

Plausible Transition of Covid-19 from Pandemic to an Endemic State: Impact of Variant UK Strain, b 7.1.1, on the Spread of Covid-19 in the Population

Prabir Chakravarty

Former scientist, Albert Einstein College of Medicine, 1300, Morris Park Avenue, Bronx, New York-10461

***Corresponding author**

Prabir Chakravarty, Former scientist, Albert Einstein College of Medicine, 1300, Morris Park Avenue, Bronx, New York-10461

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Abstract

Covid-19 is a contagious disease spreading without showing any signs of abatement across the world. Presently, sars-cov-2, the causative agent of covid-19, is giving a fresh threatening sign to renew its devastation as several new mutated strains have been detected in United Kingdom, South Africa, Brazil & the USA; the first variant being detected in the United Kingdom (b 7.1.1). Here we have shown that there was a gradual waning of active cases of covid-19 (strain originated in Wuhan, China) across the nation after implementation of complete lockdown; this demonstrated that covid-19 had lost its sheen and the covid-19 pandemic was nearing an end. However, the recent emergence of the mutated forms of sars-cov-2 in different countries including India, appears to be more contagious and virulent than the original form. This property of the variant strain could affect the ongoing pandemic. The implication of all the data obtained from the old and the new UK variant, b7.1.1, in context of pandemic has been discussed in this article.

Keywords: covid-19 – lockdown- active cases – passive immunity –endemic- sars-cov-2 - variant strain.

Introduction

Sars virus belongs to the family Coronaviridae, which is known to cause respiratory illnesses in humans and animals. Sars-cov-2 is a novel member of this family which causes acute respiratory distress syndrome (ARDS), associated with high mortality rate. A new strain, more virulent than the previously known strains, was identified recently in United Kingdom and it gradually has spread to different parts of the world. Now there are more mutated variants of sars-cov-2 originating in different countries, having higher rate of virulence and its contagious nature is threatening to destabilize human civilization. The only hope to combat this virus is by developing effective immune response against the virus. The present situation emphasizes the need for developing effective vaccination strategies to fight this menace.

The alarming nature of the spread of sars-cov-2 virus during early part of 2020, prompted the Indian authorities to call for a country-wide complete lockdown from March 25, 2020. The complete lockdown implemented in the country lasted until the end of May, 2020. Following which lockdown was relaxed in a phased manner starting from 1st June, 2020. In a series of papers, we have shown that a) evaluating the percent change of covid-19 in the popula-

tion was a better way to assess the progression and alternation, if any, in the spread of covid-19 in a population; b) implementation of timely lockdown in the entire country controlled the spread of covid-19 that was reflected in increased doubling time of covid-19 in the population; c) due to timely implementation of lockdown, there was gradual slowing down in the rate of covid-19 & d) due to timely implementation of lockdown, there was significant increase in recovery from covid-19. The data plausibly reflected that there was an emergence of protective immunity against sars-cov-2 in the population due to implementation of lockdown [1-6]. Based on the available data, it was hypothesized that in the population there was existence of prior immunity to related/unrelated pathogens, which cross-reacted with the novel sars-cov-2 virus and provided protection against development of serious covid-19. Now, we further add that because of implementation of effective lockdown may have 'slowed down' the viral movement in the population. The 'break' in chain of viral progression in the population resulted in 'weakening' (attenuation) of the live virus and aided in 'passive immunization' (vaccination) of the individuals against sars-cov-2 virus. A recent study showed that there was generation of T-cell mediated adaptive immunity in response to sars-cov-2 virus in individuals with covid-19 and such immunity also helped in restricting (em-

demicity) the virus [13]. In this article, we have taken up studies in a section of population, to further elucidate the role of passive immunization, induced by sustained lockdown, in protecting the population against the sars-cov-2 infection and plausible restriction of the virus in some pockets in the population.

