Review of Surveillance System to Track Covid-19 in India

By

Shubhreet Woodwal

Dissertation submitted in partial fulfillment of the requirements of the degree

MBA Hospital and Health Management

Academic year, 2018-2020

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **review of surveillance system to track covid-19 in India** and submitted by **Shubhreet Woodwal** Enrollment No **MBA-HM230834** under the supervision of **Dr SD Gupta** for award of MBA in Hospital and Health in Health and Hospitals of the University carried out during the period from **10th February 2020** to **30th June 2020** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Signature

ABSTRACT

- **Title:** Review of surveillance system to track COVID-19 in India
- **Aim:** The main aim of this study is to evaluate whether an indicator-based surveillance strategy is effective in accurate tracking of COVID-19 cases in India
- **Key Words:** COVID-19, surveillance, India
- **Introduction:** Accurate surveillance is the backbone of any effective disease prevention and control program. The first COVID-19 case in India was reported on 30th January 2020 and since then the disease has progressed to more than 1.3 lakh cases with a low stable rate of infection. Numerous surveillance systems have been developed by various government and private organizations like ICMR, NDMA, CovIndia, Corona tracker etc. The official portal being used for tracking COVID-19 cases in India is an indicator-based surveillance system which has helped in the development of an aggressive lockdown strategy and contact tracing system which has contributed in lowering and maintaining a low, stable rate of infection till now.
- **Methodology:**

Research Question	Is an indicator-based surveillance system effective for accurate monitoring of COVID-19 outbreak in India?
Research Objectives	➢ To identify and assess the current indicator-based surveillance system being used to track COVID-19 cases in India ➢ To identify the challenges in indicator-based surveillance of COVID-19 in India
Study Design	Descriptive study
Study Period	10th February 2020- 24th May 2020
Data Collection	Primary and Secondary

- **Conclusion:** Indicator based surveillance system is not very effective for monitoring of COVID-19 outbreak in India.

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LIST OF ABBREVIATIONS

API	Application Programming Interface
COVID-19	Coronavirus Disease 2019
DHS	Directorate of Health Services
GDP	Gross Domestic Product
GPHIN	Global Public Health Intelligence Network
GPS	Global Positioning System
HCW	Health Care Worker
ICMR	Indian Council of Medical Research
IDSP	Integrated Disease Surveillance Program
MoHFW	Ministry of Health and Family Welfare
NDMA	National Disaster Management Authority
NFHS	National Family Health Survey
NTEP	National Tuberculosis Elimination Program
RT-PCR	Reverse Transcriptase-Polymerase Chain Reaction
SARI	Severe Acute Respiratory Infection
SARS	Severe Acute Respiratory Syndrome
WHO	World Health Organization

INTRODUCTION

Accurate surveillance is the backbone of any effective disease prevention and control program. Event based surveillance and aggressive contact tracing are few of the many keys of epidemic intelligence. There is a massive availability of unstructured information with questionable reliability such as internet news and discussion sites which help in generating real time datasets for different diseases .Several systems like GPHIN, HealthMap etc. have been developed for epidemic intelligence to track the dormant infections that might convert to full-fledged epidemics owing to new strains of microbes, antibiotic resistance, lack of primary health services etc. Disease surveillance systems like GPHIN have significantly contributed in the detection of SARS outbreak in 2003.

India is one of the most populated countries with 17.7% of the world's population. Poorly developed health systems, low GDP allocation, high out of pocket expenditure and a high proportion of the population with no access to basic health services makes it difficult to monitor any disease outbreak. In India, there are comprehensive surveillance systems like IDSP which monitor twenty-two notifiable diseases all over the country and selective surveillance systems like NTEP for event-based monitoring of tuberculosis. Indicator based surveillance has been used time to time to monitor disease outbreaks like swine flu in 2009 and 2015, Nipah virus outbreak in 2018 etc. The disease control strategy developed by Kerala to control the Nipah virus outbreaks is one of the best examples of how timely surveillance and contact tracing can prevent an epidemic.

COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China, and has since spread globally, resulting in an ongoing pandemic across 188 countries with more than 5.2 million cases as on 24th May 2020. The first case in India was reported on 30th January 2020 and since then the disease has progressed to more than 1.3 lakh cases with a low stable rate of infection. Around half of all cases in India are spread around six cities- Mumbai, Delhi, Kolkata, Ahmedabad, Chennai and Pune with Mumbai alone accounting for 24% of the total confirmed COVID-19 cases. Numerous surveillance systems have been

developed by various government and private organizations like ICMR, NDMA, CovIndia, Corona tracker etc. The official portal being used for tracking COVID-19 cases in India is an

indicator-based surveillance system which has helped in the development of an aggressive lockdown strategy and contact tracing system which has contributed in lowering and maintaining a low, stable rate of infection till now.

