A Simple Method for Detecting Early the Rate of Progression of COVID-19 Following Intervention in Indian Population

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Abstract

COVID-19 (SARS-Cov-2) is spreading around the globe in a highly contagious manner. China has shown the way to halt progression of the disease by totally sealing Wuhan from rest of the country where it first appeared, but they could not prevent local spread resulting in more than 4000 deaths in a short period of time. India, taking lessons from china, ordered National Lockdown at an early stage when the positive COVID-19 cases were ~390. However, it was difficult to determine the effect of intervention on the spread of the disease. We have demonstrated for the first time a simple method for ascertaining the rate of progression of COVID-19 before and after intervention. This has appeared as a preprint (1). The study showed the after two interventions the rate of COVID-19 slowed down and maintained a flat curve when plotted in a percentage graph in a diverse population of India. Such knowledge could assist to frame further strategies to prevent community spread of COVID-19 and save human lives.

Keywords: Covid-19; Intervention; Progression; Percent graph-monitoring; Immunity.

1. Introduction

The SARS-COV-2 is a novel coronavirus having its origin in Wuhan district of China during December 2019. Its spread in china and rest of the world has caused mayhem during the last 3 months, bringing the entire world to its knees. 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; making it imperative to develop tough strategies for prevention of its spread among the population.

Coronaviruses 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 the human population.

The new coronavirus (SARS-CoV-2) 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. This time the virus started its journey in Wuhan, China and spread like wild fire and took thousands of lives. Overwhelmed by the enormity of the disaster even WHO/UN along with China downplayed the spread of virus through human to human contact when it was brought to their notice in December by a group in Taiwan. As a result, the novel Coronavirus, SARS-CoV-2 was allowed to easily spread all over the world in short period of time through international flights and lack of monitoring for early virus-symptoms at the point of entry and cause devastation in the local population.

The disaster prompted a massive global effort to contain and slow the spread of the novel Coronavirus within a population. Despite those efforts, over the last months, the virus has begun circulating outside of China in multiple countries and territories and India happens to be one of them. However, the silver lining is China was able to contain the virus within Wuhan province by cutting the chain of spread, and identifying & isolating those individuals with possible exposure to the virus.

At present it is ravaging the entire western world and gradually getting a stronghold in the eastern hemisphere. According to the Centre for Disease Control, CDC, NIH, USA, 'it may be possible to contract the virus responsible for the current outbreak, COVD-19/SARS-CoV-2, by touching a surface or object with the virus on it and then touching ones face'. However, SARS-CoV-2 is believed to mostly spread from person-to-person through respiratory droplets produced when an infected person coughs or sneezes.

Nevertheless, during early stages of infection, it is difficult to ascertain whether steps taken to contain the virus were adequate to prevent its spread among wider population by just looking at number of infected people. Here, a simple method is described for the first time to detect early the plausible signal from the available data, which could predict the extent of spread vis a vis progression in the Indian population after intervention. It is shown here that by ascertaining the percent change of COVID-19 cases at regular intervals, it was possible to detect at an early stage, whether there was slowdown (flattening of the curve) or linear/exponential progression in the rate of infection after intervention & whether further fine tuning was required for future course of action.

2. 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, starting from March 03, 2020.

Due to alarming nature of disaster world-wide and to contain further spread of the virus among 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 in different states showing diverse rate of positive cases, complete **National Lockdown** was declared for 21 days starting from 23rd Midnight to run until 14 April, 2020. From 9 PM of 22 March to 23rd March midnight there was temporary suspension of "curfew" and during this short period there was no restriction in movement across India. All data used here is available in public domain.

The Figure 1 shows the number of cases of COVID-19 until March 30, 2020. It is reflected from the graph that there was a linear increase in the number of COVID-19 cases among Indian population and as of 30 March 2020, there were 1263 cases in the entire country. However, from the graph it was not possible to determine the trajectory of spread of the virus from mere number of cases nor was it possible to determine the effect "Janata Curfew", its suspension & possible effect of enforcing a Lockdown subsequently, on the rate of infection and whether further stringent steps were warranted to control its spread among the population at large. In order to overcome such limitation, evaluation of percent change in COVID-19 cases in the population was attempted. The result obtained from this graph was informative and is given in Figure 2.The figure provided encouraging information regarding the effect of "Curfew/Lockdown" on the progression of COVID-19 in the Indian population. It is clear from figure- 2 that from 24 March 2020 onward, that is, after completion of the "Janata curfew" there was a drastic decrease in rate/percent of COVID-19 cases. The fall in percentage points was stably maintained during the period of National Lockdown in spite of a gap period of about 24 hours between curfew & enforcement of Lockdown. The trend has been maintained suggesting that there was no community spread of the virus. Another interesting observation that came out from this analysis was that in spite of nearly 24 hours gap between end of curfew and beginning of Lockdown, the disruption caused in the chain of viral spread was not repaired. The same trend was maintained in percentage of infection as of 5 April, 2020 (Unpublished data). There is a wrong perception among general population that younger population is less effected by the infection with novel coronavirus, as their immune response is superior to "older" individuals. Our study showed that younger people are equally vulnerable to SARS- CoV-2 infection where there was maximum percentage of COVID-19 effected persons in the age group of 21- 40 years of age was 42% (Figure3). A similar trend was also reflected in studies from South Korea, Iceland and Netherlands (Figure 4).