Methods

The present study was carried out on the data collected from different sources that include the ministry of health web site at www.myGov.in., Health bulletin of government of India and from other national and international news outlets. The data furnished in this article were from March 14, 2020 to January 25, 2021. The statistical analysis was performed by web based microsoft excel and power point programs and the correlation studies were performed using pearson correlation coefficient program. The data was considered when p value was less than 0.05.

Results and Conclusions

Briefly stated that more than two-month long ‘lookdown’ was imposed on march 25, 2020 to control the spread of virus in the population. Following complete lockdown, the lockdown was gradually relaxed in phases of ‘one month’ though some restrictions were maintained in some ‘pockets’ of the population. The implementation of lockdown had a profound effect on the progression of sars-cov-2 virus in the population affecting the spread of covid-19. The figure 1 reflects the distribution of covid-19 in the entire country from 14 march, 2020 until 25 January 2021. It was clear from the graph that number of total confirmed cases of covid-19 was gradually decreasing with time instead of showing acceleration as happened in most of the western countries. This suggested that prior protection existed in the population that helped in combating the sars-cov-2 virus. It is clear from the graph that from the time of first appearance of covid-19 in the population until the end of complete lockdown, that is up to 31 may, 2020, there was

insignificant spread of covid-19 in the population & this pattern continued even after relaxation of lockdown. However, from the beginning of 2nd week of July, 2020, the graph showed an abrupt ‘spurt’ in the number of covid-19 cases in the population. The rise in covid-19 cases continued until 3rd week of September 2020. This sudden increase in the number of covid-19 cases was due to some ‘extrinsic factors’ which have been discussed elsewhere in details [3]. However, the graph reflected that this ‘rise’ in covid-19 cases was a ‘temporary’ phenomenon and did not affect the overall slowing of covid-19 cases in the population. The sigmoid growth curve that was generated from the data is depicted in figure: 1. The graph clearly demonstrated that after 1st week of January, 2021 onwards, the growth curve began to ‘buck’ the trend of growth of covid-19. This signified that the pandemic situation was on the wane in the population. However, it should be noted that some ‘un-toward incident’ could affect a change the direction of the graph and cause it to move upwards. To curb such incident ‘prevention’ and vaccination to all in the population is need of the hour.

Since the beginning of change in number of total confirmed covid-19 cases was evident from december, 2020 onwards, as shown in figure: 1, we decided to study the percent change of covid-19 cases in the population from december, 2020 onwards. We demonstrated in earlier studies that evaluating percent of covid-19 cases in the population accurately reflects the progression of covid-19 and any abrupt changes taking place in the distribution of covid-19 in the population [1, 3]. The figure-2 reflects the percent change in total covid-19 cases from 1 december, 2020 to 25 december, 2021. The figure: 2 clearly demonstrates that the rate of covid-19 cases in the population, though showing some volatility, maintained a consistent downward trend and the percent of covid-19 cases was beginning to resist the trend line and the result was significant at $p < 0.01$.

