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Research Article

A Perspective on India's Fight against COVID-19

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A B S T R A C T

The COVID - 19 pandemic which has affected 209 countries/ territories, infected more than a million persons and claimed more than 50 thousands human lives worldwide (till 4th April, 2020). It is caused by SARS-CoV-2 a novel virus genetically similar to SARS virus and reported first in Wuhan, China. In India, the first case was reported in January and until 5th April, 2020 it has spread to 29 States/UTs, affected more than 3 thousand. The fate of this disease in India is to be determined by three elements of epidemiology, i.e. agent, host and environment. The agent is novel, but it has been reported that there are two strains of SARS-CoV-2 under circulation out of which one is more aggressive and spread quickly. As the susceptibility to the virus is there in Indian population, like other countries but its presentation in hosts which range from asymptomatic to severe pneumonia would be affected by the innate immunity of hosts and small proportion of population belonging to high risk group. In addition, the weather of India may also act as an impediment to the fatalities this disease may cause. The measures taken by India first to restrict the entry of this agent in community and further to interrupt its transmission are exemplary. However, still there is need to be future ready and plan strategically, learning from success and failure of other countries. In order to tackle this pandemic, there is need to strengthen the existing medical infrastructure to take care of advance stage of COVID-19 patients and quality epidemiological investigation of COVID - 19 cases at the community level.

Keywords: COVID - 19, SARS-CoV-2, Infectious Disease, Pandemic

Introduction

The pandemic of coronavirus COVID-19 has affected 209 countries, areas or territories worldwide, till April 05, 2020,[1] reportedly began in Wuhan, China. On 30th December 2019, three bronchoalveolar lavage samples of a patient with pneumonia of unknown etiology were collected in Jinyintan Hospital, Wuhan, Hubei, China. The Real time Polymerase Chain Reaction (RT-PCR) assays on those samples were positive for pan-Betacoronavirus.[2] As the virus is genetically related to the coronavirus responsible for the SARS outbreak of 2003, this new virus got its identity by International Committee on Taxonomy of Viruses (ICTV) as, "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" on 11th February, 2020. On the same day, i.e. 11th February, 2020,

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World Health Organisation (WHO) announced the novel disease's name "COVID-19".[3]

The COVID-19 disease which has the incubation period of 2 - 14 days with possible outliers of 27 days and symptoms of fever, cough and shortness of breath, had already engulfed around 4 thousand people's life and affected around 0.12 million people of 114 countries by 11th March, 2020, the day when it was characterized as pandemic by World Health Organisation (WHO).[4] Since then it has affected more than 1.00 million with cumulative death tolls of more than 50 thousand till 4th April, 2020.[5]

Epidemiological Scenario in India

In India, first case of COVID - 19 was reported on 31st January, 2020, with zero reporting until 2nd March, 2020. Afterward the regular incidence is reported and as per status update published by Ministry of Health & Family Welfare (MoHFW), GoI (as on: 05 April 2020, 9:00 GMT+5:30) the disease has spread to 29 States/ UTs of India with total confirmed cases increased to 3,374 which includes 3,030 active cases. Total 77 deaths have been reported and 267 patients have been discharged/ migrated/ cured successfully.[6]

As per the classical epidemiological explanation, the fate of an epidemic in community is determined by the three elements, i.e. agent, host and environment. In India like other countries, the agent is novel and understanding to the same is limited. However, as per the population genetic analyses of 103 SARS-CoV-2 genomes conducted in Peking university, China on sample of 103 patients, it was found that these viruses evolved into two major types L and S, out of which L type, might be more aggressive and spread more quickly.[7] In India, the more prevalent type of agent is not known but assessment of the present scenario suggests that infectivity of the antigen is very high along with mortality.

