# Near Complete Protection Against Covid-19 in a Section of Population: Implication of Lockdown on Development of Passive Vaccination to Counter SARS-CoV-2 Attack

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## Abstract

COVID-19 is fast spreading around the globe in a highly contagious manner. Until date there are no therapeutic agents/vaccines developed which could control this highly infectious virus from spreading among human population. During early stage of COVID-19, stringent Lockdown was implemented throughout India on 25 March, 2020. Our earlier findings reflected that early introduction of complete Lockdown significantly controlled the spread of COVID-19 in the population immediately after Lockdown. It was hypothesized that immune response was responsible for the control of the spread of COVID-19. To further evaluate the role of immune response/passive vaccination, data from COVID-19 positive/recovered individuals in eight states were assessed for the month of December, 2020. The results from our study reflect that in all the eight states, there was marked decrease in the number of confirmed COVID-19 cases after Lockdown, with one region recording no COVID-19 cases. All the states studied had very low number of active cases; the minimum number being two even after such a long period from the start of this disease. A negative correlation between number of recovered individuals and number of active cases of COVID-19 was noted. Here we hypothesize that passive immunization may have played a significant role in controlling SARS-CoV-2. It could be inferred from this study that implementation of prolonged Lockdown was able attenuate the virus and create an environment for the development of passive immunity in the section of population studied.

**Keywords:** COVID-19; Lockdown; Active cases; Recovery; Passive immunity.

## 1. 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), which is associated with high mortality rate. A new strain, more virulent than the previously known strains, has been identified recently in United Kingdom and now it has spread to other European countries. The only hope to combat this virus is by developing effective immune response against the virus. This has highlighted the need for developing effective vaccination strategies to fight this menace.

The alarming nature of the spread of virus during early stage, prompted the Authorities to call for a country wide complete Lockdown from March 25, 2020. The complete lockdown implemented country wide was relaxed in a phased manner from 1st June, 2020. In a series of papers, it has been shown by us that a) Evaluating percent change of COVID-19 in the population was a better way to assess the progression and alternation, if any in the spread of COVID-19 in India; b) Due to implementation of timely Lockdown, there was an increase in doubling time of COVID-19 in the population; c) Due to implementation of timely Lockdown, there was slowing down in the the rate of growth of COVID-19 & d) Due to implementation of timely Lockdown, recovery from COVID-19 following Lockdown was on the rise which plausibly reflected emergence of protective Immunity against SARS-CoV-2 in the population [1-6]. It was hypothesized that among the people there could have been existence of prior immunity which were able to cross-react with SARS-CoV-2 and provide protection against COVID-19. Now, we hypothesize that additionally, effective Lockdown may have slowed down the viral progression (attenuation) which aided in the development of passive immunization against SARS-CoV-2. Recent study published in the journal Science does show generation of adaptive immunity in COVID-19 individuals [7]. 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.

**METHODS:** The present study was carried out on the data collected from different sources that include the Ministry of Health (Health bulletin) Government of India and from other National and International News outlets starting from March 15, 2020 until March 25, June, 2020 as also described previously by us Chakravarty [1],

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Chakravarty [2], Chakravarty [3]. The Statistical analysis was performed by Microsoft Excel and power point programs and the correlation studies were done using Pearson Correlation Coefficient program.

## 2. Results and Conclusions

The present study was carried out on the data collected from Indian News portals pertaining to COVID-19 cases, during the Month of December, 2020. Briefly stated that a two month Lookdown imposed on March 25, 2020 and ending on May 30, 2020 had a profound effect on the progression of COVID-19 henceforth. From 1st June 2020 onwards the Lockdown was 'unlocked' in phases of one month and presently some restrictions are still in place. The Figure 1 reflects the distribution of COVID-19 cases in the entire country on 10th December 2020. The Figure: 1A shows the number of individuals in different groups as stated in the graph. It is clear from the graph that most of the confirmed cases recovered from COVID-19 suggesting protection exists in the population against COVID-19. The percent change in recovered and active as compared to confirmed cases is shown in Figure: 1B. The percent of total recovered cases was 94.7% and that of Active cases was 3.81% as compared to total confirmed cases. The low percent of active cases was significant.

**Figure-1.** The figure 1 shows the distribution of total confirmed, total recovered, total active & total deaths from COVID-19 in the entire country
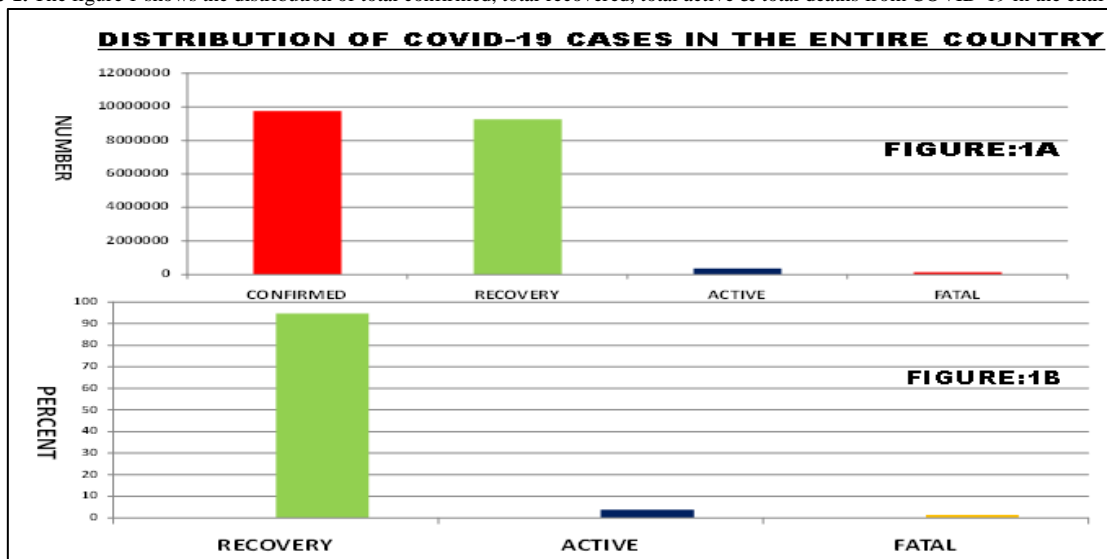


