Impact Of Literacy Rate And Population Density On nCoV-19 Outbreak In India - Theoretical Analysis

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Abstract: nCoV-19, a threat not only to any particular nation but to the whole world has put everyone into an unprecedented situation. India being the second largest populated country, the whole world was keeping an eye as to how India will fight back this virus. Due to this outbreak most of the migrant workers in India lost their jobs, many people died just because of low immunity as their body system failed to fight back with this virus. Mumbai, belonging to the state of Maharashtra and also the commercial hub of India has been reported with maximum number of positive cases. Approximately 55% of the population in the city of Mumbai remains in the slum areas where people live below poverty line. Our focus was to demonstrate if literacy rate and the population density of the states in India can have a direct impact on the spreading trend of corona virus. The data collected from the Covid-19 live tracker of India we considered five days data of the corona virus cases reported in different states of India and have also collected the literacy rate and the population density of twenty eight states and nine union territories as per 2011 Census. From this data we selected five most densely populated states and the top five states with high literacy rates. In our work we analyzed Kerala with its literacy rate of 93.90% and population density of 35122966 has reported only 103 confirmed cases with zero deceased cases within five day period. On the other side Maharashtra with its population density of 128466921 and 82.9% literacy rate has reported 10936 cases within five day period with 322 deaths. From this we can understand that we need to work on India's literacy rate to fight with not only the current pandemic situation but also any other situations. The impact of this pandemic situation on Indian economy is yet uncertain.

Keywords: Corona Virust; impact of Corona; spreading trend

I. INTRODUCTION

In early December 2019 The Novel Coronavirus disease (2019-nCoV or COVID-19) originated from the city of Wuhan (China) has been confirmed as the new coronavirus as the data reported by WHO on 4th January 2020 [World Health Organization]. The first known case on the severe illness made by a CoV was reported in 2003, and it was called as "Severe Acute Respiratory Syndrome" (SARS) that lead to a severe epidemic in China (Lee, N. et. al., 2003). A second severe epidemic by a CoV was reported in 2012 in Saudi Arabia, and it was referred as the "Middle East Respiratory Syndrome" (MERS) (Chafekar and Fielding, et al., 2018). In December 2019, the third severe case by CoV was diagnosed first in China and within a short period of time crossing the geographical barriers it started spreading rapidly in humans across the globe and infected 6,93,224 people globally causing 33106 deaths as on 30th March'2020. Due to the wildfire spread of nCoV-19 in multiple countries after China this situation was declared as a pandemic by WHO on 11th March 2020.

Figure 1: Countries, Territories or areas with reported confirmed cases of Covid-19, as on 30th March 2020 (Source: WHO situational report-70)
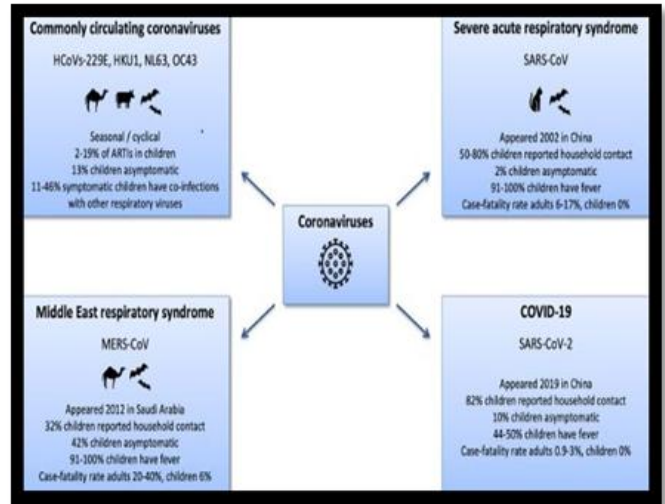

Figure 2: Summary of coronavirus diseases.Covid-19 indicates coronavirus disease 2019 (Source: Zimmermann, P. et al. 2020)

