Effect of lockdown on the spread of coronavirus in India

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ABSTRACT

Near complete shutdown of India was done at a very early stage of coronavirus infections in India. This has helped to slow down the growth rate of coronavirus infections in the country. The near complete shutdown of transportation greatly restricted the movement of people including those already infected with coronavirus. When the total coronavirus cases in India was analyzed by state for the ten day period from Apr 22 2020 to May 1, 2020, it was found that the percentage contribution of each state to the total number of cases in India has remained fairly constant over this duration. This is a novel finding related to the impact of lockdown on spread of coronavirus in India. Additionally, as the Indian lockdown was very stringent, the average daily growth rate of coronavirus infections in India at 6.3% during this period can be taken as the minimum growth rate anywhere in the world provided a strict lockdown is imposed when only a small fraction of the population has been infected.

Keywords : *coronavirus, COVID-19, India, lockdown.*

1. INTRODUCTION

India went into a near complete lockdown on Mar 25, 2020 when the number of confirmed COVID-19 (coronavirus disease 2019) cases in India was approximately 500. All the public and private transportation systems and non-essential shops were shut down. People movement was restricted to procuring groceries and medicines on foot. Containment zones, which are areas with clusters of coronavirus cases, were completely sealed off from the adjoining areas. In most of these containment zones, people could not even come out of their homes and all the essential goods are delivered to their homes. This was a very aggressive measure for a country of 1.3 billion people [1]. As the lockdown shut down movement of people considerably, the active coronavirus cases in India were suddenly frozen in space. Most of those who were carrying coronavirus could now only affect their housemates thus putting a halt on the rapid spread of coronavirus. People exempted from lockdown included those involved with transporting essential goods such as grocery and health supplies, enforcing law and order and providing health care. These exempt or essential workers comprise a negligible fraction of the Indian population. Nearly the whole of Indian population was staying in their homes and going only to nearby grocery and pharmacy stores on foot, as needed. Thus, any subsequent infection in this non-essential fraction of Indian population gets limited to their family and the small space they have access to because of the lockdown. However, as the essential workers are still free to move, they can spread coronavirus over a bigger area. However, they only comprise a small fraction of Indian population and they have been using personal protective equipment and most of them are mobile only within their city or village. Also, these essential workers are expected not to report to work if they are sick.

The lockdown suddenly created a disruption of the normal routine of Indian masses. Daily wagers were severely affected. Businesses especially hospitality industry suffered huge losses. Supply chain for several goods including food was disrupted [2-3]. However, the lockdown was a necessary step and managed to keep the rapid growth of coronavirus cases in India in check. The distribution of cases in different states of India during a portion of the lockdown period from Apr 22 – May 1, 2020 has been explored in detail, which brings about some interesting findings.

2. METHODS

Total number of coronavirus infections in India by states during the ten-day period from Apr 22, 2020 to May 1, 2020 was obtained from the Ministry of Health and Family Welfare, Government of India website (https://www.mohfw.gov.in/). Percent of coronavirus cases in India contributed by a state or union territory (also called region) is equal to the ratio of the total number of cases in that region and the total number of cases in the whole of India. This calculation was done for 15 out of 36 regions of India for each day during the ten day period. Together these 15 regions accounted for 95% of the total coronavirus cases in India.

Daily growth rate of coronavirus cases in India was calculated as total increase in the cases divided by the number of cases at the end of the prior day. An average of the daily growth rate over the ten day period was done to arrive at the average daily growth rate. Microsoft Excel 2013 was used for analysis of the data.

3. RESULTS AND DISCUSSION

The lockdown caused the near freezing in space of active coronavirus cases in India as the movement of those carrying coronavirus got restricted significantly. It can be seen from figure 1 that the percentage contribution of nearly each of the 15 states and union territories of India to the total number of cases in India has remained nearly constant over the last ten days. E.g. Contribution of the state of Gujrat (shown by light green dots) to the total number of cases in India has remained between 11.1 and 12.4% during the entire ten day period. This means that the average daily growth rate of cases in any of these 15 regions will closely match that of the nation, which is 6.3%. This will mean those states that had a higher number of cases on Apr 22, 2020 have continued to see a higher absolute increase in cases throughout the ten day period compared to states with lower number of cases, but the rate of increase of cases in the two states have largely remained the same over time. The lack of people transportation must have played a major role in this near uniform average daily growth rate of coronavirus infections in different states of India. This means that areas with very low numbers of cases currently will not result in a major outbreak. However, if they are unfrozen in space by loosening restrictions on travel, the growth rate will increase, but then again freezing in space will bring back the growth rate to previous numbers. As seen in fig 1, the total number of infections in India on Apr 22 was 20,471, which is only 0.0016% of the population. Hence these conclusions are valid only when a small fraction of the population is infected in a country. When a large fraction of the population is infected say 50%, the growth rate is sure to hit a wall and will rapidly decrease.

It can be also see in fig 1 that out of the 15 regions, Maharashtra, the state with the highest number of cases, showed an increasing contribution to the percentage of total cases in India with time for the first few days since Apr 22, after which it leveled off to the same growth rate as the other states. The city of Mumbai has more than half of the coronavirus cases in the state of Maharashtra. Mumbai is the commercial capital of India and hence there is possibility of a greater number of coronavirus infected people having arrived in Mumbai compared to rest of India. This may be responsible for a slightly higher growth rate in Maharashtra initially, but leveled off as the effect of lockdown began to dominate. Two states - Telangana and Rajasthan are showing decreased contribution to the percentage of total cases in India with time. There can be several factors behind this such as higher testing rate and consequent isolation of the infected people compared to other states.