LITERATURE REVIEW

The first COVID-19 outbreak was reported in Wuhan, China in December 2019 post which various researches are being carried out to formulate effective interventions to control the corona fire that has spread globally to account for more than 5.2 million cases as on 24th May 2020. In a study conducted in Korea to assess the impact of public health interventions on seasonal influenza during the COVID-19 outbreak, it was reported that high level national response with multiple interventions like contact tracing followed by quarantine measures and prompt epidemiological investigations had not only led to decrease in COVID-19 cases but influenza cases as well. (Lee et all,2020) (1) The effectiveness of Korea's participative disease surveillance model for COVID-19 was highlighted in its limited transmission of the disease in the country. (Lee et all,2020) (1).

Historically, the importance of an coordinated response has been displayed during control of SARS outbreak in Canada in 2003, in which Vancouver with a daily tourist inflow of 2000 was able to keep the total number of confirmed cases as low as five in comparison to Toronto which had an outbreak of 247 cases despite a 75% less tourist inflow, due to Vancouver's better surveillance strategies.(Skowronski et all,2005) (2). A more recent case was witnessed in the control of Nipah virus outbreak in Kerala in 2018 where the intensified surveillance strategies helped avert an event that could have been more disastrous than COVID-19.(Sahay et all,2020) (3).

The shift of the pandemic routes from their dominant paths over the course of many years has carved a massive demand for constant evolution of surveillance strategies to handle their unpredictability. (Saunders-Hastings et all, 2016) (4) Surveillance of emerging infectious diseases in the 21st century is a network of various web-based tools and epidemic intelligence methods such as remote sensing technology for disease prediction. (Christaki,2015) (5) Mobile based passive surveillance systems have outperformed active surveillance systems

used for tracking zoonosis in rural areas of Africa; however, the applicability of this outcome to all infectious diseases was thought to be dependent on an effective incentive-based system. (Thumbi et all,2019) (6)

A timely activation of an effective surveillance system with a detailed contact surveillance as its key component is necessary to establish a baseline for the modelling of the COVID-19 pandemic. (Kvalsvig et all,2020) (7) The significance of enhanced surveillance and contact tracing in controlling the COVID-19 pandemic has been highlighted in various studies conducted in Singapore. (Pung et all,2020) (8) (Yixiang et all,2020) (9) Utilization of both formal and informal sources is required for a timely and accurate surveillance strategy. (Shea,2017) (10) The favorable responsiveness of the surveillance system developed to monitor COVID-19 outbreak in France was attributed to adaptations of previous control strategies used for disease outbreaks in the past. (Stoecklin et all,2020) (11)

The disease surveillance system of India is a struggling character in the books of public health in India with states like Kerala and Uttar Pradesh on completely opposite ends of the surveillance scale. The existing surveillance systems in India like IDSP are still battling their pre-existing systemic failures. (Phalkey et all ,2015) (12) A country like India with scarce resources, an excellent telecom system and a struggling healthcare system makes an excellent candidate for a participatory disease surveillance model. (Garg et all, 2020) (13). An urgent requirement for random sample-based surveillance framework was reported which could utilize the existing infrastructure of NFHS to ascertain the true prevalence of COVID-19 in India. (Subramanian et all,2020) (14)

A major concern with the surveillance systems being used for the monitoring of COVID-19 is its possibility of occupying a permanent position as a surveillance creep which has already led to people defying the system so as to prevent being tested like in South Korea. (Calvo et all,2020) (15) The probability of success of traditional public health measures which helped in defeating the SARS outbreak of 2003 in control of COVID-19 outbreak was expected to be more dependent on the differences between SARS and COVID-19 rather than their similarities. (Wilder-Smith et all,2020) (16) The humongous extent of community spread due to higher transmissibility of COVID-19 than SARS could be responsible for the probable failure of the containment strategy being used. (Wilder-Smith et all,2020) (17)

METHODOLOGY

- **Aim:** The main aim of this study is to evaluate whether an indicator-based surveillance strategy is effective in accurate tracking of COVID-19 cases in India
- **Research Question:** Is an indicator-based surveillance system effective for accurate monitoring of COVID-19 outbreak in India?
- **Research Objectives:**
    - To identify and assess the current indicator-based surveillance system being used to track COVID-19 cases in India
    - To identify the challenges in indicator-based surveillance of COVID-19 in India
- **Study Design:** Descriptive study
- **Data Collection:**
    - **Primary data:** More than five virtual conversations with government officials were carried out to identify the challenges in indicator-based surveillance of COVID-19 cases in India.
    - **Secondary data:** Data was collected from the following web-portals:
        - India
            - MoHFW
            - ICMR
            - Aarogya Setu app
            - CovIndia
            - Corona Tracker
            - WHO
        - South Korea
            - WHO

- USA
    - WHO

- **Study period:**

  10th February 2020- 24th May 2020

  (The total confirmed COVID-19 cases were tracked from the 100th case till 24th May 2020)

- **Study Population:**

  - Confirmed COVID-19 cases in India (131868), USA (1568448) and South Korea (11190) as on 24th May 2020
  - Total registered accounts (10.58 crores) on Aarogya Setu app as on 24th May 2020

- **Research Procedure Adopted:**

  - The data to evaluate the indicator-based surveillance system being used to monitor COVID-19 cases in India was taken from the sources mentioned above.
  - For several analysis conducted in the study, the total number of the confirmed COVID-19 cases in India, USA and South Korea was taken from WHO situation reports from the time of 100th confirmed case till 24th May 2020 for each country. The rate of new cases per day(percentage change) was calculated by the researcher using the formula: Total new confirmed cases of COVID-19 on present day/Total confirmed cases of COVID-19 on previous day**.** The data was graphically represented for each country for better visualization and easy analysis.
  - The growth factor of daily new cases of COVID-19 was calculated by the researcher using the formula: (Total new confirmed cases of COVID-19 on present day/ Total new confirmed cases of COVID-19 on previous day)

- The identification of challenges in the surveillance of COVID-19 in India was done via several virtual conversations with government officials during the course of internship.