II. GENOMIC AND PHYLOGENOMIC ANALYSIS OF COV-19 AND ITS TRANSMISSION

Coronaviruses (CoVs) comprise a large family of enveloped, single-stranded, zoonotic RNA viruses belonging to the family *Coronaviridae*, order *Nidovirales*. CoVs has the clinical feature of rapid mutation and recombination leading to novel CoVs that can spread from animals to humans. Four CoVs that can commonly circulate among humans are - HCoV2-229E, -HKU1, -NL63 and -OC43 (Zimmermann, P. et. al., 2020). There are four sub types of this virus such as alpha, beta, gamma and delta corona virus. Each of these sub types has many serotypes. Based on the genomic data released on 2019 about nCoV and the phylogenomic analysis it was reported that the 2019-nCoV is most closely related to two severe acute respiratory syndrome (SARS)-like CoV sequences that were isolated in bats during 2015 to 2017 (Liangsheng Zhang et al., 2019 and Hu, D. et al., 2018). Human-to-human transmissions have been confirmed via droplets, contaminated hands or surfaces. Usually the spreading of this virus among human population occurs through respiratory tract and contact transmission (Chan J. F.W. et al., 2020). Through Bioinformatics analysis it has been identified that digestive system might also be a potential route of nCoV-19 (Zhang H. et al., 2020). The virus has also been traced in the feces of Covid-19 patient but it is still into question if the virus present in feces can cause the disease or not (Wu D. et al., 2020). Rapid progression in number of infected patients suggests that COVID 2019 is more contagious than SARS CoV and MERS CoV (Wang, C. et al., 2020) with a great potential for a sustained epidemic (Singh S. et al., 2020).
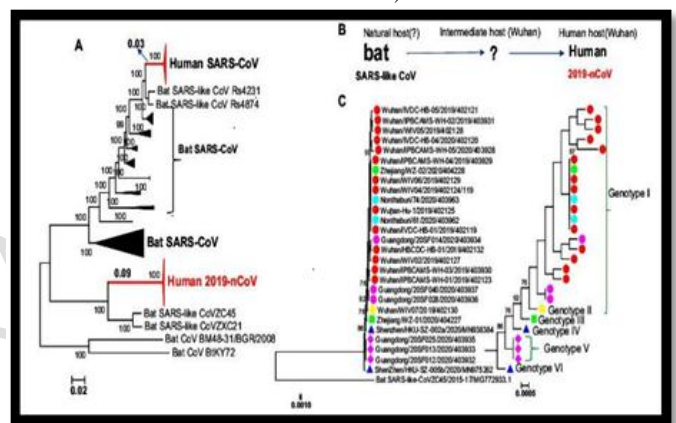

Figure 3: The phylogenomic trees of the coronavirus and the genotypes of 2019-nCoV strains (Source: Liangsheng Zhang et al.)

However, the debate and rumors about man-made mutation or bio-engineering to produce the present causative CoV-19 are still into question (Andersen, K. G. et al., 2020).

III. SYMPTOMS, TESTS AND TREATMENT OF nCoV-19

The incubation period of nCoV-19 is 3-7 days in general but it can also be 14 days in certain cases (Wang, S. X. et al., 2020). The common symptoms identified at the initial stage of this infection in humans are fever, cough, and myalgia or fatigue. Some of the infected patients have also shown the symptoms of tuffiness, pharyngalgia or diarrhea (Wang, S. X. et al., 2020 and Chen N.S. et al 2020). The mortality rate of nCoV-19 infected patients is more in elderly patients suffering from chronic diseases like diabetes and hypertension (Chen N.S. et al., 2020)

This unprecedented situation across the globe due to nCoV-19 is in high demand of efficient and robust screening methodology to identify the infected people, which can further have control over the communicable nature of this disease. Researchers in the areas of Artificial Intelligence and Machine

learning have made great contribution in making healthcare digitized. Similarly, further research should be taken into consideration where different screening machines can be designed and implemented in various sectors where public gatherings take place in huge numbers- like hospitals, malls, airports, railway stations, restaurants etc. This may help in identifying the more number of individuals with confirmed case in less time. This can also save our healthcare professions as they are the front end soldiers in this case. At present the confirmed case is defined as either positive of Novel Coronavirus nucleic acid by real-time fluorescent RT-PCR detection of respiratory or blood specimens or highly homologous to any known Novel Coronaviruses through virus gene sequencing of respiratory or blood specimens (Guan, W. et al., 2020).

