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New statistical analysis to illustrate the significance of lockdown in India during COVID-19 outbreak

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Abstract
Since the first case of 2019 novel coronavirus disease (COVID-19) detected on Jan 30, 2020, in India, the number of cases rapidly increased to 1,077,618 cases including 26,816 deaths as of 19 July 2020. The outbreak of the novel coronavirus, COVID-19, has been declared a pandemic by the WHO. The structures of social contact critically determine the spread of the infection and, in the absence of vaccines, the control of these structures through large-scale social distancing measures appears to be the most effective means of mitigation. The government of many countries imposed official lockdown to stop spreading the virus. In this paper, we represent the Statistical analysis of controlling the pandemic outbreak with the help of lockdown Mean while The effect of lock-down is also considered in the paper. It is evident from the outcome that lock- down plays an important role in abolishing the COVID-19 spread.

Keywords: COVID-19, SARS-COV, statistical analysis, lockdown, COVID-19 pandemic India

Introduction

COVID-19, the abbreviation of coronavirus disease (2019) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1] strike the globe very sharply. In December 2019, the first outbreak was noticed in Hubei province, Wuhan, China [2]. The cases were observed by various countries from November 2019 to till date. On January 30, 2020, the World Health Organization (WHO) revealed the COVID-19 to be a public health emergency and identified it as a pandemic on 11 March 2020. The Symptoms of COVID-19 are not specific and many cases showed the infected person may be asymptomatic.

The majority of the cases have two common symptoms which include dry cough (68%) and fever (88%). The disease affects the lungs and causes respiratory illness with symptoms like the flu such as cold, throat infection, cough, fever, and in critical cases, difficulty in breathing. Some of the cases have symptoms that include fatigue, muscle and joint pain, respiratory sputum production (phlegm), sore throat, loss of the sense of smell, headache or chills, and shortness of breath. Moreover, the growth of this infection can further proceed to acute respiratory distress syndrome, severe pneumonia, and death. The COVID-19 virus spreads at large extent between people in close contact with each other (within approximately 2m). The active period of the novel coronavirus is of fourteen days [3]. It is suggested by medical authorities that one can protect himself/herself by washing hands frequently, avoiding touching the nose, ears, and face, and by maintaining social distancing (1 meter or 3 feet) with other people.

Indian Timeline of Covid-19

On January 30, 2020, the first case of the COVID-19 in India was accounted for. The nation revealed its initial three cases in the state of Kerala, every one of whom was students and had a travel history from Wuhan, China [4]. The transmission escalated within March when many reported cases throughout the country found to be connected to the people having travel history to the countries which are affected with COVID-19. On 11 March 2020, the Indian government starts taking strict actions by suspending all visas to India with the effect of 13 March 2020 till 15 April 2020. India government implemented a 14-hour voluntary public curfew on 22 March 2020. Furthermore, the Prime Minister of India also ordered a nationwide lockdown at midnight on March 24, 2020, to slow the spread of COVID-19. Despite no vaccine, social distancing has identified as the most commonly used prevention and control strategy [5]. The purpose of these initiatives is the restriction of social interaction in workplaces, schools, and other public spheres, except for essential public services such as fire, police, Hospitals. No doubt the spread of this virus outbreak has seriously disrupted the life, economy, and health of citizens [6]. This is a great concern for everyone how long this scenario will last and when the disease will be controlled [6]. A 76-year-old man is the first victim of COVID-19 in the country who had returned from Saudi Arabia 0n March 12, 2020 [7]. On 15th March, the confirmed cases were 100 but it crossed 1,000 on 28 March and 2,000 on 2 April [8, 9]. A report by Cambridge University has indicated that India's countrywide three- week lockdown would not be adequate to prevent a resurgence of the new coronavirus epidemic that could bounce back in months and cause thousands of infections [10]. They suggested that two or three lockdowns can extend the slowdown longer with five- day breaks in between or a single 49-day lockdown [6]. Data-driven mathematical modeling plays a key role in disease prevention, planning for future outbreaks, and determining the effectiveness of control. Several data-driven modelling experiments have been performed in various regions [10, 11, 12, 13]. Currently, there are very limited works that studied the impact of lockdown on COVID- 19 transmission dynamics in India [6].

From the Statistical analysis in this study, we consider the number of confirmed cases before lockdown and during lockdown to study the significance of lockdown in India. table-1 represents the data of the Indian government Imposed a total four number of subsequent lockdowns.