RESULTS

1. To identify and assess the current indicator-based surveillance system being used to track COVID-19 cases in India

Description of system

- **Surveillance objectives**
    - To monitor trends in COVID-19 disease over time in order to assess the present situation in India and compare disease trends across different states in order to respond with appropriate evidence-based action
    - To identify population groups at risk and in need for targeted prevention measures
    - To develop an effective contact tracing model to control the spread of disease
    - To contribute to assessment of burden of COVID-19 on the population using data such as disease incidence, mortality rates, recovery rates etc.
- **Disease under surveillance**

    Coronavirus disease 2019(COVID-19)

    - **Confirmed case**: A person with laboratory confirmation of COVID-19 infection (done via a RT-PCR test), irrespective of clinical signs and symptoms
    - **Suspected cases**: (Any one of the following criteria)
        - All individuals who have undertaken international travel in the last 14 days with fever/cough/shortness of breath

- All contacts of laboratory confirmed cases with fever /cough /shortness of breath
- All HCW with fever/cough/shortness of breath
- All hospitalized patients with SARI
- Asymptomatic direct and high-risk contacts (Those who live in the same household with a confirmed case and the HCW who examines the confirmed case) of a confirmed case

➢ **Data sources and Data Flow**

- **Disease Monitoring**: The main source of data is a cohort of laboratories registered under ICMR which participate in regular real time indicator based updation of COVID-19 cases in India. All the laboratories- both public and private update their data on the ICMR HQ database using their respective login credentials. The access to specified data and analysis is only given to some stakeholders like MoHFW and IDSP via APIs for timely formulation of appropriate control measures.
- **Contact Tracing**: The data is collected via an application called Aarogya Setu which identifies COVID-19 suspects using Bluetooth range as a proximity sensor. The citizens are required to install the app in their phones and when two smartphones with the app installed in them come close to each other, data exchange occurs. The app alerts the user about the possibility of being infected. The potential suspected cases are also notified to MoHFW so that necessary interventions may be undertaken to rule out suspicions.