According to the guidelines released by the Centre for Disease Control and Prevention there is no specific drug for nCoV-19 treatment at present. However, Convalescent Plasma Treatment (CPT) has shown the positive rays towards the treatment of Covid-19 patient but it needs further investigations. Due to the positive response of CPT towards Covid-19 patients, FDA has issued certain guidelines to provide recommendations to healthcare providers and investigators on the administration and study of investigational CPT collected from Covid-19 recovered patient. At the University of Oxford research is being carried out to find the drug that can raise the oxygen levels in the blood of Covid-19 patients, which in turn will improve the chances of recovery.

IV. OUTBREAK OF COVID-19 IN INDIA

In Kerala the southern region of India the first three positive cases were reported amongst the citizens rescued from Wuhan till 3rd Feb'2020. Twenty nine cases had been reported by 5th March'2020; mostly in Delhi, Jaipur and Agra in Italian tourists and their primary and secondary contacts. One case was reported in an Indian who traveled back from Vienna and exposed a large number of school children in a birthday party at a city hotel. Towards the end of March 2020, there were more than 750 confirmed cases and 17 deaths. According to the data reported by world meters information till 15th May'2020 the total number of Coronavirus cases reported are 4527811 out of which 82,103 cases are from India. Considering 1,380,004,385 of India's population it can be seen that 0.01% of our country people is affected due to the pandemic situation. However, to have a control about the spreading of this deadly virus and considering lack of healthcare systems availability (0.7 hospital beds per 1000 people and doctor: population ratio is 1: 1800 instead of 1:1000), the Government of India declared nationwide lockdown for 21 days on 25th March, 2020 to control the community spread of the virus.

On 1st April, 2020 a corona positive patient was detected from Dharavi Mumbai, which is known as Asia's largest slum area. Till 3rd June, 2020, total 1849 cases have been reported alone from this area.
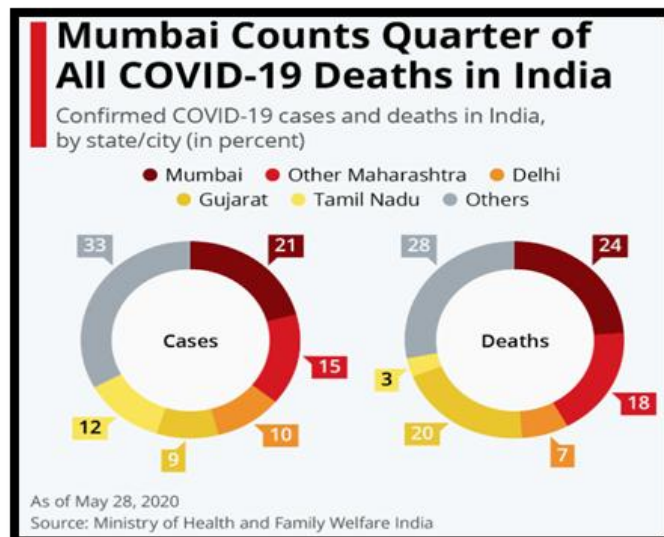

Figure 4: Total cases reported in Mumbai till 28th May'2020 (Source: Ministry of Health and Family Welfare India)