The total number of COVID-19 cases in different states of India between 1st December, 2020 and 10th December, 2020 is shown in Figure: 2. One of the regions, the territory of Lakshadweep, has not recorded any cases of COVID-19 until date showing a complete protection against COVID-19. Out of the eight states shown in the figure, four states recorded below 5000 cases of COVID-19 from the first case recorded in January of 2020. The maximum number of COVID-19 cases among the given states, was recorded in Manipur which recorded ~27000 cases in last 12 months; the number maintained more or less flattened nature for the ten days with $R^2 = 0.986$. On the contrary, there are four states which have $\leq$ 5000 cases of COVID-19 with slightly higher $R^2 = 0.950$. The results clearly indicate that all the states mentioned in this study, have maintained a constant level of COVID-19 cases and R value suggests all the states shown in the graph have maintained a flattened nature, showing a significant trend.

**Figure-2.** The Figure depicts the total number of COVID-19 cases during the period of December 01 – December 10, 2020. All the states have recorded a flattened curve with $R^2$ value between 0.987 and 0.950 rspectievely. The region of 'Dadra' is inclusive of Dadra and Nagar Haveli and Daman and Diu
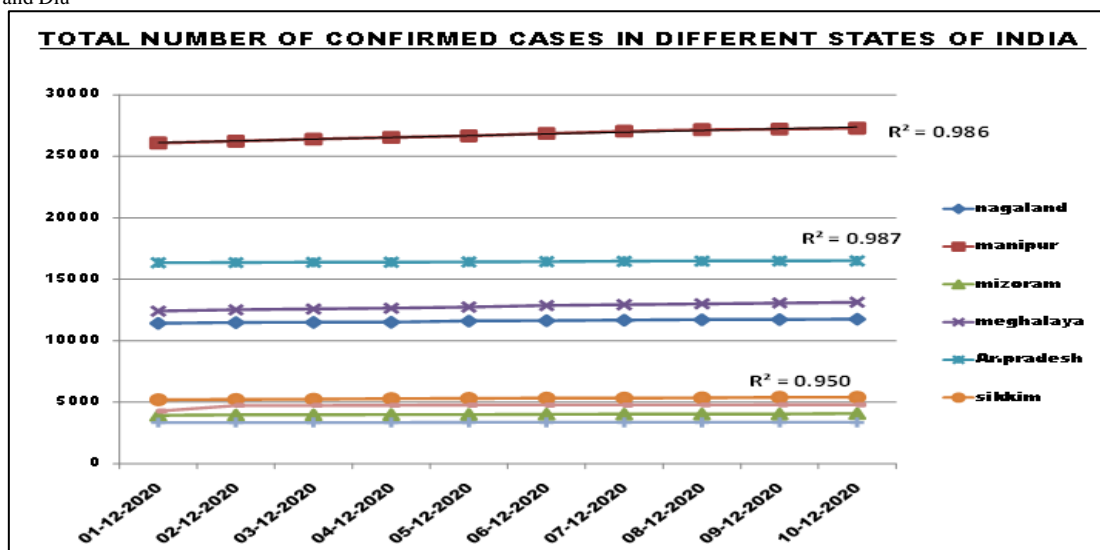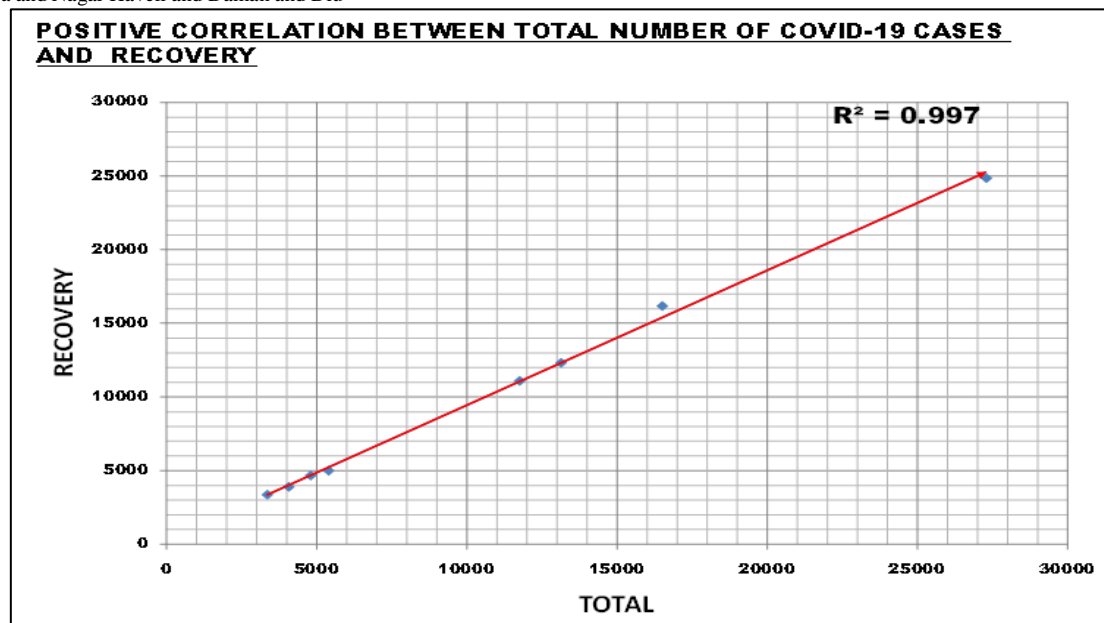
This significant control in the number of active cases of COVID-19 in these states as shown in the figure is due to higher number of patients recovering from COVID-19 (SARS-CoV-2 +ve). These patients recuperated from COVID-19 (both Symptomatic and Asymptomatic cases) without intervention with any kind of vaccine or any specific treatment available for this disease. The distribution of recovered patients in different states shown in Figure: 3, reflects that recovery number was very high in all the states with R² value between 0.752 and 0.988 respectively.

