

**PERCENT ALTERATION ACCURATELY REFLECTS THE PROGRESSION,
INTERVENTION AND ANY ABRUPT CHANGES OCCURING IN COVID-19
CASES IN A POPULATION**

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ABSTRACT

COVID-19 (SARS-Cov-2) is fast spreading around the globe in a highly contagious manner. This article describes a method to monitor the spread of COVID-19 in the Indian population and possible effect of intervention on disease control. The effect of 'National Lockdown'/curfew imposed on the entire country by the central Government has yielded positive results. The 'percentage graph' was used to study the changes in spread of disease. It was able to detect early, the flattening of the curve after intervention. From the percentage graph it was also evident that there was an abrupt increase in percentage of COVID-19 cases on 1st April 2020 & onwards which appeared as a spike in the 'percentage graph'. However, a non-significant weak positive correlation was noted between the two variables ($p \leq 0.05$). The significance of these changes has been discussed in this paper. Overall, the percentage graph reflected that there is a flattening of growth curve post Lockdown & it also confirmed that there is no sign of 'community spread' of the disease among the Indian population, during this period.

I. INTRODUCTION

The novel coronavirus (SARS- nCOV2) originated in Wuhan in Hubei province of China during December 2019, has now spread across the world; the most affected being USA, Italy, Spain & now Germany. Until date there is no new vaccine or therapeutic agents developed against this highly infectious virus that could stop spread of COVID-19 which is known to spread through human to human contact.

Corona viruses are a large family of viruses, including those that cause “the common cold” in healthy humans. These viruses account for up to 30 percent of upper respiratory tract infections in adults. This outbreak of COVID-19 marks the third time in recent years and has emerged to cause severe disease and death in human population worldwide.

The new corona virus is closely related to SARS, and its characteristic feature is long latency period before the typical flu-like fever, cough, and shortness of breath manifest. The people infected with this virus may not show any symptoms for up to two weeks, allowing them to pass it on to others in the meantime. As a result, the novel Corona virus was able to easily spread all over the world.

Due to alarming nature of this disaster world-wide and to contain further spread of the virus in Indian population, The Hon’ble Prime Minister of India declared one day of ‘Janata Curfew’ on 22 March 2020, from 7AM to 9 PM bringing the country to a standstill. Due to unnerving situation all over India, and different states in the union of India showing diverse rate of COVID-19 positive cases, complete ‘National Lockdown’ was ordered for 21

days starting from 23rd March, 2020 midnight to Midnight of 14 April, 2020.

We assessed the nature of spread using a percentage graph which is more accurate than the usual number graph. From the graph plotted, it was observed that after the lockdown was implemented on 23rd March, 2020, the percentage change in COVID-19 positive cases maintained a flattened nature until 31st March, 2020. However, a small peak in percentage graph was noted on 1st April, 2020 when there was a surge in the number of COVID-19 positive cases among Indian population. A major reason for this outbreak was traced back to a 'single source' group (The 'single source' refers a big congregation that took place in the city of Delhi, in middle of March 2020, before the Lockdown was enforced. As per report during the congregation 'social distancing' was not properly maintained. The congregation was an international gathering attended by delegates from various places across the world. It is now estimated that several thousands of them attended the congregation). Before WHO declared COVID-19 as a pandemic on March 11, 2020, local organisers were possibly not aware that a similar congregation was organised by the same group in Malaysia during end of February where spike in cases of COVID-19 was noted & those attendees may have carried the virus to India; putting an additional burden to the already existing cases.

During the congregation and later after the implementation of country wide Lockdown, many individuals who attended the congregation remained in the place of congregation and later some of the attendees left for their native

places across India. Later, during end of March, 2020, many of them were diagnosed to be positive for SARS-COV-2. It is now certain that the individuals from 'single source' group substantially contributed towards the total number of COVID-19 positive cases across India. Presently, the process of screening, diagnosis and isolation of such individuals is underway. Various places where the congregation took place in Delhi have been designated as 'Hot Spot' & such clusters were sealed to prevent further spread of the virus among general population.