Further, as SARS-CoV-2 is a newly identified pathogen, there is no known pre-existing immunity in humans, everyone is assumed to be susceptible and act as host. As per the report of the WHO-China Joint Mission on Coronavirus disease 2019 (COVID-19), the disease presentation in various hosts can range from no symptoms (asymptomatic) to severe pneumonia and death which is determined by the immune response of the host. This report also added that approximately 80% of laboratory confirmed patients develop mild to moderate disease, i.e. non-pneumonia and pneumonia cases, 13.8% develop severe disease and 6.1% reaches critical stage, i.e. respiratory failure, septic shock, and/or multiple organ dysfunction/failure. People with COVID-19 generally develop mild respiratory symptoms and fever, on an average of 5-6 days after infection (mean incubation period 5-6 days, range 1-14 days). The highest risk for development of severe disease and death is for people aged over 60 years and those with underlying conditions such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease and cancer, whereas the disease form is relatively rare and mild in children. As far as mortality is concerned the highest Case Fatality Rate (CFR) is observed in people over 80 years of age, i.e. 21.9%. CFR for patients of comorbid conditions with cardiovascular disease, diabetes, hypertension, chronic respiratory disease and cancer was found to be 13.2%, 9.2%, 8.4%, 8.0% and 7.6% respectively. However, patients with no comorbid conditions reported CFR of 1.4%.[2] The overall CFR worldwide is 5.42% and China is 4.02%.[5]

As per the population pyramid, India, 2019 (Figure 1) formulated on the basis of United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects reports,[8] there is only 0.96% of total population of India which belongs to age group of 80 years and above. However, around 10% of the population belongs to age group of 60 years and above, i.e. at the highest risk for development of severe disease and mortality. Hence, out of whole population of India around 90% is expected to develop mild to moderate disease in absence of other comorbid conditions.

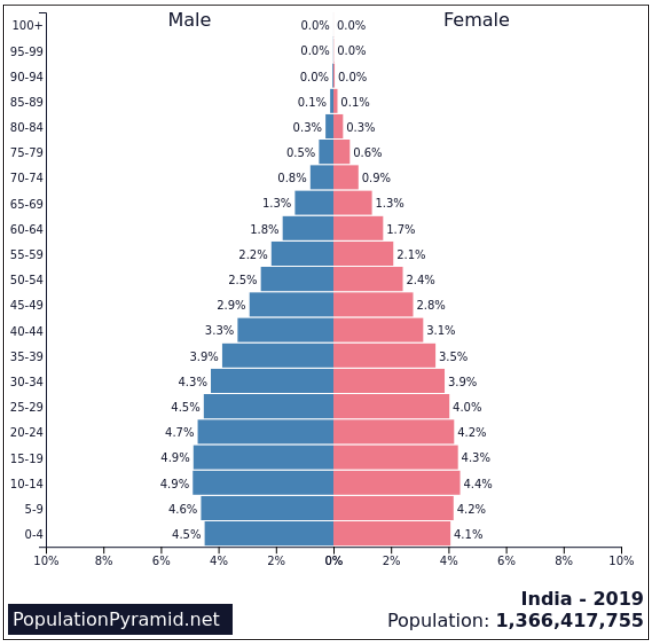

Figure 1.Population pyramid of India, 2019 (courtesy, https://www.populationpyramid.net/india/2019/)

Additionally, Killer cell Ig-like Receptors (KIR) genes which control the immune response of Natural Killer (NK) cells the innate lymphocyte subsets that mediate anti-tumor and anti-viral responses,[9] and some T cells to infections and tumors are observed active in Indian population. In a study conducted to determine the nature of KIR2DL5 gene polymorphism in four ethnic groups using direct DNA sequencing method, it was found that most common allele in Asian Indians was KIR2DL5A*00101 that occurs

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at frequencies of 59.4%. The majority of the KIR2DL5-positive Asian individuals carry an expressed variant. The impact of this line of natural defense, the innate immunity being carried by Indians may play a big role in deciding the COVID - 19 infection trend in India.[10]

The third element, i.e. environment will definitely play a crucial role in deciding the shape of epidemic curve COVID - 19 in India. The activity or behavior of the COVID-19 virus in different climatic conditions is still unknown, however a study conducted in China suggest that "One degree Celsius increase in temperature and one percent increase in relative humidity lower the R value (a quantity measuring the severity of infectiousness) by 0.0383 and 0.0224, respectively".[11] The graphical representation of relationship between R value and temperature (in Celsius) is given in Figure 2.