**Figure-3.** The Figure depicts the total number of patients recovered from COVID-19 during the period of December 01 – December 10, 2020. All the states have recorded a consistent higher number of recovering/discharged individuals during the period with R² value between 0.988 and 0.752. The region of Dadra is inclusive of Dadra and Nagar Haveli and Daman and Diu.
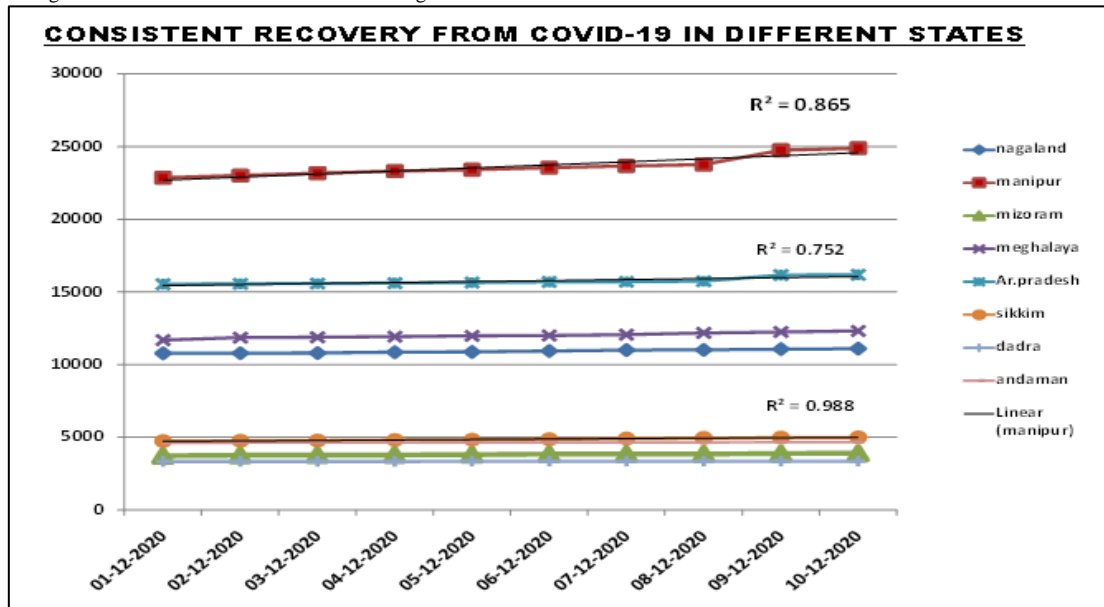