The total cases of 1849 from one single area of Mumbai are apprehensible for India as there are chances of increase in these figures in the near future. Currently the countries like Italy, UK which was hit badly due to the outbreak of Corona Virus initially is reporting less number of cases as of now. Whereas according to European CDC, countries like Brazil, Chilie, India, Russia, Peru, Mexico and Saudi Arabia are showing steep increase in the figure of confirmed cases.
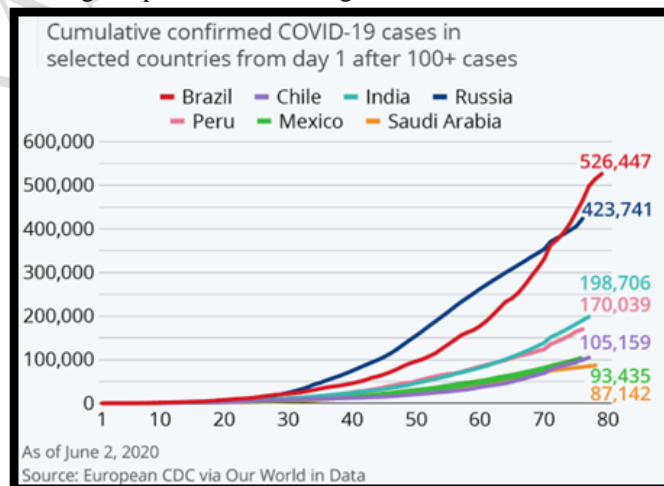

Figure 5: Countries with steep increase in number confirmed cases (Source: European CDC via our World in Data)

V. IMPACT OF nCov-19 ON INDIAN ECONOMY

The impact of nCov-19 has become apparent across the globe, beyond mortality (those who die) and morbidity (those who are incapacitated or caring for the incapacitated and unable to work for a period). This zoonotic disease has posed a threat not only to the lives of million people but also to the world's economy. This threat is not limited to the people who belongs to the below poverty line group rather it can kill people of any socioeconomic group in any society. To have control on this threat all the countries ranging from advanced

healthcare system to poor healthcare system need to invest more in public health and development (McKibbin et al., 2020). Coming to Indian healthcare system where Government spends only 1.5% of the total GDP on healthcare, is a threat to the nation to fight back with the deadly virus.

Due to several lockdown phases across the globe the whole nation has come to a deadlock situation. According to the US Bureau of Economic Analysis, the impact of nCovid-19 shows a sharp downturn of US economy in future (see figure 6).
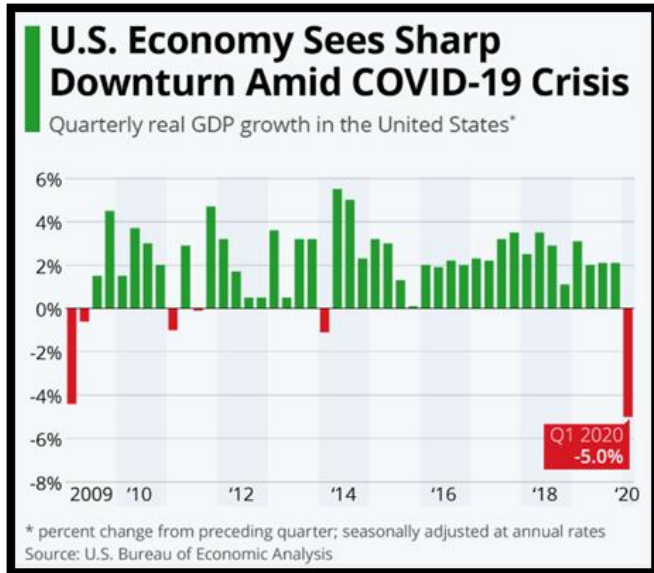

Figure 6: Future Analysis of US economy (Source: US Bureau of Economic Analysis)

India was already struggling with its low economic situation and unemployment since last several years, then this catastrophic situation is an economic threat to the nation. The unemployment rate in India has increased by 19.6% during the period of 26th Jan, 2020 till 19th Apr, 2020 (see figure 7).
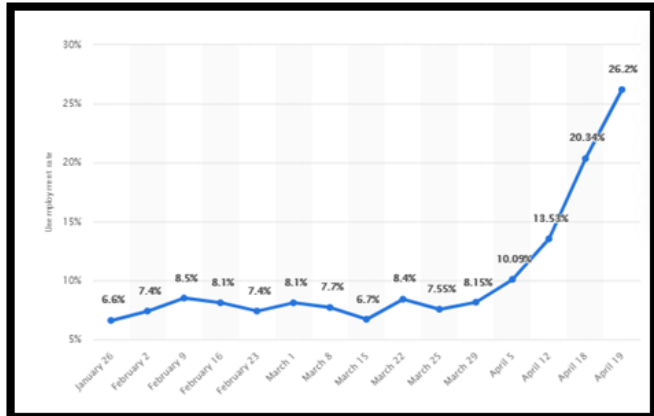
(Source: Statista 2020)
Figure 7: Indian unemployment rate between April and June 2020