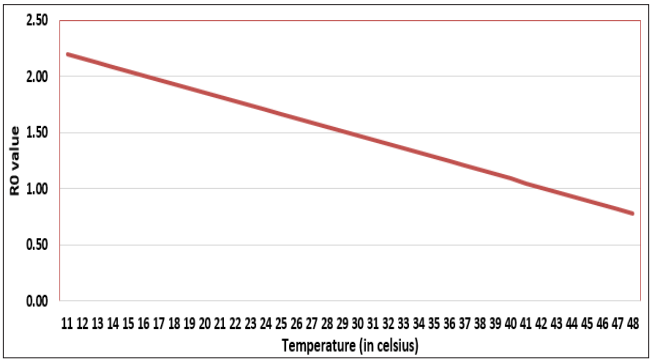

Figure 2.Relationship of R value and Temperature in Celsius

In the graph given above value of R0 is 2.2 (2, 12) on temperature 11 °C which is the average high temperature of Wuhan, Hubei, China during February.[13] As given above, it is estimated that the R value decreases to 1.09 at the temperature of 40 °C. As the temperature reaches 43°C the R value might reduce to even less than 1, i.e. 0.97, at 45°C and 48°C it would be 0.90 and 0.78 respectively.

Hence, in India where summer is very hot with heat peaks in the northern & western plains reaching to temperatures 45° C and more in June[14] and further arrival of rainy season in July, the transmission of COVID - 19 disease may be adversely affected.

In India, prevention, control and management of COVID-19 is being monitored at the highest level. Hon'ble Prime Minister of India reviewing the situation with top officials of the concerned Ministries/ Departments and States/ UTs and taking corrective measures. Various actions have been initiated and being implemented in collaboration with the 36 States/ UTs of the largest democratic country. The steps to check the entry, further spread of the novel agent and management of known cases being taken by GoI almost on daily and sometimes hourly basis.

Major Steps Taken to Restrict Entry of COVID - 19 in India

In order to restrict its entry in India more than 20 different travel advisories issued by the Ministry of Health & Family Welfare (MoHFW) since mid-January, 2020. As per the advisory dt. 11th March, 2020 key steps taken are as under:

- All existing visas, except diplomatic, official, UN/ International Organizations, employment, project visas, stand suspended till 15th April 2020.
- All incoming travelers, including Indian nationals, arriving from or having visited China, Italy, Iran, Republic of Korea, France, Spain and Germany after 15th February, 2020 be quarantined for a minimum period of 14 days.
- Indian nationals strongly advised to avoid all non-essential travel abroad. On their return, they can be subjected to quarantine for a minimum of 14 days (Figure 3).[6]

In addition, Government of India (GoI) undertook evacuation operations from several countries in the wake of the COVID-19 outbreak to bring back Indian citizens as well as nationals from other countries. As per the protocol, all of these evacuees quarantined in the isolation facilities for 14 days and allowed to go out of camp once tested negative. As per the press release dated 11th March, 2020, India evacuated 948 passengers from COVID-19 affected countries. Out of these, 900 were Indian citizens and 48 were from other countries, i.e. Maldives, Myanmar, Bangladesh, China, USA, Madagascar, Sri Lanka, Nepal, South Africa and Peru.[15]

Figure 3.Notices posted by administration on homes of quarantined persons

Major Steps Taken to Restrict Community Transmission in India

- The disease is declared as epidemic and Epidemic Act, 1897 has been invoked by all States/ UTs of India.
- An advisory for social distancing was published on MoHFW website on 16th March, 2020 for closure of all educational establishments (schools, universities etc), workplaces, gyms, museums, cultural and social

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centres, swimming pools, theatres, postponement of non-essential events and limited gathering for all social functions, i.e. marriages etc.

