successful on SARS, Ebola, and bubonic plague outbreaks. All foreign travelers entering the country were asked to undergo 14 days of self-quarantine. All travel visas to other countries have been cancelled until 15th April 2020. All the states were asked to invoke the Epidemic Disease Act , which allowed officials to quarantine suspected cases and close places in public. An ambitious campaign was launched, and guidelines were established for personal hygiene, surveillance, contact tracing, quarantine, diagnosis, laboratory testing and management. People were advised not to visit farms, live animal markets or places where animals are slaughtered and to avoid collecting masses. All health care facilities were asked to discontinue regular ambulatory and hospital services, and only continue with emergency services. Practitioners were advised to use telemedicine systems. In addition, the Arogya Setu app was launched to link critical health services to battle COVID-19 with Indians. This app will reach out to and inform users of the COVID-19 containment risk, best practices and relevant advisories. Features such as hotels, colleges, railway train coaches, etc., have been transformed into quarantine facilities and large public places as stadiums have been converted into isolation wards to handle an anticipated increase in cases. Some of the States have converted existing hospitals to treat COVID-19 patients exclusively. On March 22, Prime Minister introduced a 14-hour 'Janta Curfew' lockdown operation, followed by a lockdown in 75 COVID-19 affected districts and a 3-week national lockdown. A containment plan was developed that included the State and twenty ministries. A round-the-clock control room was set up at the Health Service Director General's (DGHS) headquarters to address the virus-related queries [13]. The countries of the South Asian Association for Regional Cooperation (SAARC) were invited to fight this pandemic together, and SAARC countries were allocated 10 million US dollars. A huge program of evacuation of many Indian nationals from the

areas affected by COVID-19 was carried out.
All the measures implemented in India reveal effectiveness in curve flattening. However, a small effort was made to identify asymptomatic and mild cases. That could have long-term negative effects on the Indian economy. A long duration of the lockdown could be more damaging in India than in prosperous countries such as the United Kingdom or Australia and could result in significant economic damage, increased hunger and deprivation, and the ability of the population to survive the infection could be diminished.

State	Tests done	Total positive cases
Kerala	5432	182
Karnataka	3076	76
Rajasthan	2325	55
Tamil Nadu	1500	49
Telangana	1319	66
Haryana	1003	33
Andhra Pradesh	496	19
West Bengal	389	18
Jammu and Kashmir	379	31
Chhattisgarh	376	7
Odisha	297	3
Madhya Pradesh	251	47

Fig3: Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) test done in India(Early stage)

The proportion of positive cases among symptomatic and asymptomatic contacts was highest, 2-3 times higher than among those with serious acute respiratory infection, or those with a history of foreign travel or health care staff. The attack rate (per million) per age was the highest among those 50-69 years old (63.3) and the lowest among those under 10 years old (6.1). The attack rate for males (41.6) was higher than for females (24.3). Six per cent of the secondary attack rate was. Overall, 99.0 percent of 736 districts reported monitoring, with COVID-19 reporting 71.1 percent. Interpretation & Conclusions: Over time, ICMR 's laboratory surveillance coverage and frequency for SARS-CoV-2 improved. COVID-19 has been reported from most parts of India, with more attack rates among men and the elderly, and more common among close contacts. Analysis of the data indicates that additional monitoring tools and strategies are needed at the national and sub-national levels for further insight.

III. Experiments and Results

A. Covid-10 Forecast and Analysis.

Ever after the novel corona virus outbreak began in India, the question on everybody's mind is when this will stop. Now, a data-driven model prediction shows that the COVID-19 in India will end 97 per cent by May 25, and 99 percent by June 4. Fig 4 stated how the graphically it is behaving.