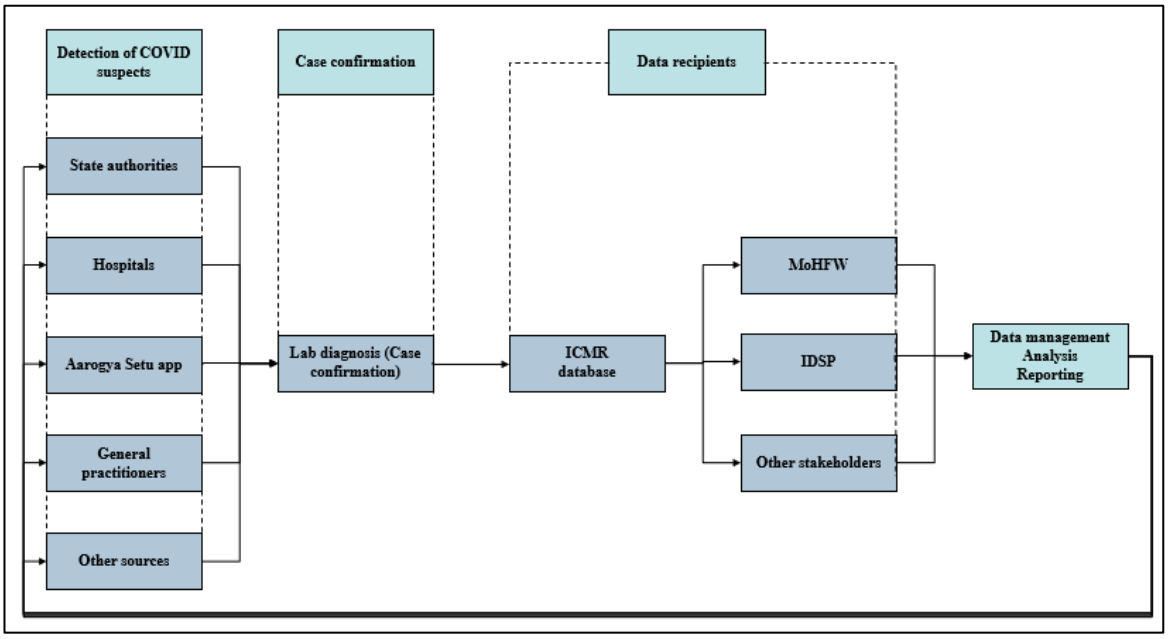

Figure 1: Data flow process for COVID surveillance system in India

The data flow process for the indicator-based surveillance system being used to monitor COVID-19 outbreak in India is represented in Figure-1. A number of bodies work together for effective case detection. The detection is through syndromic screening of travelers at airports, patients in hospitals and clinics and via contact tracing done by the Aarogya Setu app. The suspects may also be identified on the basis of the ICMR criteria mainly by the state authorities. The state authorities play a huge role in contact tracing as less than half of the population is registered on the Aarogya Setu app. Other sources may include contact tracing applications developed by individual states (CovaPunjab). The suspects are then tested using a RT-PCR test by ICMR-approved laboratories only. The details of every confirmatory test conducted is then uploaded onto the ICMR portal from where the data is further disseminated to stakeholders like MoHFW and IDSP. The data is made available for the public by MoHFW. The data available on the public domain includes state wise data for total number of COVID-19 cases in India, number of deaths due to COVID-19 and total recoveries. The district wise data is made available occasionally. All this data is then further analyzed and then enters the data flow cycle again via updation of screening strategies or containment interventions.

- **Population under surveillance:**

  The entire population of the country is under surveillance for both event monitoring and contact tracing.

- **Geographic Coverage**: The geographic unit for disease surveillance is the entire country. The entire unit is covered via mandatory notification of COVID-19 cases to public health authorities.

- **Type of Surveillance**: It is passive surveillance system as it is dependent on regular reporting of disease data by all laboratories and there is no active search for cases. The laboratories are required to participate in real time updation system for COVID-19 notification. It is a comprehensive and compulsory surveillance system as it includes cases of disease that occur within the whole population of the geographical area that have a mandatory reporting clause for laboratories.

- **Specifications of Information reported**: It is a based on a case-based dataset format as it includes individual records of COVID-19 cases. The frequency of data collection is real time i.e. immediate notification upon confirmation of test results.

  - Specification of Variables:

    - **ICMR database:**

      - Contact details of patient
      - Results of diagnostic tests

    - **Aarogya Setu:**

      - Age
      - Gender
      - Name
      - Health status
      - Travel history
      - Location details (tracked via GPS)

- Willingness to help in times of need
- Exempted category of professionals
- Self-assessment details- Presence of symptoms; Comorbidities; Travel history; Possibility of contact with confirmed COVID-19 cases

- **Reporting Format**: Electronic systems
- **Data entry**: It is a web-based data entry system. The laboratories enter their data into the ICMR HQ database using specific login credentials.

Evaluation of Surveillance Attributes

- **Completeness:**
  - **Internal completeness**: It refers to the total number of completed data fields out of total number of data fields (unknown and missing fields). The internal completeness for ICMR database cannot be accurately predicted based on secondary research but it is estimated to be low based on certain newspaper reports from various states. For Aarogya Setu app, the internal completeness can be estimated at 7.8% as total number of app users on May 10, 2020 were 10.58 crores while the total population of India is 135.26 crores.
  - **External Completeness**: It relates to whether the data available reflects the true number of cases affected by COVID-19. It can be used as a measure to estimate underreporting of surveillance data.

    To evaluate external completeness, the MoHFW dataset will be compared with two datasets that capture real time data for COVID-19 cases in India. The two datasets used are:

    - **CovIndia:** It is a website / web application developed by students and faculty of Mahindra École Centrale College of Engineering, Hyderabad. It supports the real time updation of COVID-19 cases in India through authentic sources like MoHFW, DHS Kerala, Livemint,

Deccan Herald, Economic times, The Hindu and other trustworthy sources. It is a district-wise Covid-19 tracker that can be helpful for people travelling within the country so that they can avoid virus-prone zones and would also help the authorities to mobilize resources more efficiently.

- **Corona Tracker:** It is a website that was developed by some students in Goa. It provides real time event monitoring via trustworthy sources like John Hopkins University, MoHFW and crowd sourced with verification. It provides a graphical representation of daily new cases of COVID-19 in India, total number of cases and age wise distribution of total COVID-19 cases. The site also provides an additional feature of tracing the nearest positive COVID-19 case for effective social distancing.