Perhaps the best result was observed in Andaman, Mizoram and Dadra among others with R² value of ~ 0.988. No volatility was recorded in any of the states during this period. In order to determine the association between the total number of confirmed cases and the number of recovered/discharged cases on 10 December, 2020, a correlation study was evaluated. The Figure: 4 show a strong positive correlation between the total number of confirmed cases and the number of recovered/discharged cases with value is 0.997 suggesting as the number of Total confirmed increases the number of recovery will also increase suggesting an underlying mechanism is in place among the population, which is providing protection against the development of severe COVID-19.
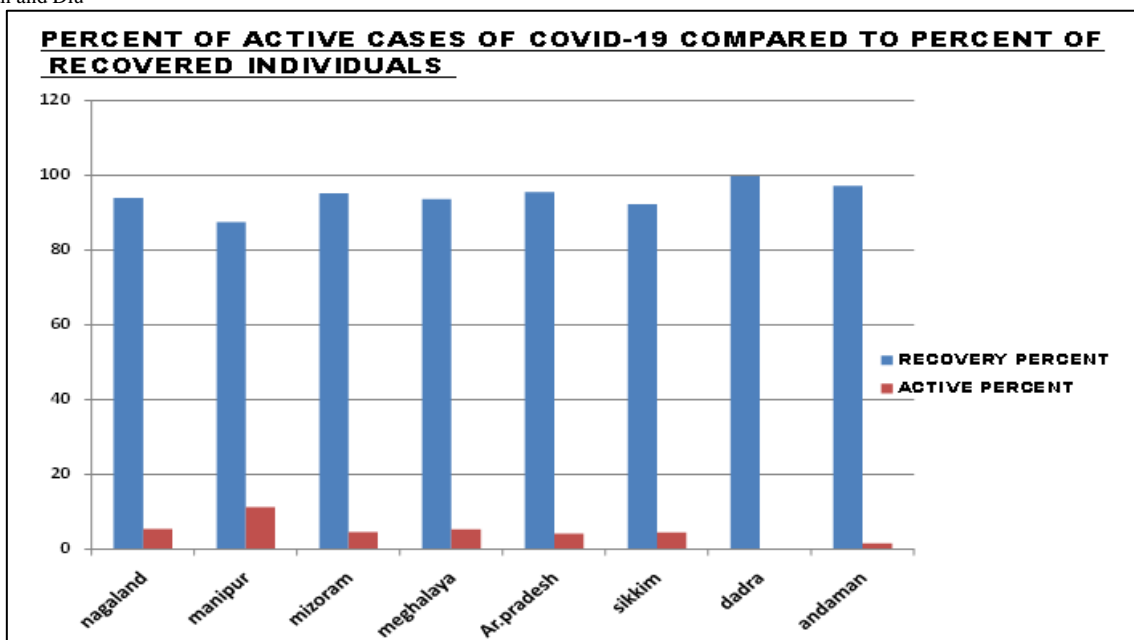
**Figure-4.** The Figure depicts the correlation between the Total number of confirmed cases and total number of recovery from COVID-19 in different states on 10 December, 2020. A positive correlation exists between the two variables with R²=0.997. The region of 'Dadra' is inclusive of Dadra and Nagar Haveli and Daman and Diu



Another interesting aspect of the significant increase in the number of recovery/discharged individuals was also reflected to influence the number of active cases as shown in Figure: 5. The figure illustrates the percent of Active cases as compared to that of recovered cases in different states. The low percentage of active cases in all the states as illustrated in the graph, especially Dadra and Andaman Islands, point to gradual waning of the disease due to

weakening of the virus.  Most states recorded a significant rise in recovered cases (above ~90%) & reduced percent of active cases (below ~6%). However, Dadra & Nagar Haveli and Nicobar Island and Andaman Islands showed nearly ~100% recovery with less than 1% of Active cases; while island of Lakshadweep had no known cases of COVID-19. Further studies were undertaken to evaluate the association between active and recovered cases of COVID-19. The correlation study reflected that

**Figure-5.** The figure depicts the rate of recovery (percent) and rate of active cases of COVID-19 in different states as on 10 December, 2020. In some states there is 100% recovery with nearly no active cases of COVID-19. The region of Dadra is inclusive of Dadra and Nagar Haveli and Daman and Diu



Correlation study was conducted which is depicted in Figure: 6. The correlation coefficient graph was evaluated for data obtained on 10 December, 2020, which reflected that there was a negative correlation between the two variables, though presently there seems to be a weak correlation, with $R^2$ value of 0.553. However, this points to the fact that active cases of COVID-19 are waning with time without any intervention; signifying an immune based response against SARS-CoV-2 (FIGURE-6A and FIGURE- 6B). The two figures show the number of Active cases of COVID-19 in different states on 10 December, 2020. The downward trend is observed in all the states and a trend line shows a weak correlation among the states (1-Nagaland; 2-Manipur; 3- Mizoram; 4-Meghalaya; 5- Arunachal Pradesh; 6- Sikkim; 7-8- Dadra Nagar Haveli and Daman & Diu) with $R^2$ value at 0.371)

**Figure-6.** A and B: The Figures show the mortality in different states (1-Nagaland; 2-Manipur; 3- Mizoram; 4-Meghalaya; 5- Arunachal Pradesh; 6- Sikkim; 7-8- Dadra and Nagar Haveli and Daman and Diu) with $R^2$ value at 0.371
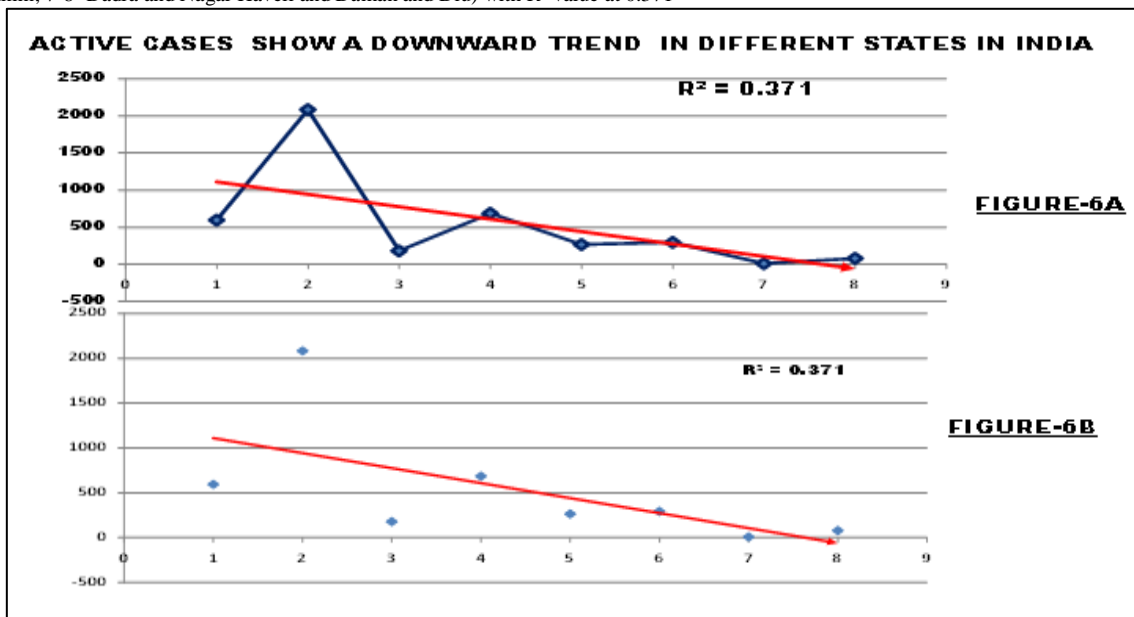