TOTAL CONFIRMED CASES OF COVID-19 FROM 14 MARCH 2020-25 JANUARY, 2021

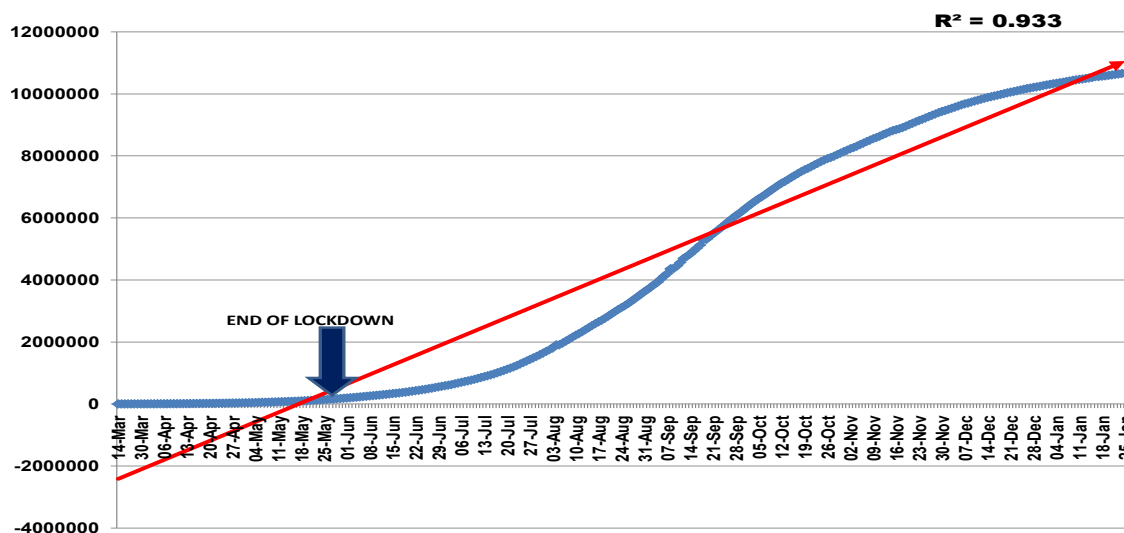


FIGURE-1

Figure 1: the figure shows the distribution of total number of confirmed covid-19 cases in the entire population from 14 march, 2020 to 25 January, 2021. The results were significant at $p < 0.05$.

PERCENT CHANGE IN TOTAL COVID CASES BETWEEN 01 DECEMBER, 2020 AND 25 JANUARY, 2021

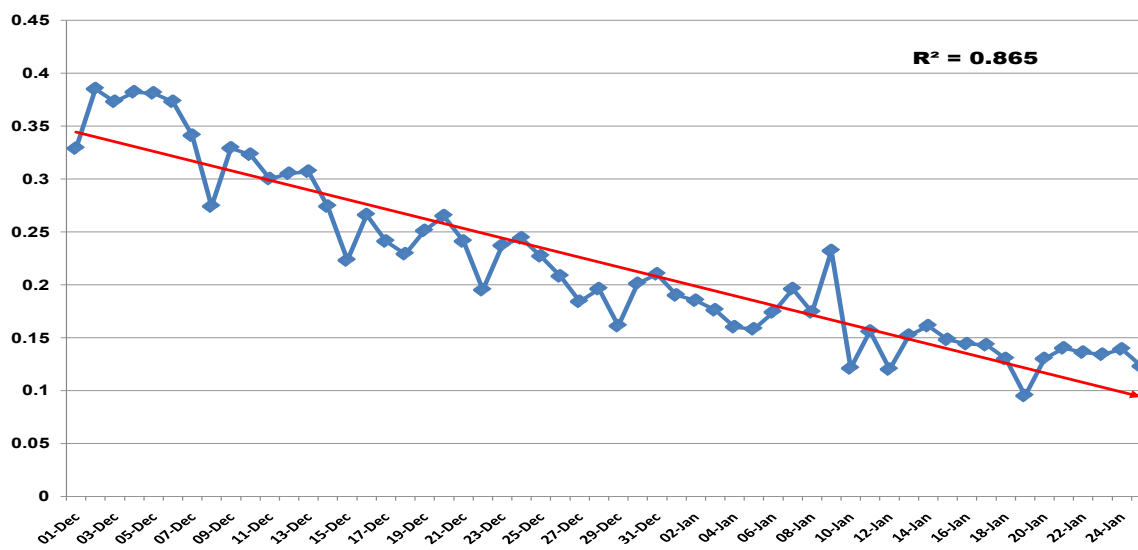


FIGURE-2

Figure 2: the figure shows the rate of change of covid-19 in the population. The trend line shows a down ward trend with $p < 0.01$.