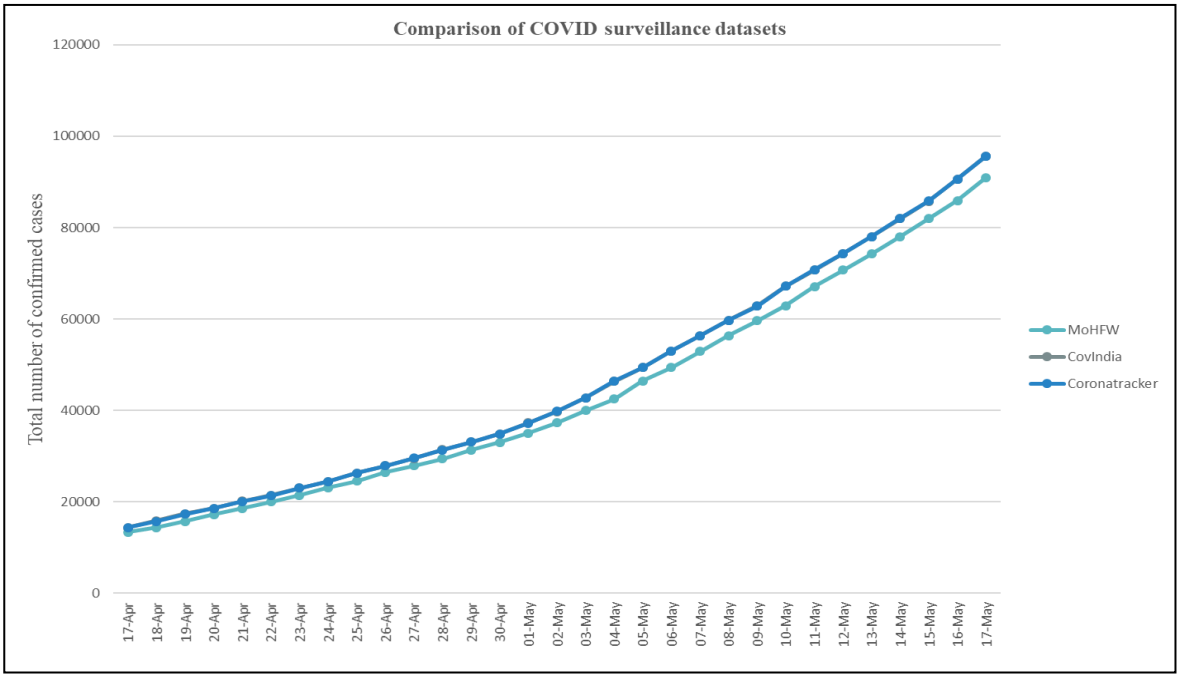

Figure 2: Comparison of three datasets (MoHFW, CovIndia and Corona Tracker) being used for tracking COVID-19 cases in India

The data for the above graph was taken for a period of one month i.e. 17th April 2020 to 17th May 2020 due to unavailability of older data on Corona

tracker. From the above graph, it can be observed the data being reported by CovIndia and Corona tracker is almost identical, and their curves are overlapping. The data being reported by MoHFW is significantly different from the data being reported by the other two datasets. This might be indicative of underreporting of data in the ICMR database. The total cases reported by MoHFW, CovIndia and Corona tracker in the given time period were 1348148, 1430252 and 1430087 respectively. Hence the external completeness of the system is low as it is not indicating the true number of COVID-19 cases in India.

- **Validity**

It is the ability to capture the true value of COVID-19 disease burden in India which is useful for analysis of surveillance data. Validity is estimated to be low as the data is not indicative of the true burden of disease which has been inferred after comparison with multiple datasets as seen above.

- **Internal Validity**: It is the extent of errors within the system. It cannot be estimated for the system based on secondary research.
- **External Validity**: It relates to whether the information recorded about the cases is correct. We require a gold standard value against which the external validity can be measured. The external validity in this study cannot be measured due to unavailability of gold standard values like patient records.

- **Sensitivity**

For event-based surveillance, it is the proportion of outbreaks occurring in a community that are picked up by the surveillance system. For this study, the total number of cases in the community will be taken from the CovIndia dataset because the system carries out real time monitoring of disease using multiple credible sources which are crosschecked such as news articles and there is a possibility that all laboratories are not updating their data into the ICMR database. The actual burden of disease is difficult to estimate as the number of asymptomatic cases in COVID-19 is very high. The sensitivity the MoHFW system according to this study is 94%.

- **Specificity**

It does not apply to case-based surveillance systems.

- **Representativeness**

It is the population covered by the surveillance system divided by the total population. For the MoHFW dataset, the representativeness is 100%

- **Timeliness**

Timeliness reflects the speed or delay between steps in a surveillance system. An important aspect of timeliness is the time required for the effect of control measures. In this study, we will measure the timeliness of the system against the lockdown measures undertaken to control the COVID-19 spread in India. We will also compare it with two country models- USA and Korea to establish the effectiveness of lockdown and other control measures in controlling the growth of rate of infection.

India

The lockdown measures were undertaken in four phases in India with the main aim of breaking the COVID infection cycle and thus slow down the pandemic in India.

Phase-1(25th March 2020- 14th April 2020)

This phase was initiated when the rate of growth of daily new cases was as high as 47% and the total confirmed cases were 434 as on 24th March 2020. The 21-day lockdown period was calculated on basis of interpretation of data from previous and present outbreaks. The first 14 days were to surpass the incubation period of the virus and the next seven days for elimination of any residual cases. Disinfection of all buildings, vehicles and surfaces were carried out in this period. This period also allowed hospitals to prepare for the next phase of operations. The base rules of any national lockdown were followed during this period. All international, interstate as well as intercity travel was restricted during this period. All movements were restricted except for essential goods and emergencies. A 13% rate of growth of daily new cases was observed at the end of the lockdown with the cumulative number of the total confirmed cases equal to 10363.