II. METHOD AND RESULTS: The present study was carried out on the data collected from the entire Indian population who were diagnosed as COVID-19 positive cases, starting from March 03, 2020 until 09 April, from the websites of Government of India and other national News agencies.

The **Figure 1** reflects the total number of positive cases of COVID-19/day until 09 April, 2020. The number was collected at 10 PM each day from National news agencies & other sources. The graph reflected that there was a linear increase in the number of COVID-19 cases and on 31 March, 2020, there were 1397 cases in the entire country. However, on the next day, 01 April, 2020 there was an abrupt rise of 437 cases and the total number of COVID-19 stood at 1834; showing an increase in 23.8%. There was increase of ~500 cases on subsequent days until 09 April, 2020. However, from the numbers, it is difficult to ascertain the actual effect of this increase on the long term flattened curve that was in place after Lockdown. This is evident from the percentage graph depicted in **Figure-2**. It is clear from Figure-2 that from 24 March 2020 onwards, that is, during the period of ongoing

Lockdown, there was significant decrease of COVID-19 cases and that was stably maintained until 31 March 2020. However, on 1st April, 2020 the percent graph reflected that there was 2.5 folds increase in individuals with COVID-19. This was visible as a ‘small peak’ (P1) in the graph. And the percent of positive cases was twofold on 04 April, 2020 and on 06 April it came down to 1.5 fold and there after the percentage rate stabilized. The ‘temporary surge’ in number of cases of COVID-19 appears to have no impact on the overall trend of the curve.

The **Figure: 3** reflects the percent of COVID-19 cases from ‘single source’ group that contributed towards total number of COVID-19 cases in India during 24 hours between 08 April to 09 April, 2020. The graph reflects that there was 30% contribution from ‘single source’ in the total number of COVID-19 cases in India. Breaking down the results for different states of India are also given in Figure-3: In Haryana the contribution from ‘single source’ was 86/134, in Delhi it was 93/93, in UP it was 187/343, in Assam it was 27/28, in Rajasthan it was 48/328, in Kashmir it was 9/9 & in Tamil Nadu it was 42/48 respectively.

The **Figure 4A & 4B reflects** highlights the effect of the ‘surge’ on the total COVID-19 cases from 1st April, 2020 to 9th April, 2020. The Figure-4A shows the number of COVID-19 in the above mentioned period which appears as a linear graph. However, Figure-2B represents the percentage graph during the same period as depicted in Figure-4A. The graph clearly indicates different peaks reflecting the change in percent of COVID-19 cases that is not possible to detect in a linear graph. The graph reflects that there are three

small peaks appearing on 1st April, 2020 (P1), 4th April, 2020 (P2) & 6th April, 2020 (P3) respectively. The Figure- 4B also indicated that the percentage of cases after 6th April 2020 onwards regressed and by 9th April, 2020, the percent of COVID-19 cases had stabilized. A correlation coefficient graph representing the percentage of cases prior to and following the 'spurt' in percent of Covid-19 cases, showed a weak positive correlation between the two variables and the p value was at a non-significant level (≤ 0.05) - **Figure: 5**; suggesting that 'spurt' in Covid-19 cases did not have any immediate impact on the underlying trend line of the growth curve.

DISCUSSION:

The recent disaster caused all over the world by the advent of the corona virus has prompted a massive global effort to contain and slow the spread of this virus in addition to find a cure/vaccine for COVID-19. However, regardless of those efforts, over the last few months, it has not been possible to contain the virus without intervention as it mostly spreads from person-to-person through respiratory droplets produced when an infected person coughs or sneezes. It is dangerous because of its 'community spread' in an exponential manner. The enormity of the disaster is starkly visible in the USA, Italy, Spain & Germany; none of these countries had introduced any stringent restriction on the movement of people across the country when the number of COVID-19 cases was small. India however, was an exception as it introduced various stringent measures to restrict movement of people, at an early stage when the number of COVID-19 positive cases was small. Among the measures taken were a 'curfew' enforced on 22nd March from 9 AM to 7