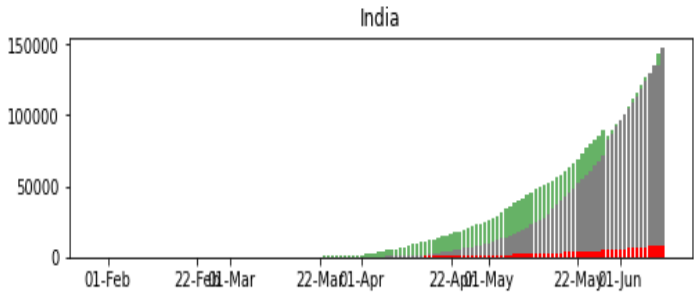

Fig 4: Corona virus treating India

As per the latest predictions from the DDI lab, the cases will end 100% in India by August 1. Across the world, on the other hand, the cases of the novel corona virus disease COVID-19 could continue till November 27. The predictions show that the disease caused by SARS-CoV-2 will end 97% by May 30 and 99% by June 16 across the globe.

	Country/Region	Cases	Deaths	PCases	PDeaths	Cases (+)	Deaths (+)	Fatality Rate	Continent
0	US	2023347	113820	1925765	110068	97582	3752	5.6	North America
1	Brazil	802828	40919	672846	35930	129982	4989	5.1	South America
2	Russia	501800	6522	458102	5717	43698	805	1.3	Europe
3	India	297535	8498	246622	6946	50913	1552	2.9	Asia
4	United Kingdom	292860	41364	286294	40548	6566	816	14.1	Europe
5	Spain	242707	27136	241310	27135	1397	1	11.2	Europe
6	Italy	236142	34167	234801	33846	1341	321	14.5	Europe
7	Peru	214788	6088	191758	5301	23030	787	2.8	South America
8	France	192493	29349	190759	29145	1734	204	15.2	Europe
9	Germany	186691	8772	185450	8673	1241	99	4.7	Europe
10	Iran	180156	8584	169425	8209	10731	375	4.8	Asia

Fig 5: Global Statistics (in early June)

Figure 5 has shown the outbreak forecasting of novel corona virus statistics. US is suffering more than any other country in the world with 2.2 millions of total cases and the highest fatality rate of 5.6, India Stands fourth among the most covid effective countries with the total of 0.29 million cases with the fatality rate of 2.9.

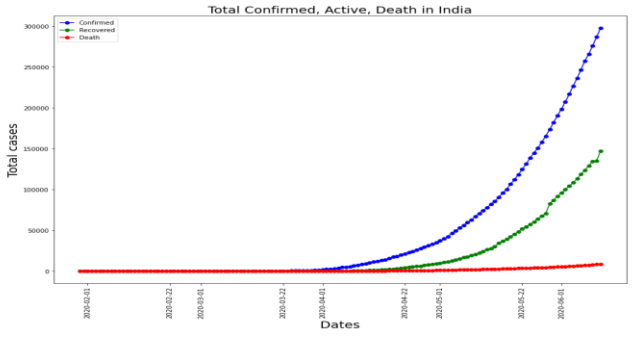

Fig 7: Forecast of outbreak in India

According to the forecast predicted in Fig 7, Covid-19 first strike in January 30, 2020 in India and gradually start increasing during mid of march, 2020 but because of applied lockdown this virus slows down in spreading as compare to its actual rate of spreading and this lockdown last till may,2020 .But, because of the financial crisis India Unlocked most of the places and hotspot remains under supervision. However lockdown slows down the spread but Unlock might actually give rise to increasing in spreading positive cases and number of deaths and graph shows it very well. Although the recovery rate is quite impressive, it increased by 57 % in early June.

But, peak is still yet to come which is predicted in late June which would be critical as the number of deaths also might get increased.

B. Global Recession Forecast

The crisis at COVID-19 is truly a global crisis. Both advanced and emerging market economies will be in recession for the first time since the Great Depression in 2020, with negative growth rates likely to be worse than previously predicted in the IMF's World Economic Outlook.