Another interesting finding from this study was there was a negative correlation between the active cases of COVID-19 and those showing recovery from the disease. The Figure-7 reflects that the percent of active cases declined with increase in the number of recovered cases. The correlation between the two variables showed a strong correlation with $R^2$ value at 0.926.

**Figure-7.** The scatter plot describes a NEGATIVE correlation between percent of Active cases of COVID-19 and percent of recovered patients
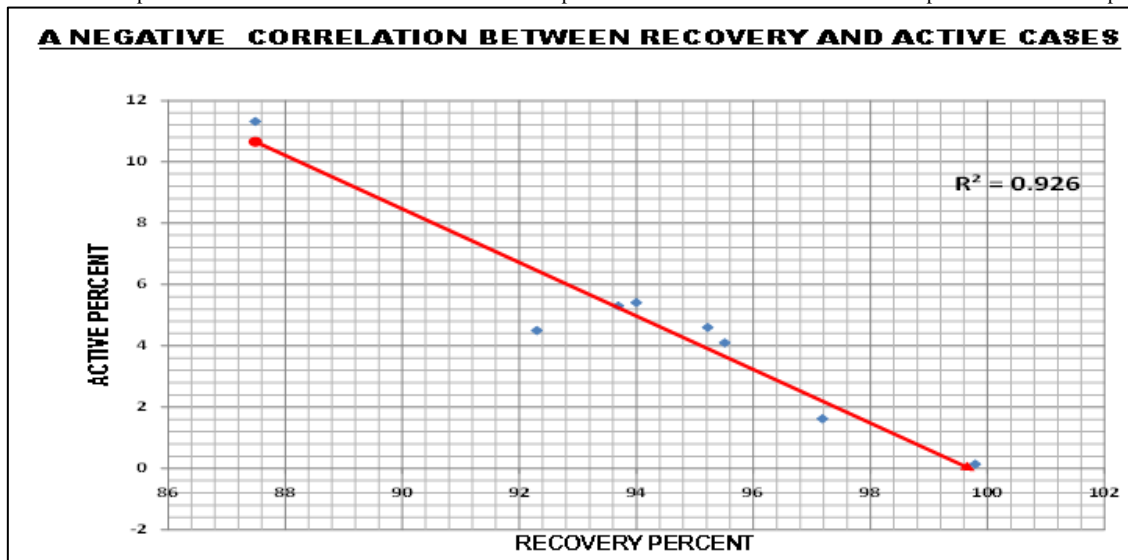


Recent studies have shown that 'natural immunity' in the Indian population is better than that of the western countries including that of the USA. The lower threshold of immunity in the western countries was owing to the nature of life style, making them vulnerable to infectious diseases. The lower level of immunity among the population may have contributed to higher mortality rate in the USA compared to that of India. In this study, the mortality in all the states between 01 December, 2020 and 10 December, 2020 are depicted in Figure: 8. The maximum number of fatality was recorded in the state of Manipur and the minimum number was recorded in Dadra & Nagar Haveli, Daman & Diu. However, the trend of Mortality in