PM followed by a 'Lockdown' that took effect from midnight of 23rd March 2020 for 21 days. Until 31 March, 2020, the measures taken were able to slow down the spread of the contagious virus (SARS-COV-2), and that was evident in the percentage graph which, more or less, recorded a 'stable curve' until 31 March 2020. However, the picture abruptly changed from 1st April 2020 onwards, when there was a substantial increase in COVID-19 positive cases. Due to this abrupt increase in number of positive cases, new stringent actions were initiated by the Authority to identify, isolate and quarantine the COVID-19 individuals. Further, hundreds such 'hot spots' were identified in different regions of Delhi & in all other parts of India. However, in midst of such discouraging picture, some states maintained a minimal number of COVID-19 cases, suggesting an effective implementation of Lockdown in those states. These states include Tripura, Assam, Manipur, Odisha & Bihar; where the total number of COVID-19 cases, on an average is below 100 as of 9 April, 2020. Nevertheless, as stated earlier, the situation across India has the potential to change abruptly as many new cases are surfacing every day. Recently, 102 persons were located in a place in Delhi of which 52 persons were COVID-19 positive.

The silver lining so far, about this highly infectious disease is that there are many instances where individuals with COVID-19 have recovered completely world-wide including India. Many such recovered patients showed presence of antibodies against the SARS-cov-2 and transfer of 'Plasma' taken from recovered patients were able to cure patients suffering from COVID-19 in Delhi and elsewhere in the world. Studies from South Korea further

confirmed the role of immunity, when such recovered individuals were re-infected had a weak infection and cured. However, in a study in the USA, demonstrated that specific T cells were also could have played a role in late stage of infection with SARS-COV-2. Therefore, it is speculated that an earlier induction of specific T cell response may become a game changer for the treatment of SARS-COV-2 infected cells. This plausibly could be achieved by *in vivo* induction of inflammatory FLT-3L that is known to generate a T cell response *in vivo* (2). We have generated a long-term protective immune response by Flt3L therapy following irradiation *in situ* (3, 4); this concept could be extended for treatment of COVID-19 patients.

In this article it is demonstrated that the spread of SARS-Cov-2 within the Indian population was contained so far, by implementing total Lockdown with 'social distancing'. It was revealed in this study that **(a)** Much of the success of Lockdown depends on 'early detection' of the intervention introduced in the population so that fine tuning of the intervention could be made possible. This could be achieved by evaluating the rate of change in COVID-19 cases; **(b)** Any unprecedented changes taking place due to any unforeseen event was detectable at an early stage from the plotted percent graph; **(c)** The 'Spurt' noted in the graph after 31st March, 2020 had weak positive correlation with the overall increase in COVID-19 cases; & **(d)** The percent graph also elucidated that the long term down trend of SARS- Cov-2 spread remained intact and the population appears to have not entered the third phase of community spread of COVID-19.

III. Acknowledgement:

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3. Thanks to Dr. Prabal Chakravarty to assist me in preparation of Manuscript and for encouragement.

IV. References:

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FIGURE-1

THE NUMBER OF COVID-19 CASES FROM 23 MARCH 2020 TO 09 APRIL, 2020.