Phase-2(15th April 2020- 3rd May 2020)

The 2nd phase of lockdown was implemented due to the insufficiency of the previous phase in ensuring a decisive victory against the pandemic. This phase was marked by a limited opening of certain commercial activities in some districts to support the drowning economy. Despite the high number of total confirmed cases, a 3% drop in rate of growth of daily new cases was observed at the end of this phase.

Phase-3(4th May 2020- 17th May 2020)

The entire country was chromatographically divided into zones with different partial de-lockdown strategies (graded relaxations) for different zones. The districts with high number of confirmed cases and a high rate of infection were classified as red. The districts with low rate of infection were marked as orange and the districts with no newly reported cases for the past 21 days were green zones. A low rate of growth of daily new cases was reported at the end of this phase

Phase 4(18th May 2020- 31st May 2020)

A major relaxation was observed in the lockdown guidelines permitting almost all economic activities and significant public movement. Almost all the restrictions were revoked for the entire country except for the red zones. The baton of decision making for classifying the graded zones was passed on to the state governments which would to prove to be very beneficial due to effective reallocation of resources towards the smaller infection hotspots identified by the state rather than the whole district. Till 24th March 2020, the total confirmed cases were 131868 with a low rate of growth of daily new cases ~ 5%.

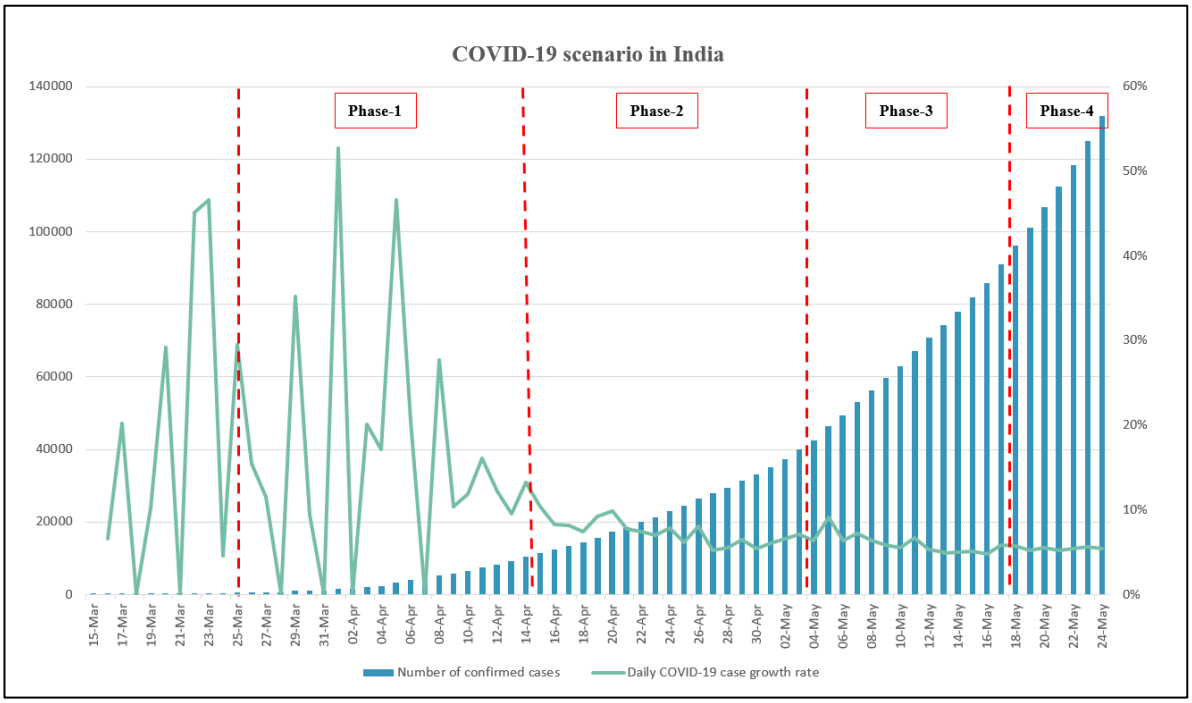

Figure 3: Representation of COVID-19 scenario in India

The above graph tracks the total confirmed cases of COVID-19 in India from the 100th case i.e. on 15th March 2020.The first case in India was reported on 30th January 2020. It took a span of 45 days for the total number of cases to reach 100 after which it took a swift upward trajectory. The gradual decline in rate of new infections in the four phases indicates how an effective lockdown strategy helped India break the infection cycle and reverse the pandemic track that countries like USA undertook.

To get a clearer picture, a comparison will be made between the COVID-19 control strategies used by USA and South Korea and the total number of confirmed cases will be tracked along with the rate of new infections for an effective comparative analysis.

South Korea

The first case in South Korea was reported on 21st January 2020 after which it took 30 days for the total number of cases to reach 100. The initial high rate of daily new confirmed cases was attributed to a superseding event that led to more than 3900 secondary cases. One of the hallmarks of the country's success was the rapid uptake

of timely interventions to control the spread of disease. The country used a mixed model of widespread testing, aggressive contact tracing, strict quarantine and strict curfews in some places without having to impose a widespread lockdown.