This data demonstrated that the covid- 19 pandemic was plausibly under control and to continue maintaining such a condition, ‘prevention’ of covid-19 takes a centre stage. It is clear from various published studies that ‘masking up’ was one important factor to control the spread of covid-19 in the population. In order to understand the co-relation of ‘masking-up’ with the rate of spread of covid-19, we carried out a quick sample survey in the population to determine the number of individuals using mask when they were carrying out their outdoor activities. The survey was taken

during the month of january, 2021. The result obtained from this survey is shown in figure: 3. The study reflected that a substantial number (30%) of people, irrespective of gender, were moving around without wearing any mask to cover their face during different time period of the day. The number of people wearing mask was slightly higher during noon compared to morning hours in the population. It is plausible to assume that wearing mask did not influence the rate of covid-19 in the population when in open space.

MASKING IN THE POPULATION DURING COVID-19 PANDEMIC

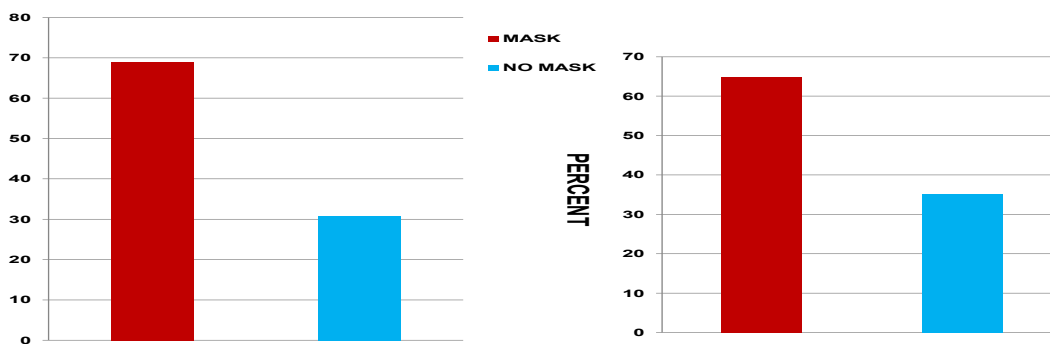


FIGURE: 3

Figure 3: the figure shows the percent of people wearing mask compared to those who were not putting on mask; during two separate time periods. The left panel represents time between 7 am-8.30 am and right panel represents time between 11 am- 1 pm.

However, this survey was undertaken locally in a small number of individuals. A wide spread survey taking into consideration other factors like gender etc. Would address the issue in a more comprehensive way. This survey did not take into consideration effect of not wearing mask in closed space with poor ventilation and other such factors. So, the importance of wearing mask in closed space

is the only way to prevent spread in small crowded place with poor air circulation. In context of our study, the conclusion could plausibly be drawn that probably there were other immunological factors which were behind the lower number of covid-19 cases in the Indian population.

The new coronavirus variants detected in United Kingdom, Brazil, and South Africa and in different states of the USA, as shown in the figure: 4, have added a new dimension in the pandemic of

covid-19 across the world. The major variant of sars-cov-2 appeared first in the UK and is designated as b.1.1.7; this variant has also been detected in Indian in january, 2021.