The International Monetary Fund (IMF) further cut India's growth forecast for FY21 from an estimated 5.8 per cent in January to 1.9 per cent, warning that the "worst recession since the Great Depression" would overshadow the economic harm caused a decade earlier by the global financial crisis. The also said that the only two major economies likely to experience growth will be India and China, with all the others contracting. The Covid-19 pandemic will shrink world production by 3 percent in 2020, the IMF said in its World Economic Outlook (WEO) April update published in Washington DC on Tuesday, the first after the severity of the outbreak.

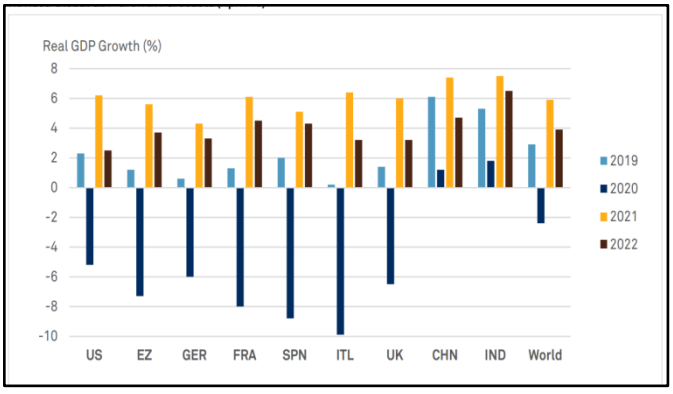

Fig 6: GDP Global Forecast

In the next fiscal year, India's growth is seen to recover sharply to 7.4 per cent. The IMF sees the growth of India's FY20 at 4.2 per cent, down from an estimated 4.8 per cent in January.

C. Prediction of next 15 days

According to the statistics results of global statistics as mentioned in fig 5, India is now at the 4th position in total cases and also it has been observed that cases per day in India has now increased and tends towards the highest peak as in early June it recorded 8000-9000 positive cases/day now it is increased to 10k to 12k confirmed cases/day as recorded on June 13,2020.

In Fig 8, the result is showing the prediction of next 15 days confirmed cases will arise across India, and it is predicted that it will cross more than 50k confirmed cases in the next 2 weeks.

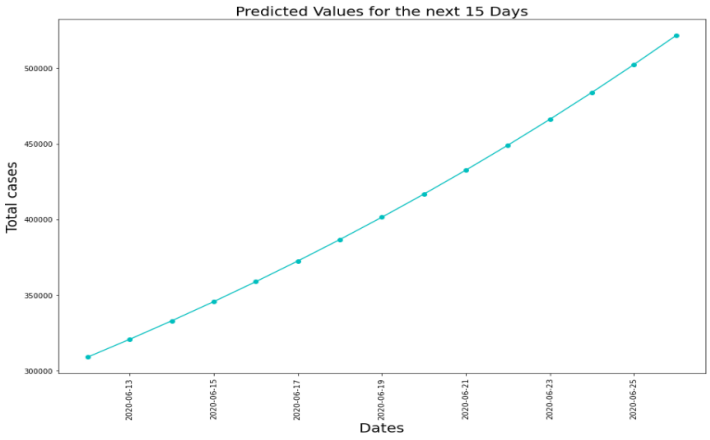

Fig 8: Prediction Graph

IV. CONCLUSION AND FUTURE DIRECTIVES

COVID-19 has emerged as a threat to public health around the world in the last two months. It adds to the list of previous outbreaks of infectious disease epidemics, including 1986 Bovine Spongiform Encephalitis, 1997 Avian flu, 2002 SARS, 2009 Swine Flu and 2014 Ebola. All these outbreaks remind us that in order to survive and thrive we live in a habitat where there is a need to respect the relationship between animal, social life and the environment.

Nature is sending us a message with COVID-19 that we need to recognize the interrelationship between animals, including animals, livestock and wildlife. The transdisciplinary One Health approach, involving professionals from many disciplines, including medicine, veterinary, environmental health , and social sciences, has been advocated to limit new infectious outbreaks.[54] Global experience teaches that containment measures and aggressive contract tracing are mandatory to keep the infection under control until an approved treatment or vaccine is received.

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