**Figure-8.** The Figure shows the mortality from COVID-19 in different states from 01 December, 2020 to 10 December 2020
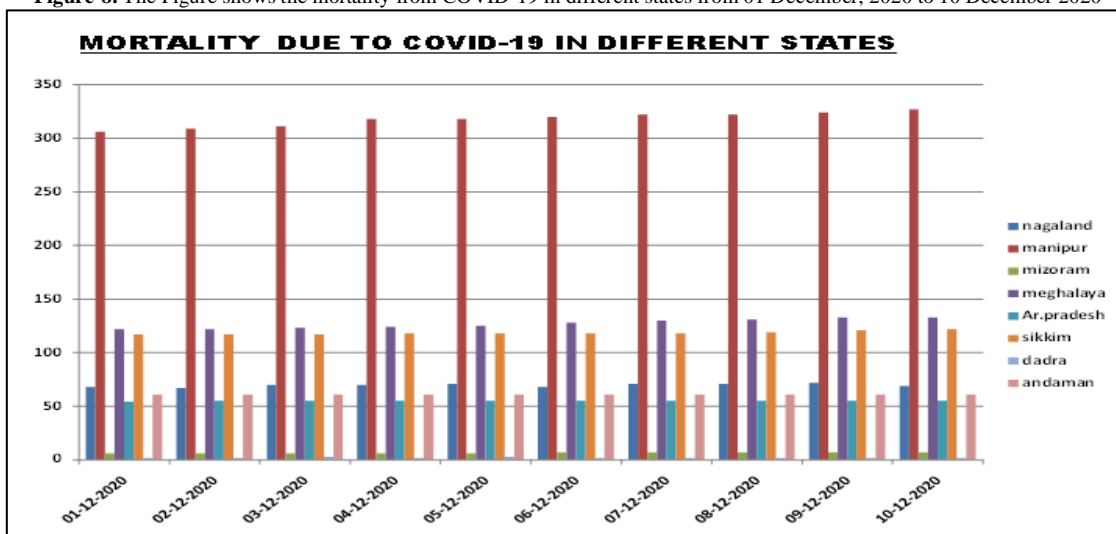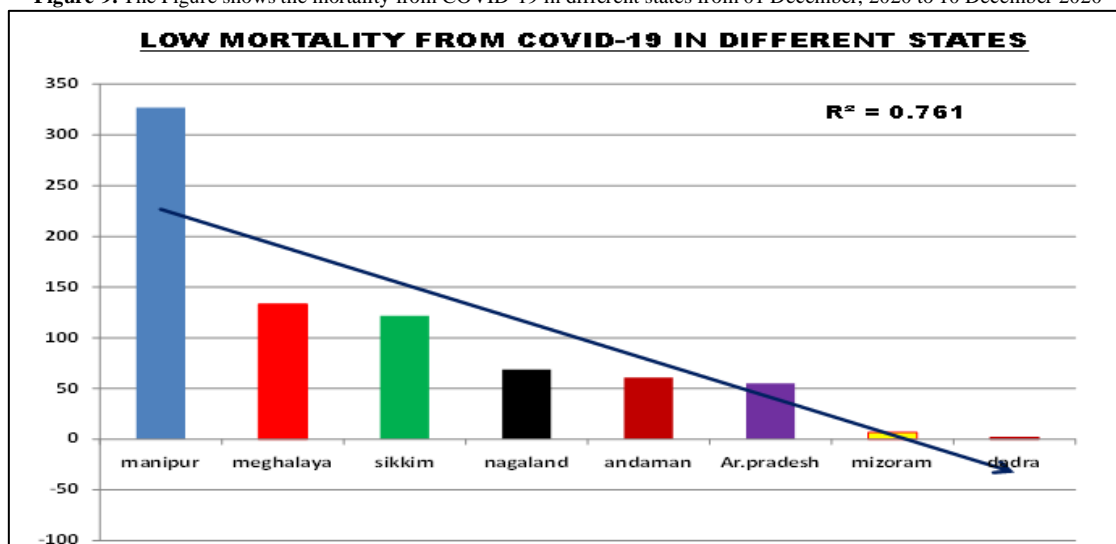


**Figure-9.** The Figure shows the mortality from COVID-19 in different states from 01 December, 2020 to 10 December 2020

All the states was observed to be downward with R² value at 0.761.

Our previous studies have reflected that in spite of initial volatility in the rate of COVID-19 cases following complete Lockdown implemented at the end of March, 2020, the rate stabilised from second week of May, 2020. Thereafter, the growth curve maintained a flattened nature and early results also suggested a gradual increase in the number of Recovered/disease-free individuals with time [1-6], we therefore, hypothesized that the Indian population could be having protective immunity against COVID-19 and imposing a complete Lockdown early only accelerated this process by gradually causing attenuation of SARS-CoV-2 in the population (4). We extended our study further to evaluate the significant drop in active cases and the increase in recovery from COVID-19, which in some regions reached up to 100%. The results obtained in this study, point to a positive role of immunity in preventing the spread of the disease among the population. It is plausible that Lockdown caused an abrupt break in the chain of its mobility, and along with the prevailing adverse temperature required for its spread, for a prolonged time period weakened the virus, causing **attenuation of SARS-CoV-2.** The passive entry of the attenuated virus caused immune response in the host without the virus causing COVID-19. It was also observed in a small group, that inhaling vapours of 70% alcohol from finger tips, was able to provide relief from mild head ache (a symptom of COVID-19). It is plausible that the vapours from 70% alcohol help in attenuation of the virus, if any, and aid in passive vaccination to stimulate specific immune response.

**Passive immunity** can occur naturally, such as an infant receiving a mother's antibodies through the placenta or breast milk, or artificially, wherein antibodies (gamma-globulin) are administered by injection.

During passive immune response, it usually takes some time to develop immunity upon disease exposure.

Weakened, or attenuated, vaccines (herein the SARS-CoV-2) lost the ability to cause serious illness but retained the ability to stimulate immunity. Under such condition it may have produced a mild or subclinical form of COVID-19 without having a serious impact on the affected individual. This is plausibly the reason for high percentage of recovery with very low mortality seen in the population studied.

Attenuated vaccines used so far to treat pathological conditions include those for measles, mumps, polio (Sabin vaccine), rubella etc. Through vaccination, small pox was eradicated worldwide by 1980, & polio also declined by ~99% as shown in Figure: 10 (Encyclopedia Britanica Inc.).