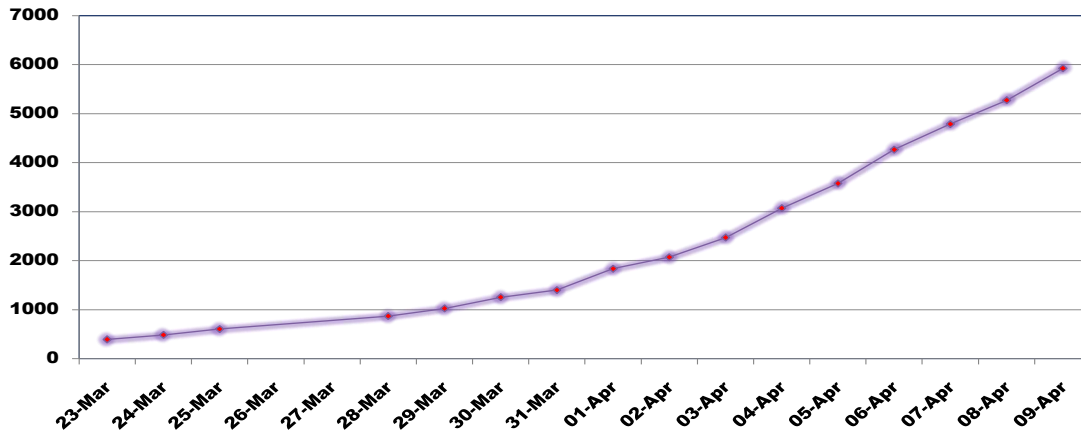


FIGURE-1

Figure: 1 The graph shows the number of COVID-19 positive individuals in Indian Population at different time points. As evident from the graph, there is an increase in number of positive cases starting from 23 March, 2020 until 09 April, 2020. On 23 March April 2020, there were only 1397 cases and on 9th April the number increased to 5928 cases. That is an increase in 76% of positive cases.

FIGURE-2

PERCENT CHANGE OF COVID-19 CASES FOLLOWING LOCKDOWN

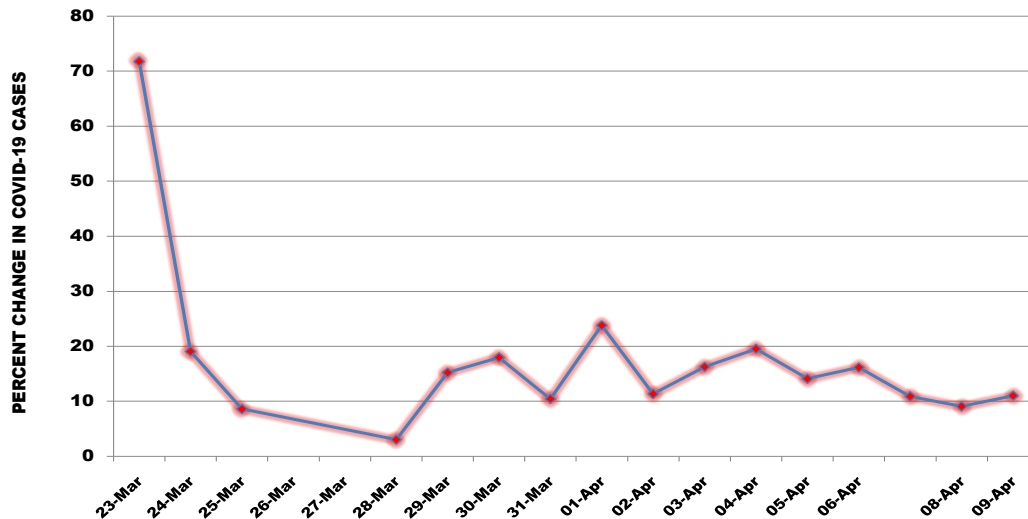


FIGURE-2

FIGURE: 2 The graph shows the percent change in COVID-19 cases from 23 March, 2020 until 09 April, 2020. The graph reflects that the positive effect of 'Lockdown' was maintained from 24 March, 2020 until 31 March, 2020. And on 1st April, 2020, there was an abrupt increase in percentage of cases, particularly due to the addition of positive cases from a 'single Source'. This trend continued until 06 April 2020 and then subsided to around 10%.