India's GDP growth slowed to 4.7% in 2019, the lowest level since 2013. This lockdown has put a halt to all the economic activities of the nation. Covid-19 has caused a major damage to India's aviation, tourism and hospitality industries and still it is questionable as to when and till what extent they can ride out this storm post lockdown. According to The

Centre for Asia Pacific Aviation (CAPA), the Indian aviation industry will encounter a loss of nearly $4 billion this year (Dev, S. M. et al 2020). The International Monetary Fund has predicted that India's GDP growth for 2020-21 will fall to 1.9 per cent, while the global economy is expected to suffer a loss of $9 trillion (Dev, S. M. et al 2020). The major industries of India with finance, real estate & professional services is estimated to scrimmage with a loss of 17.3% (see Figure 8). Further research is required to predict the impact of nCov-19 on India's economy because the number of confirmed cases in India is increasing at a steady rate.
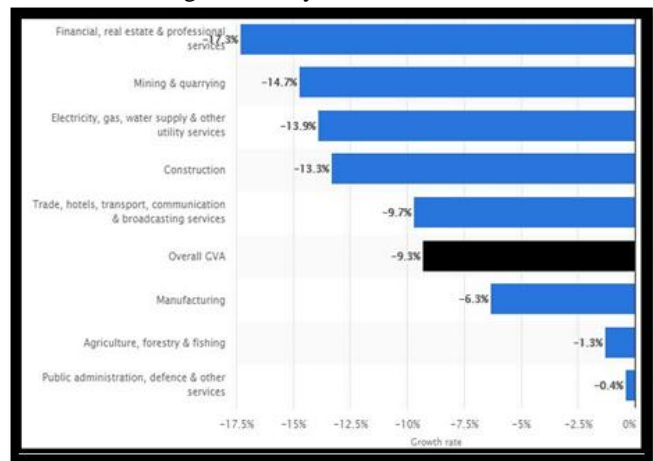
(Source: Statista 2020)
Figure 8: Estimated impact of nCoV-19 on Indian economy between April and June 2020, by sector GVA

VI. STATE WISE ANALYSIS OF nCov-19 IN INDIA

Among the first fifty positive cases reported in India, most of them were due to travel history from the countries that have reported a high number of Covid-19 cases. Few of them were also reported due to local transmission.
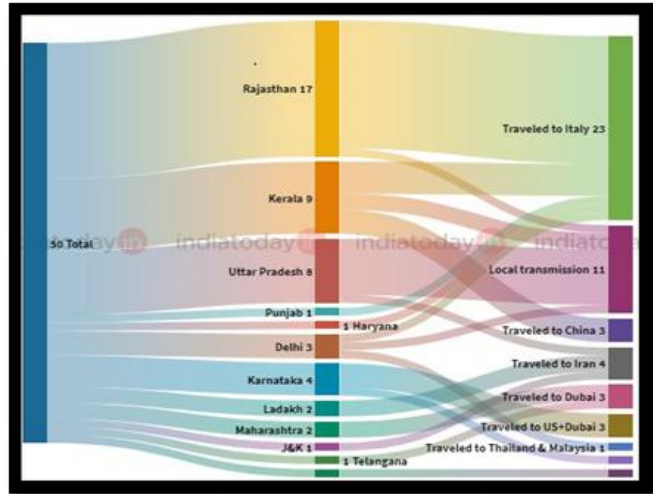
(Source: Ministry of Health & Family Welfare)
Figure 9: India's first 50 Covid-19 cases and their travel history

Coming to the state wise analysis, Maharashtra, Gujarat, Delhi, Tamil Nadu, Madhya Pradesh and Rajasthan are the hotspots for Covid-19 cases. Maharashtra and Gujarat have

also reported the highest number of Covid-19 deaths, accounting for nearly 60% of the country's Covid-19 toll. Mumbai being the commercial hub of India has been mostly affected.