**Figure-10.** The figure shows the effect of vaccines on controlling the dreadful diseases like Diphtheria, Polio and measles in a population
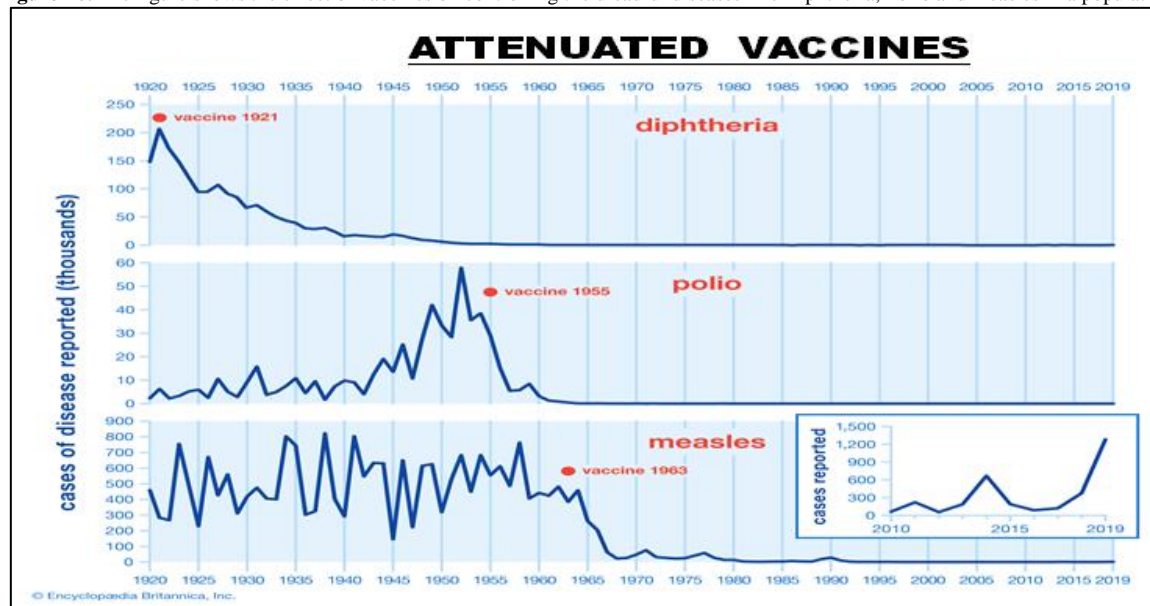


Vaccines against viruses provide better immune protection, since, unlike bacterial infections, viral infections do not respond to antibiotics. But once it does so, the protection can last for an entire lifetime.

The Coronavirus, SARS-CoV-2, could have been weakened due to persistent Lockdown and non-conducive temperature during early part of 2020 was a better antigen for the immune response to respond. Inactivated vaccines also elicit an immune response, but the response often is less complete than with weakened (attenuated) vaccines; as such they are not as effective at fighting infection as those made from attenuated microorganisms. The rabies, polio, some forms of influenza, measles, mumps, and rubella (MMR), varicella (chickenpox) vaccines are example of Killed (inactivated) vaccines.

The population was passively vaccinated against attenuated form of SARS-CoV-2 during the prolonged and sustained Lockdown. Literature available in this regard, presumed that measles-mumps-rubella (MMR) vaccine could be responsible for such protection against COVID-19 [7].

Some interesting facts about COVID-19 in this study are: (a) Majority of the people in the population were largely spared from severity of the disease; (b) COVID-19 related death rates were very low in all the states showing a downward trend with R² value= 0.761; (c) Some people, in spite of prolonged close contact with COVID-19 positive people, never become positive themselves and (d) Many who tested positive for SARS-CoV-2 by RT-PCR test remained asymptomatic.

From our evaluation, in addition to passive vaccination occurring due to Lockdown, a large section of the population was immune against SARS-CoV-2 as they may have been immunized against related/unrelated bacteria during early childhood that could have conferred protective immunity against COVID-19. The Table-1 lists the different vaccines used in India since 1893 against different unrelated bacteria/virus which could have aided in protection against SARS-CoV-2 [8]. A recent study has shown that blood from SARS-CoV-1 patients collected in 2015 was able to mount immune response against SARS-CoV-2 [9].

**Table-1.** The table shows the different vaccines used in India during the last century to vaccinate majority of the population at a younger age. Such vaccines have been effective in controlling some dreadful disease [8]

### HISTORY OF VACCINATION IN INDIA

| Year | Milestone |
|------|-----------|
| 1893 | Efficacy trials on cholera vaccine conducted in Agra, India |
| 1897 | First plague vaccine discovered by Dr Haffkine |
| 1904/1905 | First vaccine research institute established at Kasauli, Himachal Pradesh |
| 1907 | Pasteur Institute of India, Coonoor, manufactured neural tissue anti-rabies vaccine |
| 1920-1939 | DPT, DT and TT vaccine became available in the country |
| 1940 | Drug and Cosmetics Act enacted |
| 1948 | BCG vaccine laboratory set up in Guindy, near Madras (Chennai) |
| 1951 | Liquid BCG vaccine became available in India as part of mass campaigns |
| 1965 | Live attenuated freeze dried smallpox vaccine became available |
| 1967 | Freeze dried BCG vaccine became available<br>OPV became available in India |
| 1970 | The first time in India indigenous Oral Polio Vaccine Trivalent (Sabin) was developed and produced |
| 1980s | Indigenous measles vaccine production started |
| 1984 | Inactivated polio vaccine first produced in India (later on production stopped) |
| 1985/1988 | AEFI surveillance system established and initial guidelines were released |
| 1989 | Indian Vaccine Company Limited (IVCOL) and Bharat Immunological and Biological Limited (BIBCOL) were set up as public private joint venture companies |
| 1997 | First ever recombinant DNA hepatitis B vaccine developed in India |
| 2006 | Guidelines for clinical trials by Indian Council of Medical Research (ICMR) |
| 2009 | Three Indian manufacturers developed pandemic flu (Novel H1N1: 2009) vaccine |
| 2010 | National Pharmacovigilance Programme of India launched<br>Meningitis A vaccine for African Meningitis Belt licensed and successfully used in campaigns in Africa<br>Indigenously researched bivalent oral cholera vaccine developed and licensed in the country |
| 2012 | An indigenous 'inactivated JE vaccine' licensed in the country.<br>Indian manufacturer acquired capacity to produce inactivated polio vaccine |