- On 19th March, 2020, Prime Minister of India, Sh. Narendra Modi, addressed the nation and made an appeal to observe "Janta Curfew", i.e. "People's Curfew" on 22nd March, 2020. Hence, on Sunday, 22nd March, 2020, India stayed at home from 7:00 hrs to 21:00 hrs (IST) and followed social distancing. On the same day as desired by PM, people of India appreciated the essential service delivery workers, healthcare workers etc. from their houses through clapping, ringing bells etc.
- On 24th March, 2020, PM again addressed the nation to communicate that the social distancing is the only solution to interrupt the transmission of this agent in the community and announcement for lock down of whole India for 21 days was made. At present India is locked down till 14th April, 2020. This resulted into empty roads and monuments seen in figure 4.

Discussion

It is opined that the disease has not entered in the third phase of transmission/ community transmission, i.e. when a patient not exposed to any infected person or one who has not travelled to any of the affected countries tests positive.

The growth rate of COVID – 19 in India is fluctuating and as on 2nd April, 2020 it is 0.27 as given in the Figure 5.

After the implementation of lockdown the decrease in the growth rate was observed however after the episode of Nizamuddin, Markaz, Delhi the growth rate of COVID-19 shoot up. As per the various news reports more than 6,000 Indians and foreign nationals from Indonesia, China, Nepal etc., attended the Tablighi Jamaat congregation in Nizamuddin in March. The place is erupted as a biggest hot spot for COVID - 19 in India, from where around 2,500 persons were evacuated on dated 2nd April, 2020.

As per the various news reports the incidence of the COVID - 19 linked to the 'Tablighi Jamaat' group was reported on dated 18th March, 2019 in Telangana State. If the public health investigations for this incidence, which were reported in Indonesian Nationals at that time, would have accomplished timely with proper intervention measures, the complications would have been averted.

It is already learned that the social distancing is the key factor which has influenced the transmission dynamics of this novel agent in various countries if followed properly. As given in the figure 6 below, Netherlands has drastically reduced the growth rate after the lock down implementation in the country.

Figure 4.Vacant roads and places in India during lockdown

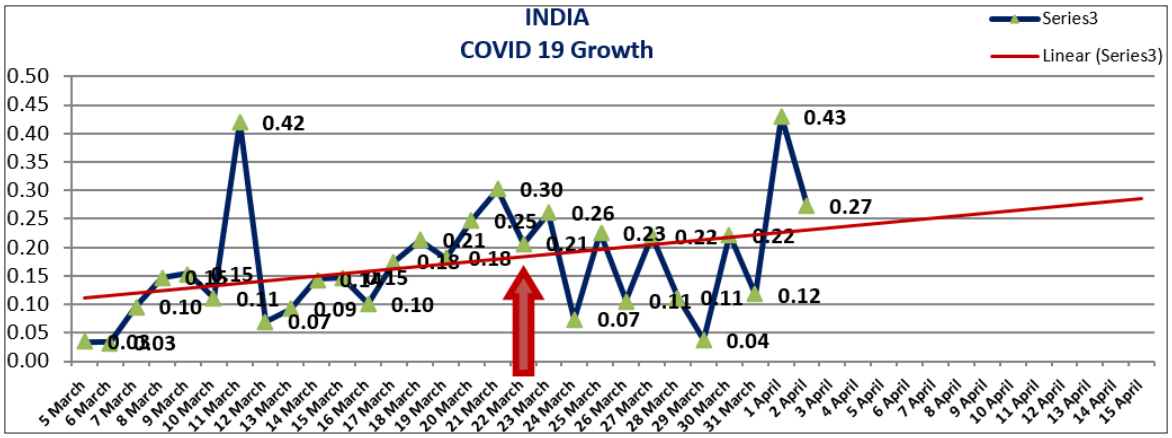

Figure 5.Growth of COVID – 19 in India from 5th March, 2020 onward (based on web data aggregated from multiple sources)