Table 1: Duration of Lockdown imposed by the Indian Government

Lockdown	Duration of lockdown
Lockdown-1	25 March 2020 - 14 April 2020 (21 Days)
Lockdown-2	15 April 2020 – 3 May 2020 (19 Days)
Lockdown-3	4 May 2020 – 17 May 2020 (14 Days)
Lockdown-4	18 May 2020 – 31 May 2020 (14 Days)

Statistical analysis

In the present manuscript, we proposed a new Statistical analysis for COVID-19 that incorporates the lockdown consequences.

Lockdown Data

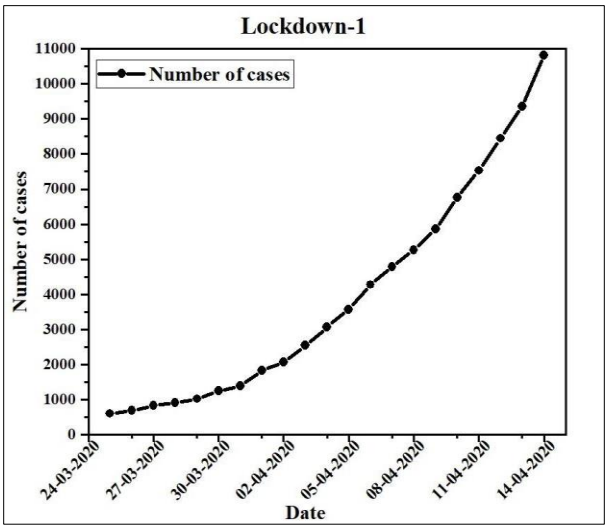

Fig 1: Graph of an increasing number of cases day by day during lockdown-1

Figure 1 shows the graph of the increasing number of cases day by day during lockdown-1. However statistical data suggest the number of cases is rapidly increasing. Additionally Figure 1, indicates that the first date of lockdown 25 March 2020 the total number of active cases in India was 606. Subsequently, the average increment of 15 % per day leads the total number of cases on the last day of lockdown 14 April 2020 was 10815. Before the first lockdown, the average rate of increment in the total number of cases was about 18%.

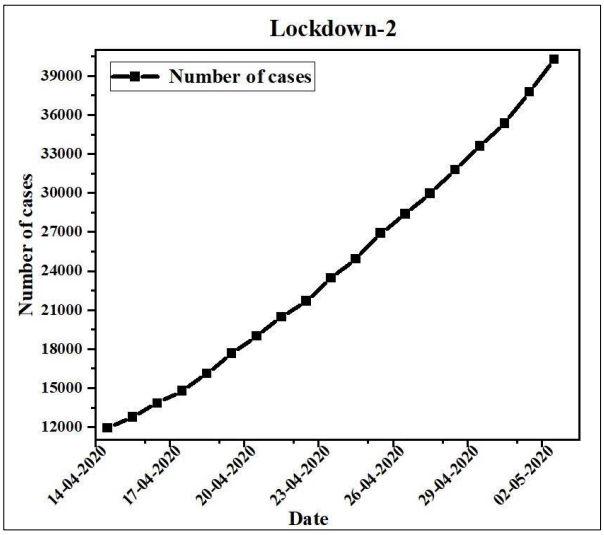

Fig 2: Graph of an increasing number of cases day by day during lockdown-2

From the resultant data of the lockdown-1 Indian government noticed an average reduction of 3% of the total number of cases each day. Consequently, the government of India decided to extend the lockdown till 3rd May 2020. Figure 2 shows that the first day of lockdown 15 April 2020 the total number of active cases was 11933. Subsequently, the data of lockdown-2 was having a drastic reduction of the average number of cases per day, increment in cases was an average 7% cases per day. This increment 7% daily cases lead the total number of cases on the last date of lockdown 3 May 2020 was 40283.