VII. DATASET EXPLORATION

We have collected total number of Covid-19 cases reported in India during the period of 17th May, 2020 to 21st May, 2020. During this period of five days the total number of deceased cases in India was 699 (see table 1). The total number of cases reported till 21st May, 2020 was 118226.

Date	Confirmed	Active	Recovered	Deceased
5/17/2020	90788	53612	34232	178
5/18/2020	96793	56014	37579	105
5/19/2020	102238	58886	39235	146
5/20/2020	107435	61293	42403	128
5/21/2020	112642	63472	45422	142

Table 1: Five days Covid-19 dataset

This figure 118226 represents the total figure of nine Union Territories and twenty eight states affected due to Corona Virus. In addition to total number of nCoV-19 cases reported in India, we have also considered state-wise literacy rate and population in India according to 2011 census.

VIII. STATE WISE LITERACY RATE IMPACT ON OUTBREAK OF nCov-19 IN INDIA

According to the 2011 census, Uttar Pradesh is the most densely populated state in India with literacy rate of only 69.7%. Maharashtra being the 2nd most densely populated state has literacy rate of 82.90%. Taking an eye to the top five well-educated states of India with maximum literacy rates in the states of: Kerala, Lakshadweep Mizoram, Tripura and Goa (See Table 2), it is noticed that the total number of confirmed Covid-19 cases reported is less and deceased figure is also comparatively less in comparison to other states of India. The confirmed and deceased figures under table-2 are the total of five days data captured from Covid 19 during the period of 17th May, 2020 to 21st May, 2020. Figure-10 is the graphical representation of India's literacy rates state-wise as per 2011census.

State/UT	Population	Literacy rate	Confirmed	Deceased
Kerala	35122966	93.90%	103	0
Lakshadweep	64429	92.30%	0	0
Mizoram	1091014	91.60%	0	0
Tripura	3671032	87.80%	8	3
Goa	1457723	87.40%	32	0

Table 2: State wise highest Literacy rate, Population, confirmed and Deceased patients
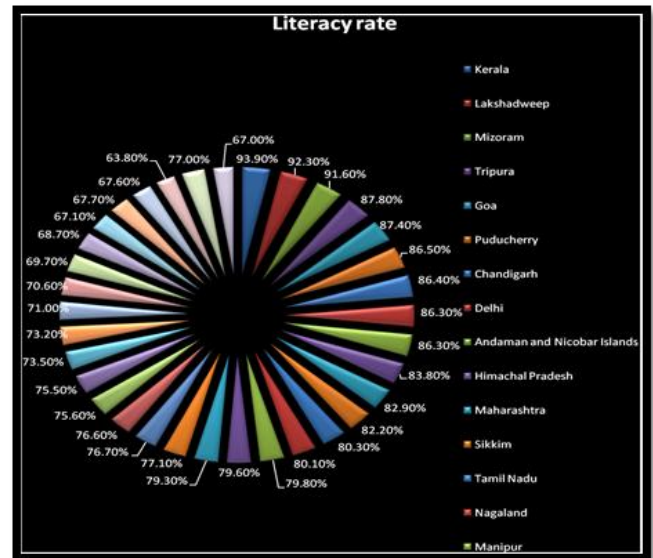