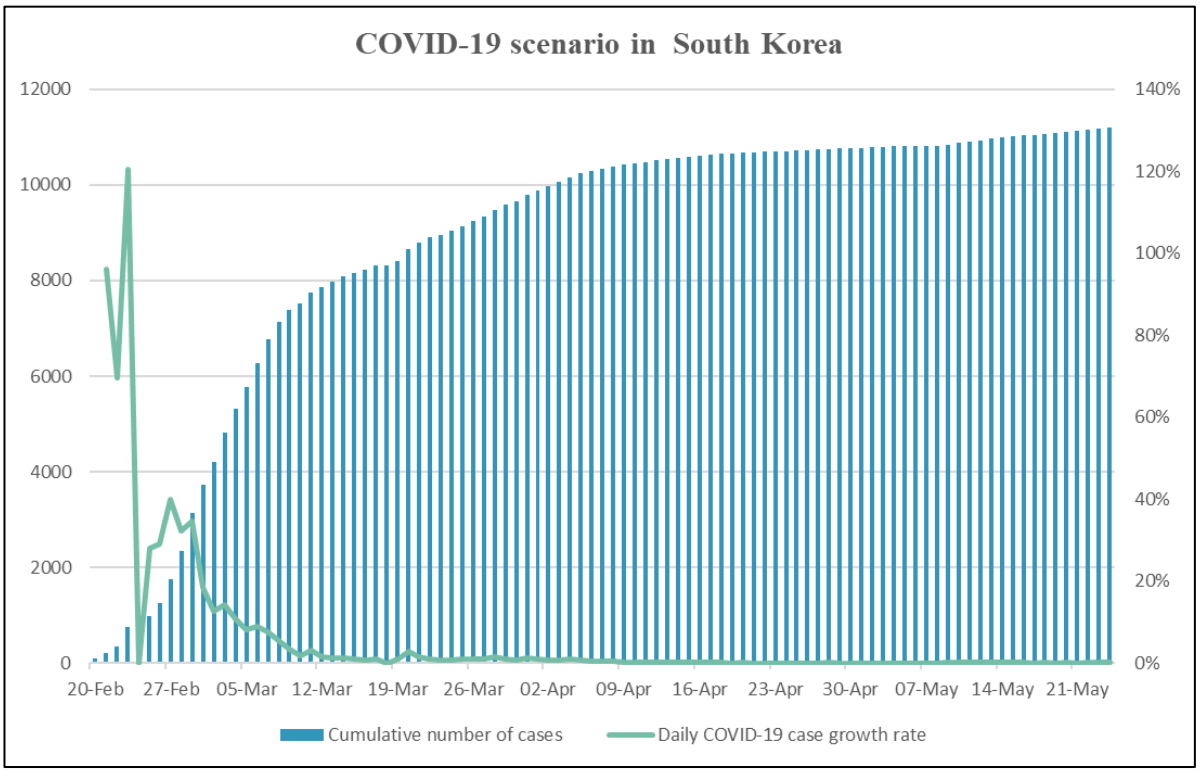

Figure 4: Representation of COVID-19 scenario in South Korea

The timely interventions undertaken helped in flattening the pandemic curve in Korea. The graph tracks the total confirmed cases in Korea from the 100th case i.e. from 20th February 2020.

USA

The first COVID-19 case in USA was reported on 23rd January 2020.It took 40 days for the total number of confirmed cases to reach 100 after which there was drastic spike in total confirmed cases due to the tardy response of the authorities. At a time when the total number of confirmed cases had surpassed 1 lakh and the rate of growth of daily new cases was still very high, only 32 states had adopted lockdown measures. Lack of control measures like widespread testing and contact tracing also carved the

path for the initial blind journey that USA underwent in terms of the pandemic path thus leading to more than 1.5 million cases as on 24th May 2020.