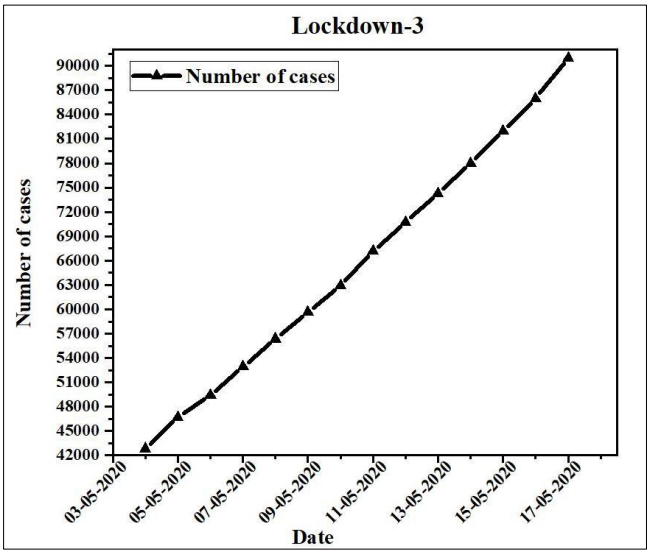

Fig 3: Graph of an increasing number of cases day by day during lockdown-3

Effect of lockdown-2 was considerably impressive and the consequences of it assist the Indian government to aggrandize the lockdown. On the 3 May 2020 Indian Prime minister aggrandize the lockdown for 14 days. Figure 3 infer that the first day of the lockdown-3 total number of cases was 42836.with the hike rate of average 5.99% per day the total number of cases on the last day of lockdown was 90927. A significant percentage reduction rate has been observed throughout all the three lockdowns.

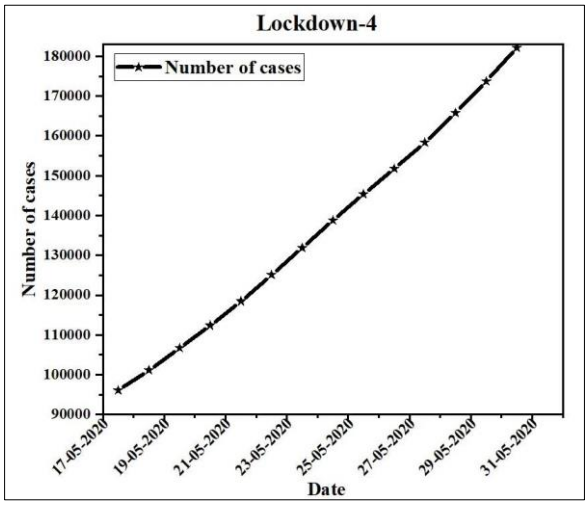

Fig 4: Graph of an increasing number of cases day by day during lockdown-4

According to the Indian population and the rate of spreading coronavirus government decided to impose lockdown-4. On the lockdown-4 the number of active cases of corona was 96179. But the rate of increasing day to day cases in percentage was reduced drastically during the period of lockdown-4. The average increment of 5% per day in new cases directs the graph of the total number of cases above 1 lac. Figure 4 indicates that the last day of lockdown 31 May 2020 has the total number of cases 182143.

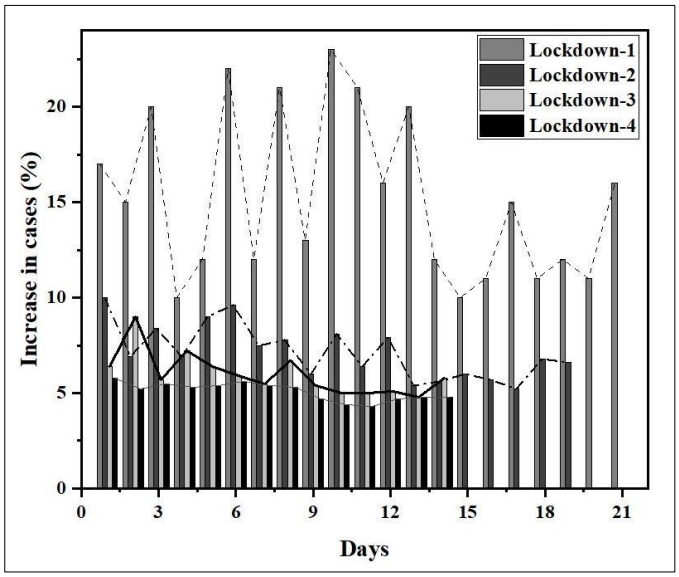

Fig 5: Comparison of increase in the total number of cases during the Lockdown in India

Figure 5 indicates the drastic and significant reduction of day to day cases encountered in India during the four consecutively lockdown. Meanwhile, a comparison of simultaneous data of all illustrate that for the diminishing of the spread of COVID-19 lockdown is indeed.