MAP OF DETECTED CASES OF SARS-CoV-2 VARIANTS # B 117 OR 501YV.1 AND # 501Y.2

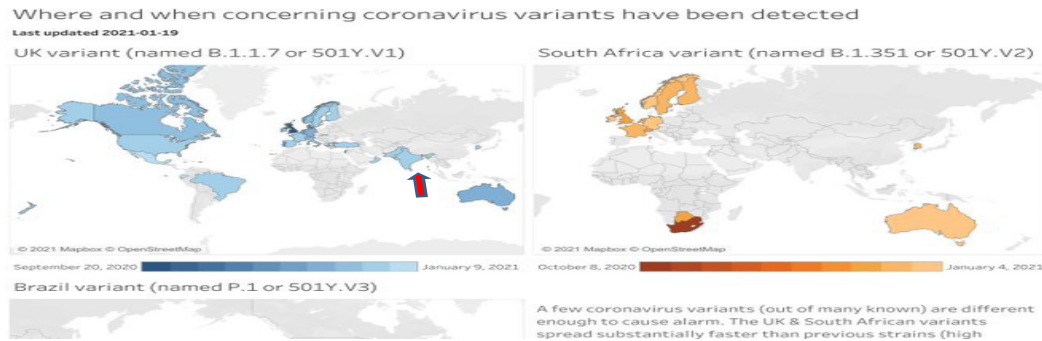


FIGURE:4

Figure 4: Distribution of new-variants of sars-cov-2 in different countries of the world including India (red arrow)- source -2021 mapindex@opensourcemap).

The new variant strain b1.1.7 is more contagious than the original strain of sars-cov-2 that originated in wuhan district of china. As per the US centres for disease control and prevention (cdc), the new, more contagious variants are likely to accelerate the spread of the virus. Multiple lines of evidence indicated that b.1.1.7 is more efficiently transmitted than the other sars-cov-2 variants and it has potential to influence the trajectory of covid-19 in many countries. It was also suggested, “b.1.1.7 prevalence is initially low, yet because it is more transmissible than the older form, the b.1.1.7 strain may become the predominant variant in usa, in march, 2021”. However, in India though the strain had been detected in the population more than a month back, it was unable to spread in high frequency in the population as it has done in the united kingdom and some other countries. The total number of people infected with the b.1.1.7 variant in India has been observed to be comparatively

modest during the month of january, 2021 (figure: 5). The presence of modest number of UK variant b.1.1.7 in the population implies that the new UK variant is facing resistance like the older strain faced during lockdown. It appears that ‘immune protective mechanism’ that protected the Indian population against sars-cov-2 is also preventing the spread of the variant b.1.1.7 presently circulating in the population. This is perhaps better reflected from figure: 6 which depict the percent of covid-19 cases infected with the b.1.1.7 variant strain during the month of january. The result indicated that though there was high volatility, the trend line in the percent of covid-19 cases (UK strain) among the population showed a downward trend. The high level of volatility is reflected in the r^2 value of 0.385. However, the growth curve appears to have taken a flattened nature from 21 january, 2021 onwards.

TOTAL NUMBER OF COVID-19 CASES INFECTED WITH UK VARIANT OF SARS-CoV-2 DURING JANUARY, 2021

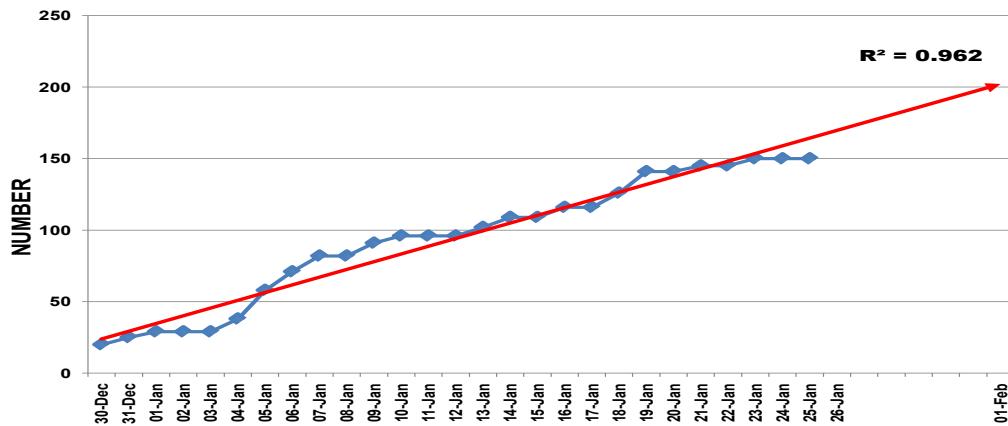


FIGURE: 5

Figure- 5: the total number of covid-19 (UK variant) in the entire population. The trend line shows an upward trend. However, the actual number of cases appears to have slowed down after 25 january, 2021.