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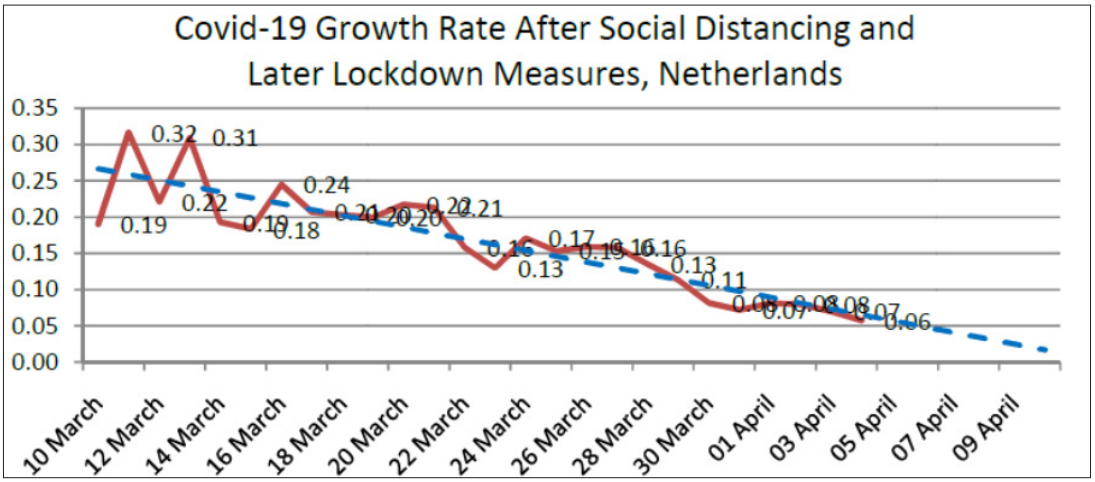

Figure 6.Trend of COVID-19 growth rate after social distancing and lockdown measures, in Netherlands (based on web data aggregated from multiple sources)

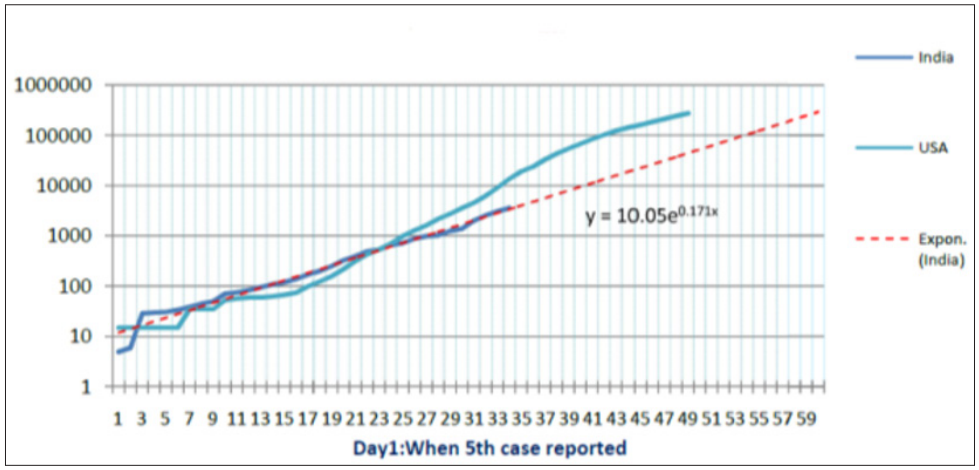

Figure 7.Comparison of day wise trend of cumulative COVID – 19 cases of USA & India (based on web data aggregated from multiple sources)

However, on the other hand the United States of Americas (USA) which did not implement the lock down measures throughout the nation, is continuously reporting new cases and deaths. The comparison of day wise trend of cumulative COVID - 19 cases of United States of America and India is given in figure 7.

Hence, comparison of scenarios of two different Nations given in the figure 6 & 7 it must be assumed that India has certainly invested in the best strategy for prevention of COVID - 19. Through this timely lock down of 21 days of whole nation, the transmission of this novel agent is arrested. In addition, the grace period of 21 days is acquired to enable the system for further challenges, this pandemic may throw. If the momentum gained by India and the trend (shown in figure 7) is continued, then the cumulative COVID - 19 cases might remain much lower than the USA for some time.