Figure-1. The graph shows the number of COVID-19 positiv individuals in Indian Population at different time points. There is a gradual increase in number of positive cases starting from 14 March until 30 March 2020.
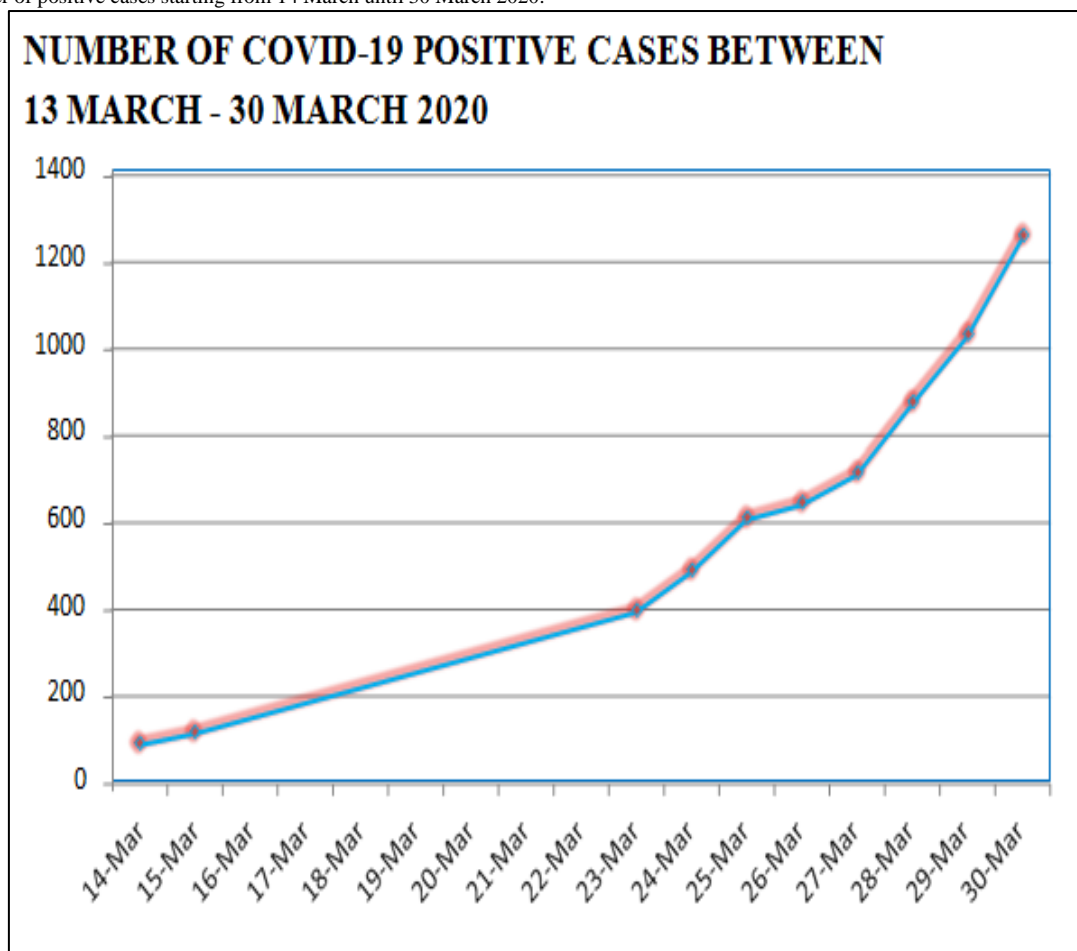
Figure-2. The graph shows the percent of COVID-19 cases before and after Lockdown. It is clear that there was "flattening" of the curve after Janata Curfew & Lockdown, which was maintained until 30 March 2020. There was slight drop on 30 March 2020 compared to 29 March 2020 suggesting that a second phase of slowdown started on the 6th day of Lockdown.