Figure 10: Literacy rate- State-wise

IX. STATE-WISE POPULATION DENSITY IMPACT ON OUTBREAK OF nCoV-19 IN INDIA

Among twenty eight states and nine union territories in India, Uttar Pradesh is the most densely populated state. With its population of 237,095,024, this state has reported total 5515 confirmed covid-19 cases with 138 death cases till 21st May, 2020. Whereas the 2nd most densely populated state with its population of 128466921, has reported 41,642 confirmed covid-19 cases with deceased figure of 1453 till 21st May, 2020. Likewise, Bihar, West Bengal and Madhya Pradesh with their high population of 126750326, 102741588 and 86044251 has reported 1987, 3197 and 5981 respectively confirmed cases with 9, 259 and 272 deceased cases respectively. The confirmed and deceased figures under table 3 are the total of 5 days data captured from Covid 19 during the period of 17th May, 2020 to 21st May, 2020. Figure-11 is the graphical representation of India's population state-wise as per 2011census.
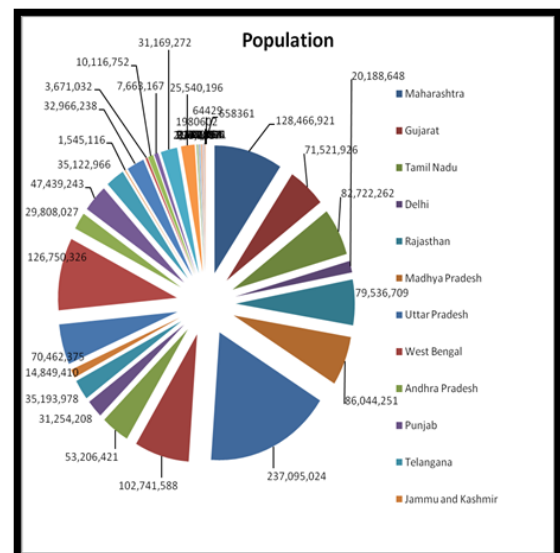

Figure 11: Population growth- State-wise

X. STATE-WISE TOTAL CASES

While analyzing the state-wise spreading trend of corona virus it is noted that Maharashtra being less populated state as compared to Uttar Pradesh has reported maximum number of confirmed cases. With the increase in India's population, the population in slum areas of India has also shown rapid increase. According to government data it is figured out, nearly 55% of Mumbai population lives in slum area. Mumbai, the financial hub of India belongs to the state of Maharashtra where maximum cases of Corona virus have been reported. On the other side Kerala, the southern state of India being the most literate state has reported only 691 confirmed cases with four deceased cases till 21st May, 2020. Thinking from the point of population density and literacy rate it can be understood that there is a lag of awareness among the people in certain states of India where literacy rate is low. However, further research is required on how the awareness among the people can be increased to control the spreading of this deadly virus if there is a second wave of nCovid-19. Figure-12 represents the confirmed cases cross various states of India.

State/UT	Population	Literacy rate	Confirmed	Deceased
Uttar Pradesh	237095024	69.70%	1257	54
Maharashtra	128466921	82.90%	10936	322
Bihar	126750326	63.80%	809	1
West Bengal	102741588	77.10%	621	28
Madhya Pradesh	86044251	70.60%	1191	28

Table 3: State wise highest, Population, Literacy rate, Confirmed and Deceased patients
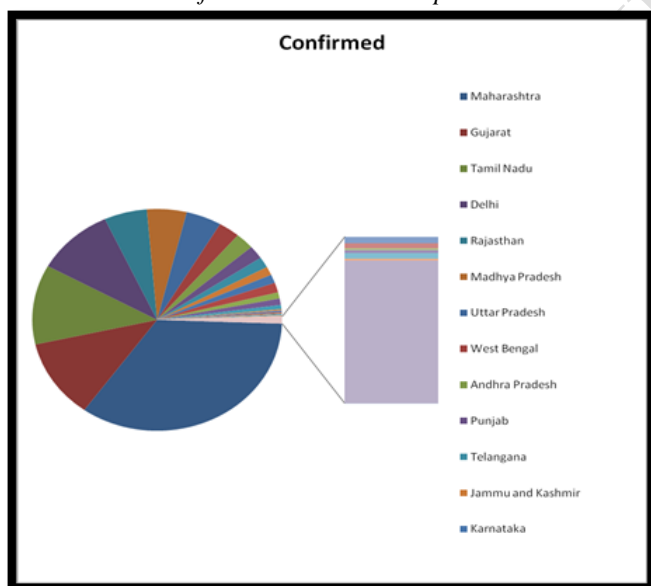

Figure 12: Covid 19 confirmed cases- State-wise

XI. FIVE DAYS DEATH TOLL IN INDIA

Till 21st of May, 2020 the total number of death cases due to Corona Virus was 3584. We have considered five days death cases (see table 4) starting from 17th May, 2020 till 21st of May, 2020 reported by the government of India. We represented five days death toll in the form of a linear graph (see figure 13) which does not represent a steady increase in death rate.