When the percent change in previous covid-19 cases (wuhan-strain) was correlated with the percent change of covid-19 cases (b.1.1.7 -UK -strain) during the entire month of january,

2021, it was observed that there was a non-significant correlation between the two variables (figure-7).

PERCENT CHANGE IN VARIANT CASES OF COVID-19 DURING JANUARY, 2021

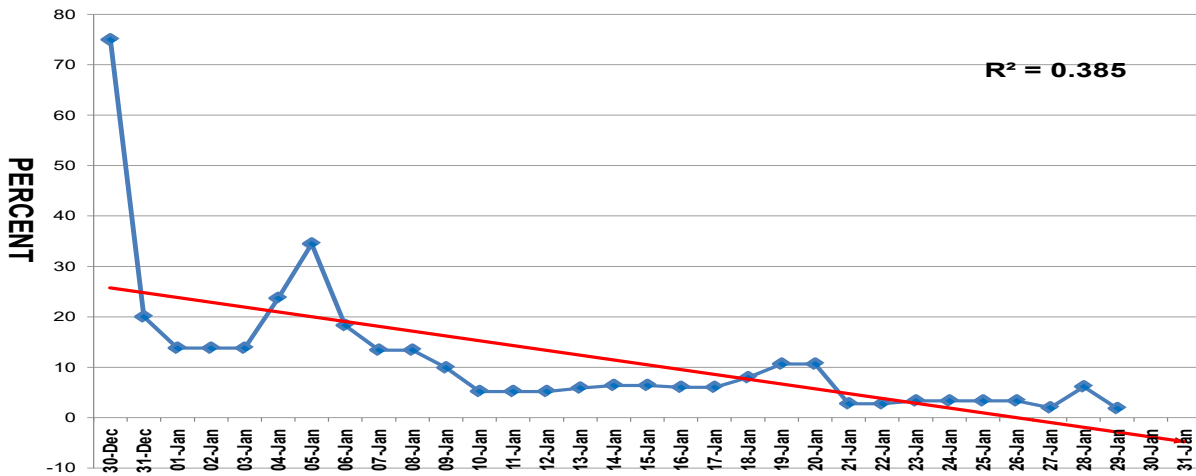


FIGURE:6

Figure- 6: the percent of UK variant of covid-19 (b.1.1.7) in the entire population. The trend line shows there is a gradual decrease in the percent of covid-19 cases though it is not significant at $p < 0.05$.