In order to get ready for the future, we need to be aware about the number of infection this agent may raise in country in the coming months. As per the estimates done by John Hopkins university, The Centre for Disease Dynamics, Economics & Policy, Washington DC & New Delhi, wherein the model was fitted with data from Italy and China with various key parameters of disease transmission, it is stated that in the lowest scenario prediction, around 1200 lakh persons in community may be infected by last week of June, 2020 in India. This scenario prediction is very optimistic considering temperature/ humidity and low virulence of agent.

Considering the above mentioned estimates, if it is considered that 80% of persons affected would not require hospitalization at all and will recover by themselves, still there may be around 240 Lakh persons affected requiring hospital care by end of June, 2020. If around 6.1% of cases needs assistance in terms of critical care in India then the requirement for ventilators in June, 2020 may be around 73.2 Lakhs. It may be noted that the prediction of even lowest scenario could be very bad for India hence we need to take all measures to thwart these predictions.

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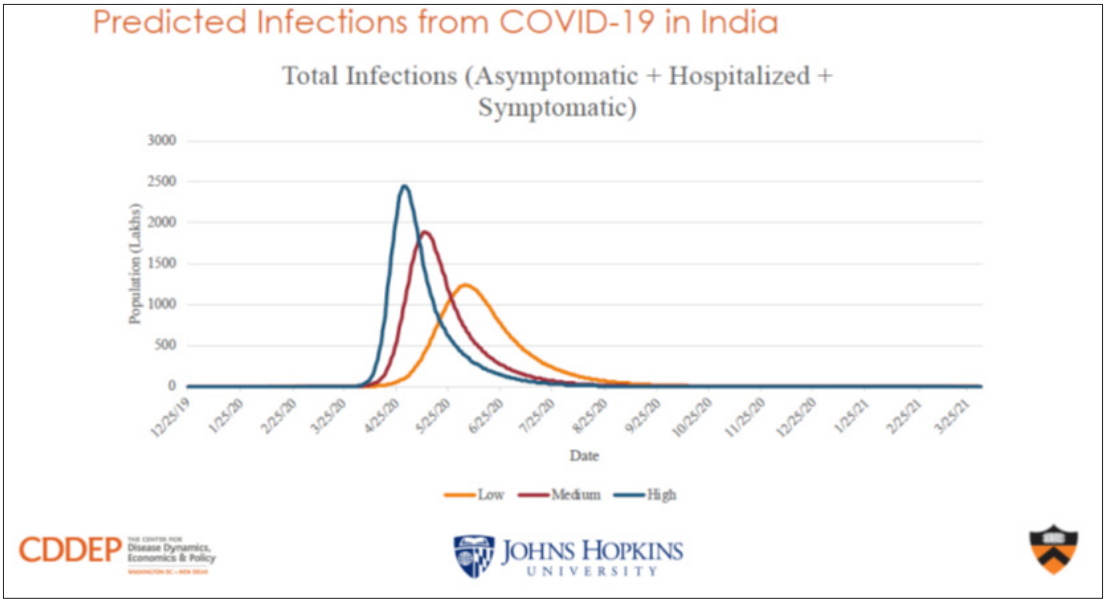

Figure 8.Prediction of infection of COVID - 19 in India.[16]

Recommendation

- Social distancing must be followed by whole population of India. We need to ensure that incidence like Markaz, Nizamuddin should not happen in future.
- Extension of lock down in selected districts based on epidemiological scenario.
- All basic public health principles and approach in addition to advanced one at block, district, state and national level. Including strengthening of quality epidemiological investigation of COVID - 19 cases at the community level.
- In order to be prepared for the adverse scenario the medical infrastructure like availability of isolation wards, ventilators and PPE kits etc. need to be ensured.
- Additional data on use of hydroxychloroquine and other retroviral drugs for prevention and treatment need to be collected, so that same can be utilized for prevention among general community as per the requirement. This may act as a game changer in the present scenario.

Conclusion

The recent initiatives taken to tackle COVID - 19 in India is exemplary, however strengthening of the existing medical and public health infrastructure at all levels of healthcare delivery is the need of hour. India has opportunity and is capable of creating history to keep the impact of present pandemic at the low level of adversity.

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