The testing rate may not be affecting the % contribution by a region since there are uniform guidelines for doing coronavirus testing throughout India. Hence, the ratio of actual to confirmed coronavirus cases in different regions of India is expected to be higher by the same factor.

4. CONCLUSIONS

The lockdown in India has resulted in each of the 15 Indian states and union territories, which together account for 95% of the coronavirus cases in India, reporting nearly the same percentage contribution to the national tally for the ten-day period from Apr 22, 2020 to May 1, 2020. The average daily growth rate of coronavirus cases in India during this period has been 6.3%. This can be taken as the minimum growth rate achievable with only stringent restriction on people movement, provided only a small fraction of the population is infected. Given the huge diversity in India, this conclusion may be generalized to the rest of the world.

A growth rate of 6.3% is alarming, despite such a strict lockdown. At this rate, total number of coronavirus infections will reach 2,35,000 by the end of May and 14,70,000 by the end of June. Besides enforcing still stricter lockdown, extensive use of N-95 type

masks and strict adherence to social distancing for people exempted from lockdown, more testing, contact tracing and quick isolation of the infected individuals will be needed to stop the growth rate of the coronavirus [4-5].

Similar data analysis exercises can be done by districts instead of states in India to see if a near uniform growth rate is seen in various districts as well. However, due to a greater movement of essential people between districts compared to between states, the data may not yield such a clear trend as was seen for states. Future work can involve similar data analysis exercise in different countries of the world especially where public movement is highly restricted.

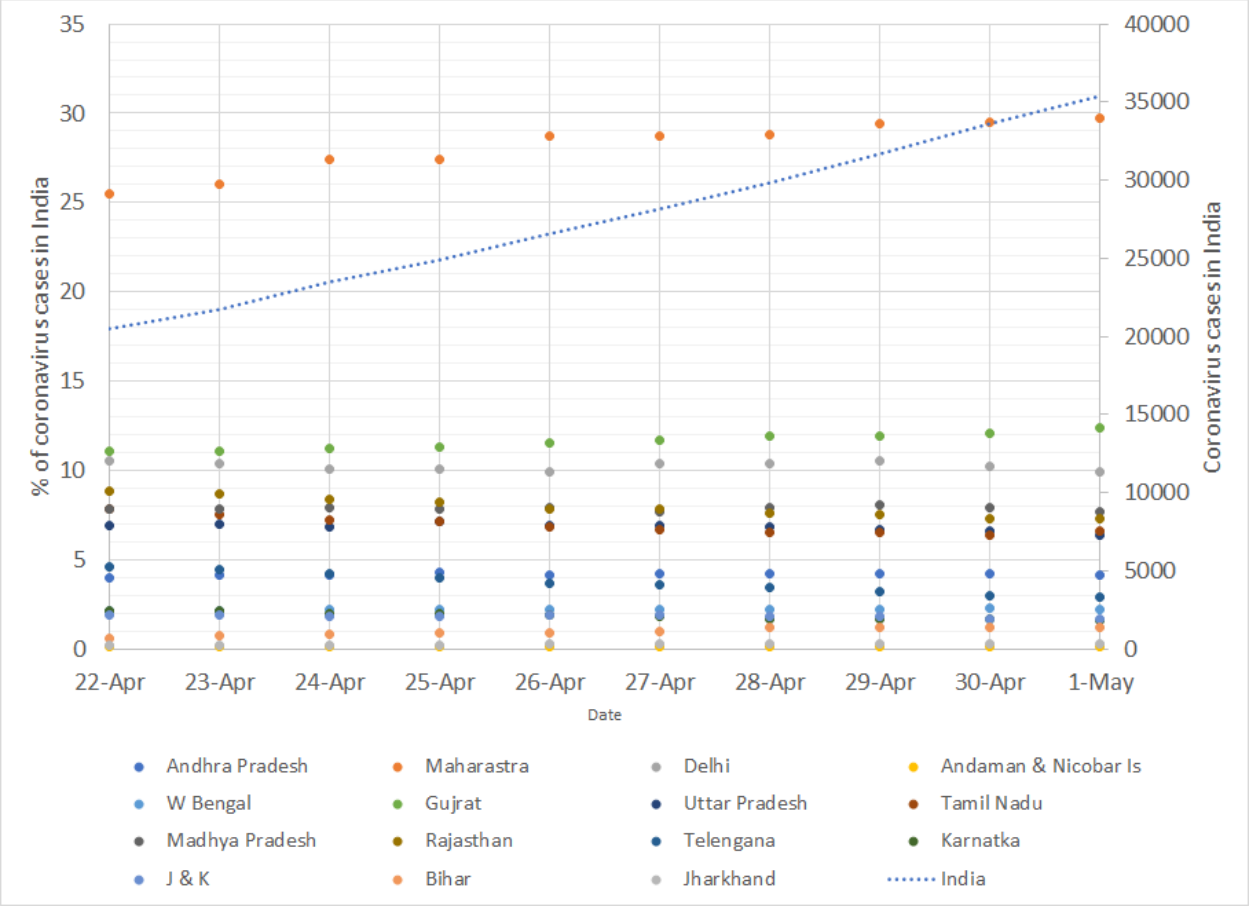

Fig 1: Total number of Coronavirus cases in India is shown by blue line. The data points represent the % contribution of each state or union territory to the total number of cases in India.

5. REFERENCES

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