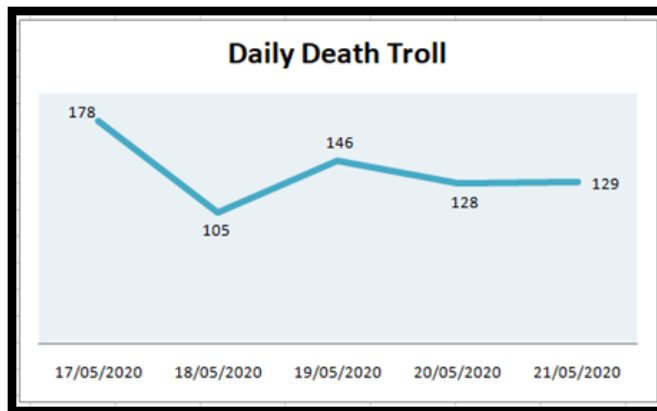| Date	Deceased
17/05/2020	178
18/05/2020	105
19/05/2020	146
20/05/2020	128
21/05/2020	129

Table 4: Death toll of 5 days in India

Figure 13: Death toll for 5 days

XII. RESULTS AND DISCUSSION

A research is of interest when it has its impact on future research and other researchers and this impact is evidenced by addressing a problem that has some manner of impact on the reader as well (Ellis, T. J. et al., 2008). In this paper we tried to analyze what can be the impact of literacy rate and population on the spread of nCoV-19 across the states of India. Considering the top five states with high literacy rate, it is noticed that the spreading trend among the people residing in these five states is low as compared to the other states of India. On the other side considering India's five most densely populated states, are highly impacted due to this virus. Therefore, government of India should take necessary measures to bring awareness among the people to control the spreading trend of Corona Virus.

XIII. PREVENTIVE MEASURES TO FIGHT WITH nCoV-19

Due to the unavailability of any specific drug as reported by the Centre for Disease Control and Prevention preventive and controlling measures are the key strategies to fight with this virus. Some of the measures that can be the preventive measures to fight with this virus are-social distancing, maintain proper hygiene, avoid public gathering, using of sanitizers, n95mask and gloves. Drinking of hot water building up of strong immune system is also recommended by most of the healthcare professionals. Additionally, for underdeveloped countries and developing countries some awareness programs about different precautionary measures should be taken up by the governments of that country through different extension programs.

XIV. CONCLUSION

The episode of halt, that we are living in due to the Novel Corona Virus Disease, was never a part of any individual's wildest dream. Researchers are rigorously working with clinical collaborators for treatment of this virus all over across the world but have not yet reported any specific drug to treat nCoV-19.

This pandemic situation has not only affected one particular sector, rather it has hit the world economy. Starting from education to job everything has come to a standstill position. In India the tourism and the aviation sector is badly affected due to the outbreak of this disease. India, being a developing country with low healthcare facility is into the verge of threat with the steady increase in figure of Corona virus cases. Since the first outbreak of nCoV-19 in the month of Feb, 2020 in Kerala, total 118226 has been reported in India till 21st of May, 2020. Going into the depth of state-wise spreading trend of this virus it was analyzed, the states with high literacy rates has reported less number of cases. Not only this, but also the deceased figure reported was only four till 21st May, 2020 in Kerala which is having the highest literacy rate. On the other side, Maharashtra the second most densely populated state with approximately 55% of Mumbai population leaving in slum areas has reported highest number of Corona Virus cases. However, in today's world of automation, researchers from AI can develop analytical tool that can measure the direct impact of literacy rate in the outbreak of Covid 19. Further, to have control over the spreading trend of this virus, if there is a 2nd vive in future then designing of automated screening tools using AI techniques and placing them at different places like hospitals, malls, restaurants, airports, railway stations can also be helpful in early diagnosis and detection of confirmed cases.

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