Results and discussion

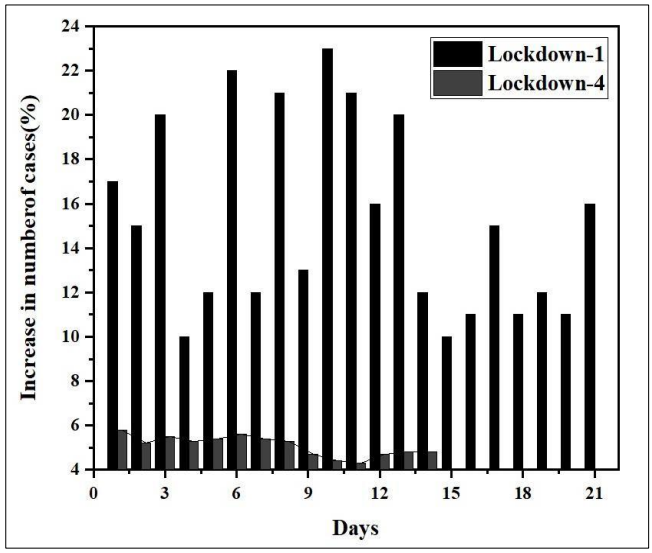

Fig 6: Comparison of increase in the number of cases during Lockwon-1 and Lockdown-4

We can conclude that the percentage of the total number of cases drastically reduces during the Lockdown-4 with compare to lockdown-1. Figure 6 bar chart indicates that the percentage of day to day increase in new cases in India is diminishing.

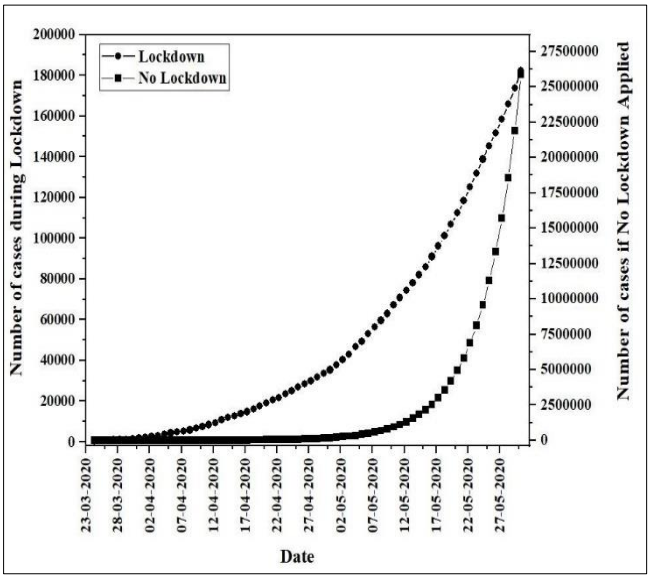

Fig 7: Comparison of the number of cases during (X axis) the lockdown and if there is no lockdown imposed (X'axis).

Table 2: India's journey to a million COVID-19 cases

Date	Total cases	Days taken
18 May 2020	1 Lakhs	109
2 June 2020	2 Lakhs	15
12 June 2020	3 Lakhs	10
20 June 2020	4 Lakhs	8
26 June 2020	5 Lakhs	6
01 July 2020	6 Lakhs	5
06 July 2020	7 Lakhs	5
10 July 2020	8 Lakhs	4
13 July 2020	9 Lakhs	3
16 July 2020	10 Lakhs	3

Figure 7 points out a graph of the number of cases encountered during the lockdown and it further suggests that if there is no lockdown imposed by the government of India the rate of the increasing number of cases before the lockdown lead India to a very huge number of active cases. This statistical model represents that during the period of lockdown 25 March 2020 to 31 May 2020 the total number of active cases increase 24942 to 182143. But if the Indian government not implemented a nationwide lockdown at midnight on March 24, 2020, the total number of estimated cases according to our statistical model will be 25851209 on 31 May 2020 and raise rapidly with the rate of 18% per day. Table 2 illustrate that during the period of the lockdown the increase in positive cases was under control but as the government started the unlocking process the increment in positive cases increases rapidly. Now the rate of increase in positive cases in India is 1 lakhs case in just 3 days.

Conclusion

In conclusion, as there is no official cure has been invented to date for novel coronavirus the only way to stop spreading the virus is social distancing and vaccination. Consequently, the lockdown is the best way to the best way to stop spreading the virus rapidly and maintain social distancing. Thus, from our statistical analysis, we can conclude that the lockdown is obligatory for stopping and spreading the virus, besides it plays a very important role. From the result and comparison of lockdown data, we can say that if there is no lockdown implemented in India then it will be very difficult to handle such rapid rising cases for the government. Hence, this proposed paper exhibits the significance of lockdown to spread the novel coronavirus.

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