CORRELATION BETWEEN THE RATE OF COVID-19 IN THE ORIGINAL STRAIN AND UK-VARIANT OF SARS-CoV-2

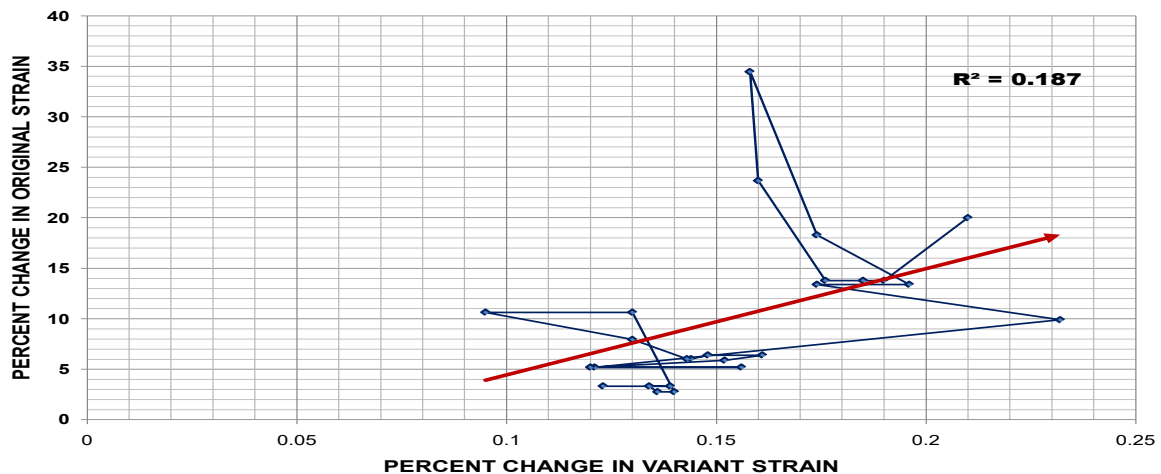


FIGURE : 7

Figure- 7: the correlation between percent change of covid-19 cases infected with old and new strains of sars-cov-2 (b1.1.7) did not show any correlation. The two variables appears to be independent of each other.

Our previous studies reflected that in spite of initial volatility in the number of covid-19 cases following complete lockdown, the percent change of covid-19 cases stabilised from the second week of May 2020 and we had concluded that the Indian population could be having protective immunity against covid-19 [1-6]. We postulated that lockdown induced passive entry of the live attenuated virus into the subject, was able to actively generate immune

response in the host but was unable to cause substantial fatality from covid-19 (6). Along this line, it has been reported that when individuals are vaccinated with live attenuated yellow fever virus, there was very low mortality [7]. This finding corroborates with our contention that lockdown induces live attenuation of the virus such that the virulence of the virus is lost resulting in very low mortality due to covid-19 (1.4%).

In the present study the total number of covid-19 cases reflected an 's-shape growth curve (figure: 1) but it was not converted into a 'j' curve as usually happens. A typical s-shaped growth curve (sigmoid growth curve) increases slowly initially, in a positive acceleration phase; then increases rapidly approaching an exponential growth rate as in the j-shaped curve. In this study, though there was a belated increase in covid-19 cases from September, 2020 onwards, there was no exponential growth of covid-19 cases in October, 2020 onwards. On the contrary, a gradual decline in total number of covid-19 cases was registered from the end of october, 2020. In order to further verify the nature of control of covid-19,

we evaluated the total number of active cases of covid-19 in the same time period from when there was an increase in total number of covid-19 cases as demonstrated in figure: 1. The evaluation shows that there was an increase in the total number of active cases from 25 September, 2020 concomitant with the observed increase in total number of confirmed cases of covid-19. However, a dip in number of active cases of covid-19 starting from October 2020 onwards was noticed which continued until 24 november, 2020. Again, there was an increase in the number of active cases until 02 december, 2020 and thereafter a downward trend was observed until 25 january, 2021 (figure: 8).