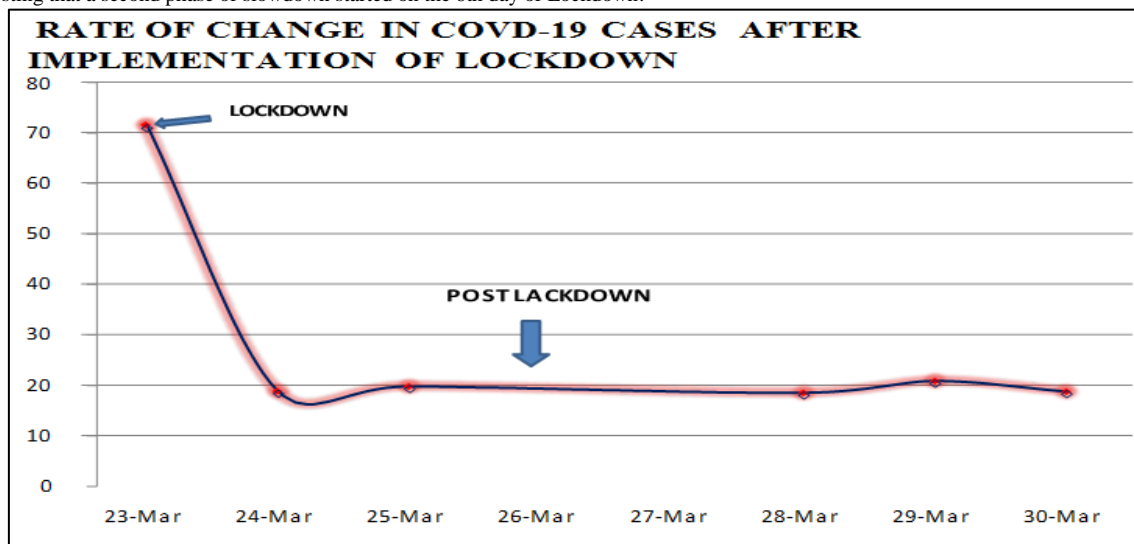
Figure-3. The graph shows that age is not a criterion for being afflicted by novel coronavirus among a given population
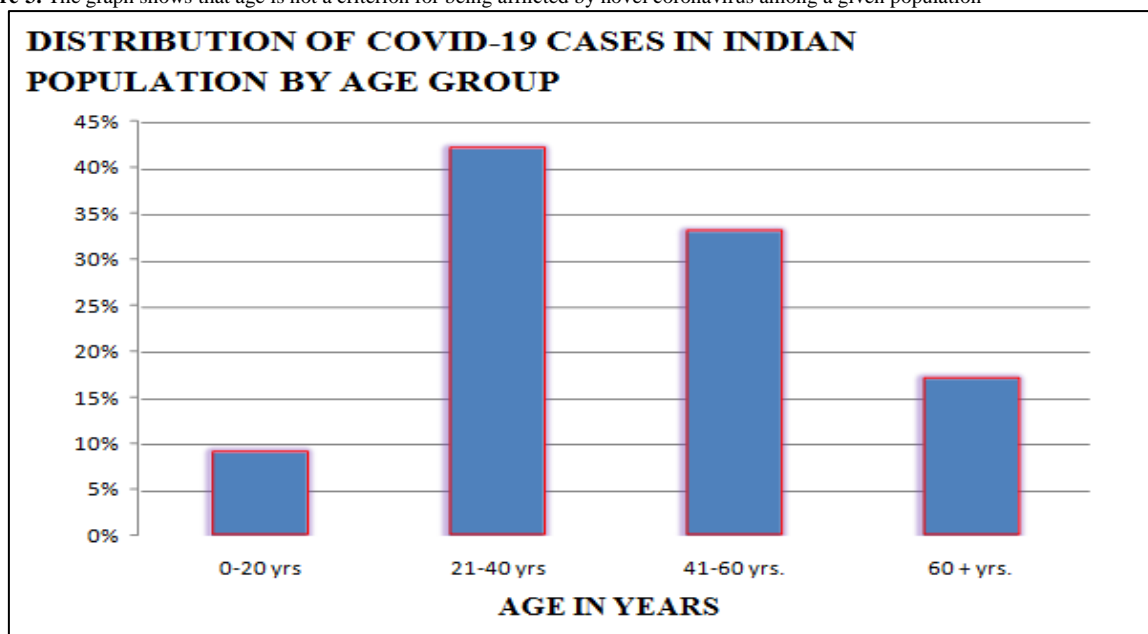
Figure-4. The graph shows the distribution COVID-19 in different age groups within different populations. The result reflects that people in the age group of 21-40 years have maximum rate of infection (42%)
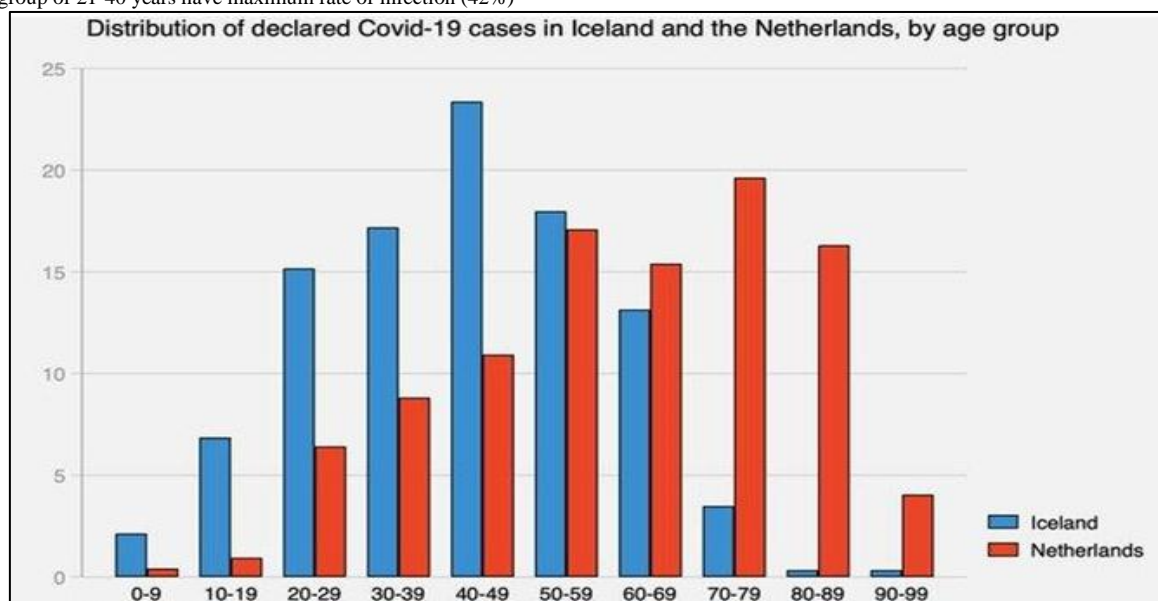
Source: RIVM; Covid.is