FIGURE-3

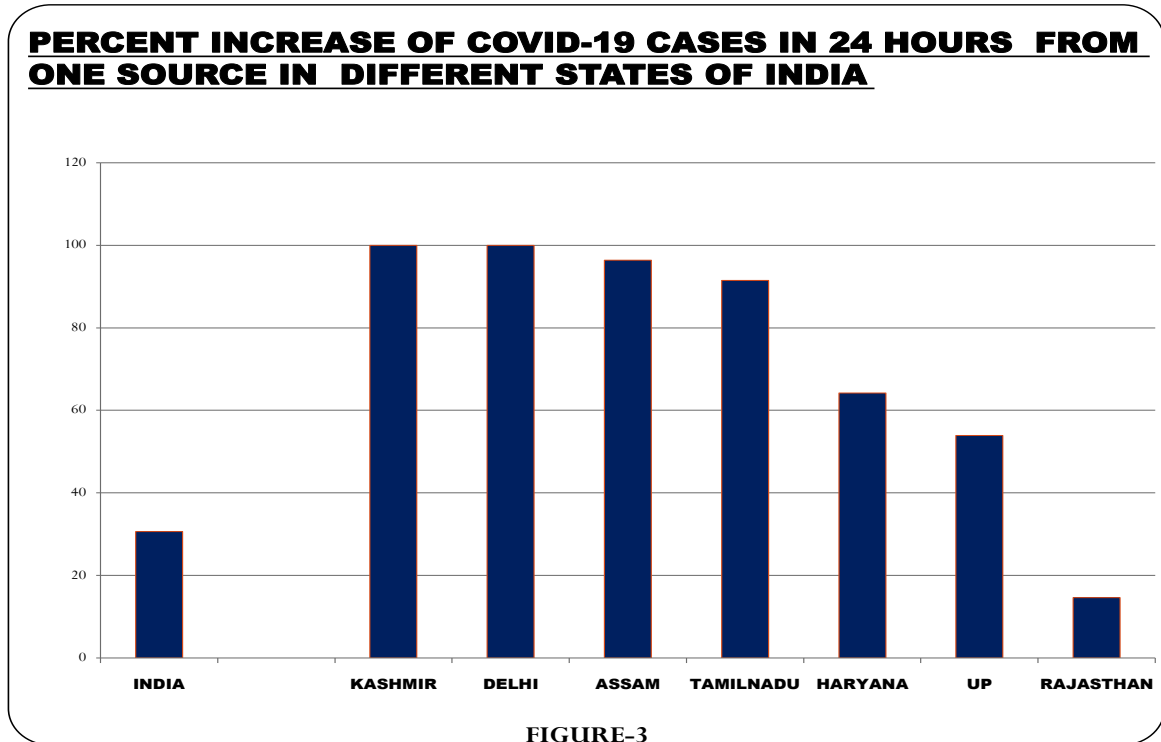


FIGURE-3: The graph shows the contribution of COVID-19 cases from a 'Single source' as compared to total cases reported in different states in union of India, during 24 hours.