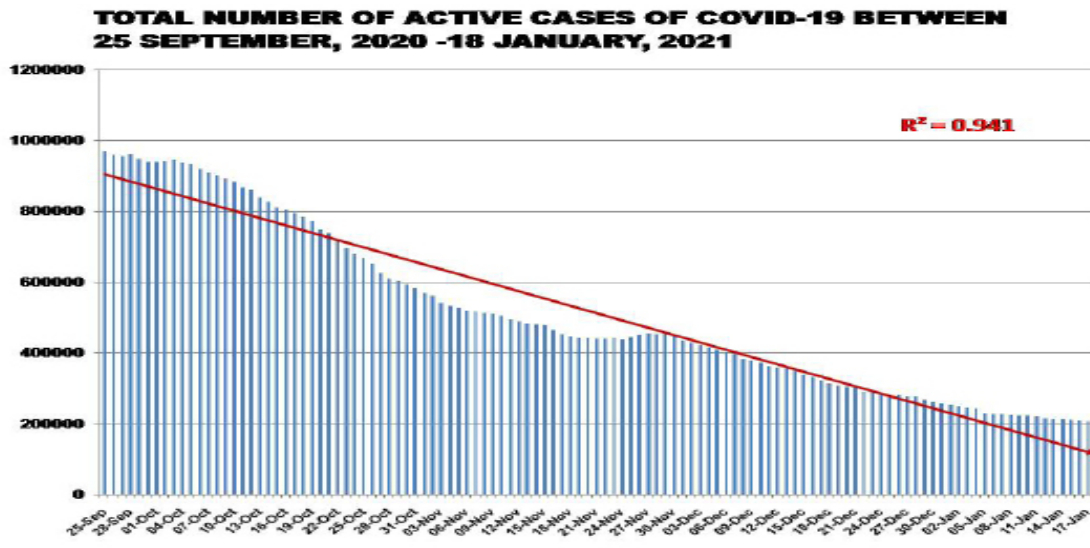


FIGURE-8

Figure 8: the rise and decline of active cases of covid-19 (old, wuhan, strain) between 25 september to 25 january, 2021. The result was highly significant with $p < .001$.

The trend line in the graph clearly demonstrated a strong and significant downward trajectory. The rise and wane of total number of active cases beginning from 20 october, 2020 in the population, signals a possible beginning of the end of epidemic of covid-19 in the population.

The Study further established the fact that live attenuated sars-cov-2 virus served as an effective passive vaccine during lockdown. The live attenuated sars-cov-2 virus retained the capability to stimulate immune response in the host but could only produce a mild or subclinical form of covid-19, which did not have serious impact on the health of affected individuals leading to their quick recovery and thereby lowering the number of active cases and mortality. On India context, it is required to be mentioned that different vaccines have been used in India since 1893 to protect individuals against different bacterial/viral diseases [8]; such vaccination strategy appears to have played an useful role in protecting the population against sars-cov-2 infection. A recent example of immune response to sars-cov-2 after immunization with unrelated vaccine has been seen for vaccination with measles-mumps-rubella (mmr) vaccine, which protected individuals from developing covid-19 [9]. A more recent study with sars-cov-2 has corroborated such an outcome, wherein blood collected from sars-cov-1 infected individuals in the year 2015, was capable of mounting an immune response, in vitro, against sars-cov-2 infected cells in 2020 without

being exposed to sars-cov-2 [10]. Studies have also shown that individuals with covid-19 have cross-reactive t helper cells that are capable of recognizing & responding faster to the sars-cov-2 virus suggesting that t cell mediated adaptive immunity is crucial for long term immunity to virus [11, 12]. Our findings reported in this article, is in line with some recent data, which reflected that the some pockets in the population where antibody against sars-cov-2 was detected had minimal number of active covid-19 cases [6].

The above discussion clearly demonstrates that there appears to be a gradual transition from pandemic to endemic state of covid-19 in the population and the sars-cov-2 variant b1.1.7 detected in India, did not appear to influence the prevailing downward trend of covid-19 in India.

However, it is to be noted that the UK variant has mutations which increases the ability of the outer spike protein to efficiently bind to the ace-2 receptor bearing cells lining the nasal tract; this makes the UK variant more contagious and gives the virus the ability to re-infect people who are already sick with covid-19. One aspect is clear from various studies that people infected with the UK variant (b.1.1.7) are about one third more likely to die than similar people infected with the pre-existing viral lineages, that is, they have a more mortality rate than the older strain.

In conclusion, this study demonstrated that lockdown not only

played a major role in controlling the immediate spread of covid-19 in the population but also lockdown assisted in attenuation of sars-cov-2 virus. The live attenuated virus acted as a potential vaccine and assisted in passive immunization of the population against covid-19.

The gradual wane of active cases of covid-19 throughout the country implied the plausible end of pandemicity of covid-19. At present the virus appears to be restricted to some pockets in the population, which reinforce the importance of behavioural containment for continuing vaccination in the endemic phase. The knowledge about specific immune responses generated to maintain endemicity would help in further improving the strategy of vaccination [13]. Once the endemic phase is reached and with primary exposure, during childhood, to sars-cov-2, would make the sars-cov-2 no more virulent than the common cold virus.

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