*Source* : Refs 4, 6, 27-30
DPT, Diphtheria, pertussis and tetanus; DT, diphtheria and tetanus; TT, tetanus toxid; OPV, oral polio vaccine

In this direction, a recent study has shown that mumps titers related to the MMR II vaccine are significantly and inversely correlated with the severity of COVID-19-related symptoms [7] which supports our hypothesis of existence of unrelated prior immunization resulted in such swift & unexpected control of COVID-19 in spite of no active vaccination or medication administered for treatment of COVID-19. Further corroboration for such robust immune response has come from some studies which demonstrate that i) some persons respond to the coronavirus through a T cell mediated immune response; ii) Blood samples from 2015 exposed to flu virus, showed a T cell response to SARS-CoV-2 in 2020; and iii) more recently study showing that some immunized with other pathogens had cross-reactive $T_h$ cells that were capable of recognizing & responding faster to the SARS-CoV-2 virus [9-11]. This is reflected in the waning of active cases in all the states. The Figure: 11 shows the percent of active cases compared to the confirmed COVID-19 cases in five states as on 31 December, 2020. The result shows that active cases are below ~4% even after 12 months of first infection reported.

**Figure-11.**
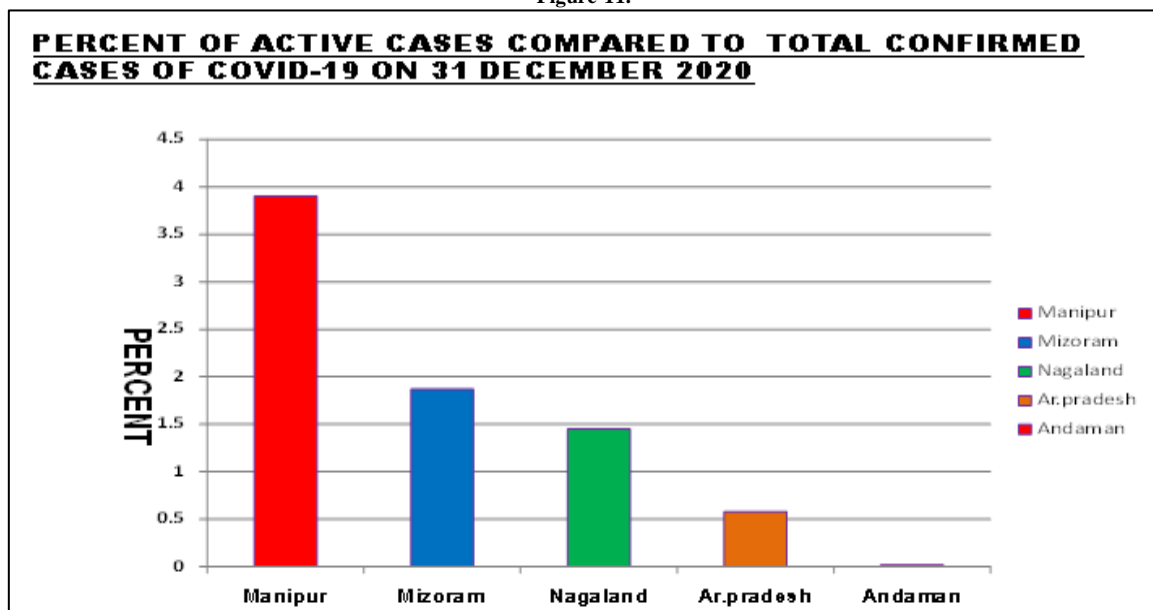
In conclusion, considering the data furnished and analyzed for eight states during the month of December, demonstrates that Lockdown played a major role not only in controlling the immediate spread of COVID-19 in population of the eight states but also it assisted in passive vaccination against SARS-CoV-2 for ensuring a long term protective immunity for COVID-19 among the population. Further to this our data also supports our hypothesis that Herd immunity, also called herd protection may have set in which is causing resistance to the spread of COVID-19 within the population as reflected in the gradual decrease in the number of confirmed cases of COVID-19. The increased number of recovery from COVID-19 also suggests an indirect protection to those few who may not be immune to the disease.

# 3. Abbreviations: Not Applicable
# 4. Declarations
1. Ethics approval and consent to participate: Not Applicable
2. Consent to publish: Yes
3. Availability of data and materials: From public domain [1-3].
4. Competing interests: No competing interest
5. Funding: No funding was available for this study
6. Authors' Contributions: Full

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