FIGURE-4

SUDDEN SPURT IN COVID-19 CASES AFTER 31 MARCH, 2020 DURING LOCKDOWN

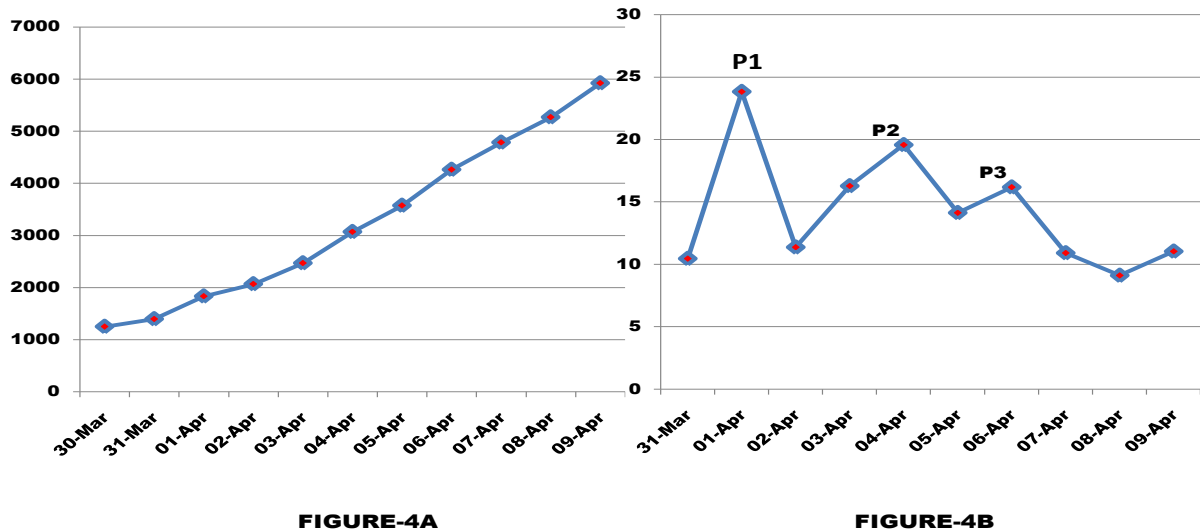


FIGURE-4A & 4B: The Figure- 4A shows the number of COVID-19 cases from 01 April, 2020 TO 09 April, 2020 when abrupt increase in COVID-19 cases was noted. The figure-4B shows the percentage change in COVID-19 cases during the same period. The upward trend in the percentage of COVID-19 cases among the population is clearly visible from 1st April to 6th April, 2020 when three small peaks were made, designated as P1, P2 & P3 respectively. Following the third peak made on 6th April there was a gradual decrease in percent positive cases until 9th April, 2020.

FIGURE-5

CORRELATION BETWEEN PERCENT CHANGES IN COVID-19 CASES BEFORE AND AFTER 31 MARCH, 2020

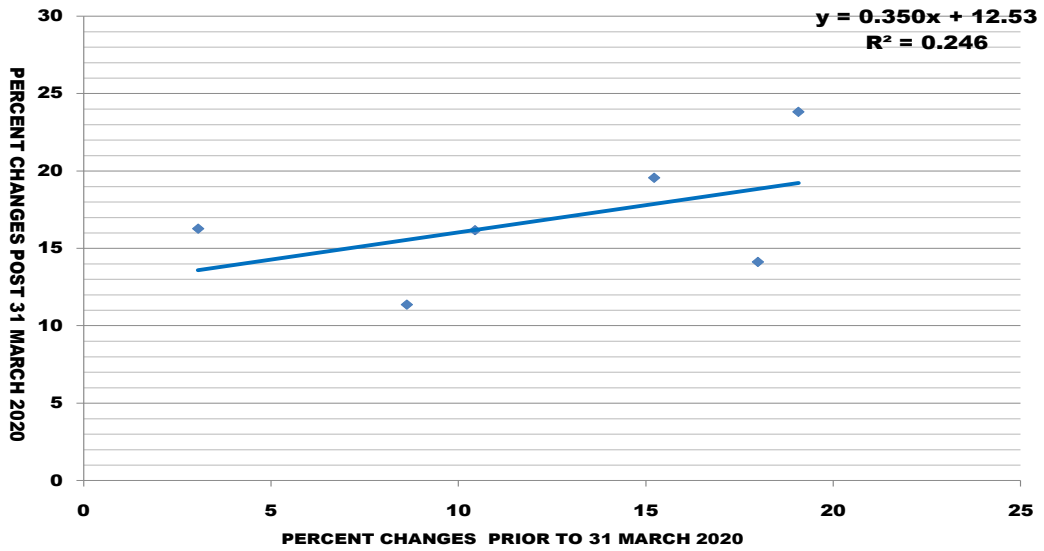


FIGURE-5

FIGURE 5: A correlation coefficient graph reflects that there is weak correlation between percentage of COVID-19 cases prior to after 31 March, 2020. The p value at 0.440872 is non-significant ($p \leq 0.05$).