3. Discussion

The COVID-19 is a dangerous disease because of its ability to spread rapidly in the community through human to human contact within a population. Thousands are infected in an exponential manner in short period of time during community spread, making the highly skilled and technically savvy medical fraternity look helpless and inadequate to deal with the enormity of the crisis resulting in huge number of deaths as observed in the USA, Italy & Spain. Therefore, availability of an early direction regarding the nature & quickness of spread of the disease could effectively prepare the medical fraternity of an affected area, to be prepared to combat the disaster. In this study we have described a simple method to determine early the nature of the spread of virus after intervention which could be used to plan strategies and fine tune the existing strategy required to curb spread of the virus. Perhaps, the silver lining of this gloom is that a substantial number of people suffering from COVID-19 recovered and most of them have shown the presence of antibodies and T cells specific to SARS-CoV-2 suggesting that an immune response against the virus was generated.

3.1. Immune Response to COVID-19

Recently, Melbourne researchers have mapped immune responses from one of Australia's COVID-19 patients, showing the body's ability to fight the virus and recover from infection. This suggested that the patient's body had been using many different "weapons" effectively against the new virus. The "influenza like immune response" started on 3rd day of appearance of symptoms. The response involved increase in IgG, IgM up to 20 days & from 7th day there was an increase in number of specialized helper & Killer T cells & B cells; showing body's ability to fight the virus and recover from infection, notes Dr. Nguyen the head of the Research group.

3.2. Vaccination against SARS-CoV-2

Several studies are underway in the USA and elsewhere to develop a vaccine against the novel coronavirus. A first clinical trial in the U.S.A. to evaluate an experimental treatment for COVID-19 is already underway at the University of Nebraska Medical Center's bio-containment unit (2). The NIH-sponsored trial will evaluate the safety and efficacy of the experimental antiviral drug remdesivir in hospitalized adults diagnosed with COVID-19.

However, at present prevention is the best way to stay safe from this highly contagious disease by implementation of physical intervention and maintaining social distancing among individuals. An early detection method of the rate of spread of COVID-19 within a population after intervention is warranted. The data presented in this paper clearly indicates that: **a)** Complete Lockdown is a correct approach to prevent human contact and thereby break the chain of virus spread as reflected from the result; **b)** An early signal could be obtained by plotting a simple graph depicting the percent change in number of positive cases after introduction of stringent measures ; **c)** A small time gap in between two successive intervention did not nullify advantage obtained in breaking the chain of spread of the virus; **d)** The "unaffected" areas that were quarantined by intervention and remained "unaffected" until date; & **e)** Population study also reflected that age of an individual does not in any way, affect rate of infection by COVID-19 (1).

On the contrary, not implementing appropriate tough measures at the proper time could spell doom to human survival as has been the case of some western countries.

Acknowledgement

References

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