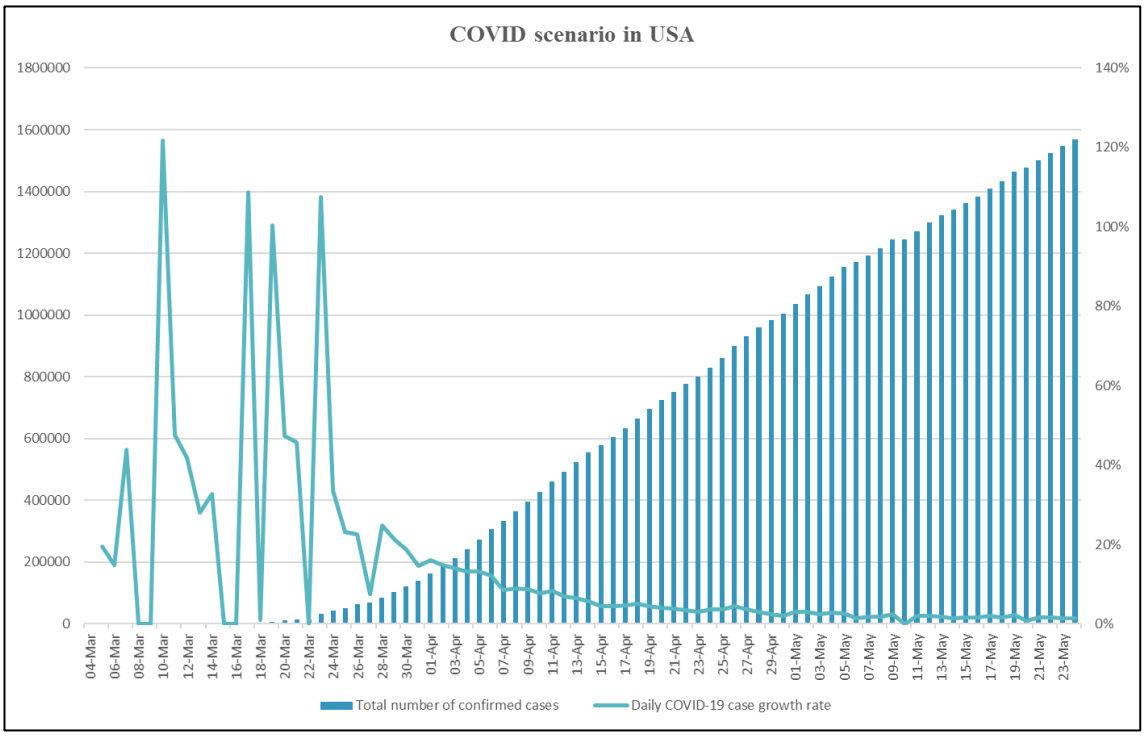

Figure 5: Representation of COVID-19 scenario in USA

The graph tracks the data for USA from the 100th case i.e. from 4th March 2020 to 24th May 2020. A daily percentage growth increase of more than 20% was reported for almost 30 days.

Comparison of the three cases- India, USA, Korea

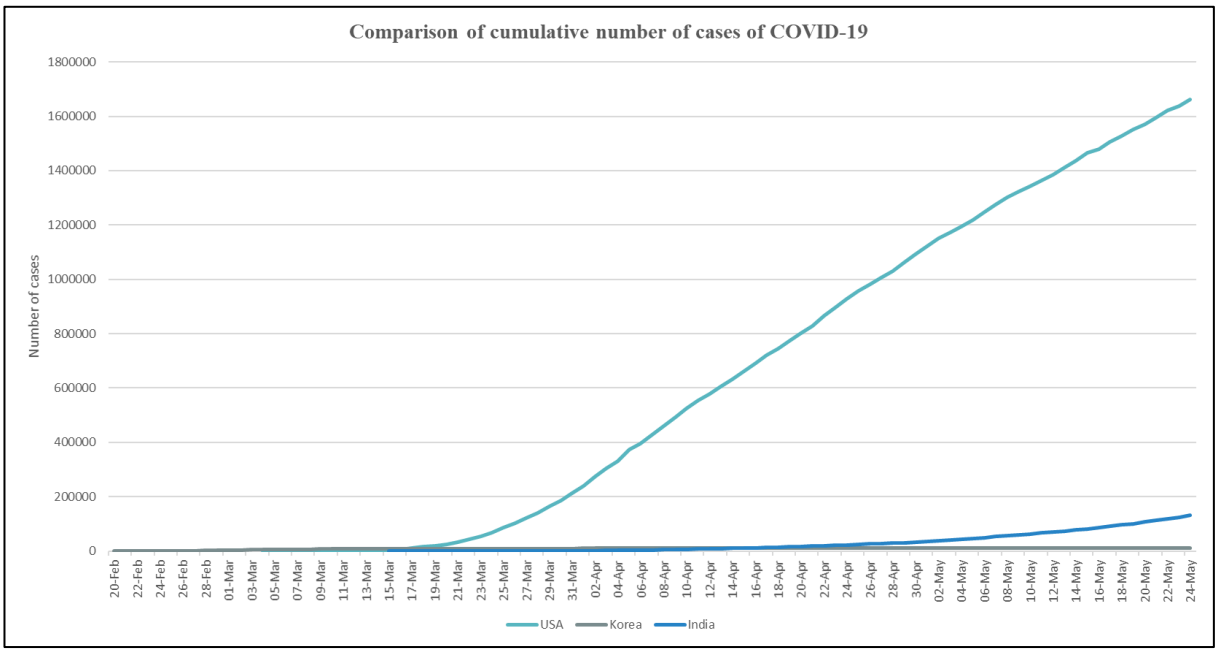

Figure 6: Comparison of total confirmed cases of COVID-19 in India, USA and South Korea

The above graph compares the total number of confirmed cases of COVID-19 in Korea, India and USA. It took the three countries 94, 83 and 71 days respectively to reach 11190, 1568448 and 131868 total confirmed COVID-19 cases. The low number of cases in South Korea (5.16 Cr population) could be attributed to the premature control measures like aggressive contact tracing and testing undertaken by the country. India has a population size 4.12 times that of USA yet 9.84 times less cases when compared to USA on the 71st day post the 100th case. The snail-paced approach to implement lockdown measures resulted in United states accounting for 30% of the total globally confirmed COVID cases as on 24th May 2020 while India's timely lockdown measures helped keep it off the disastrous track that USA took.

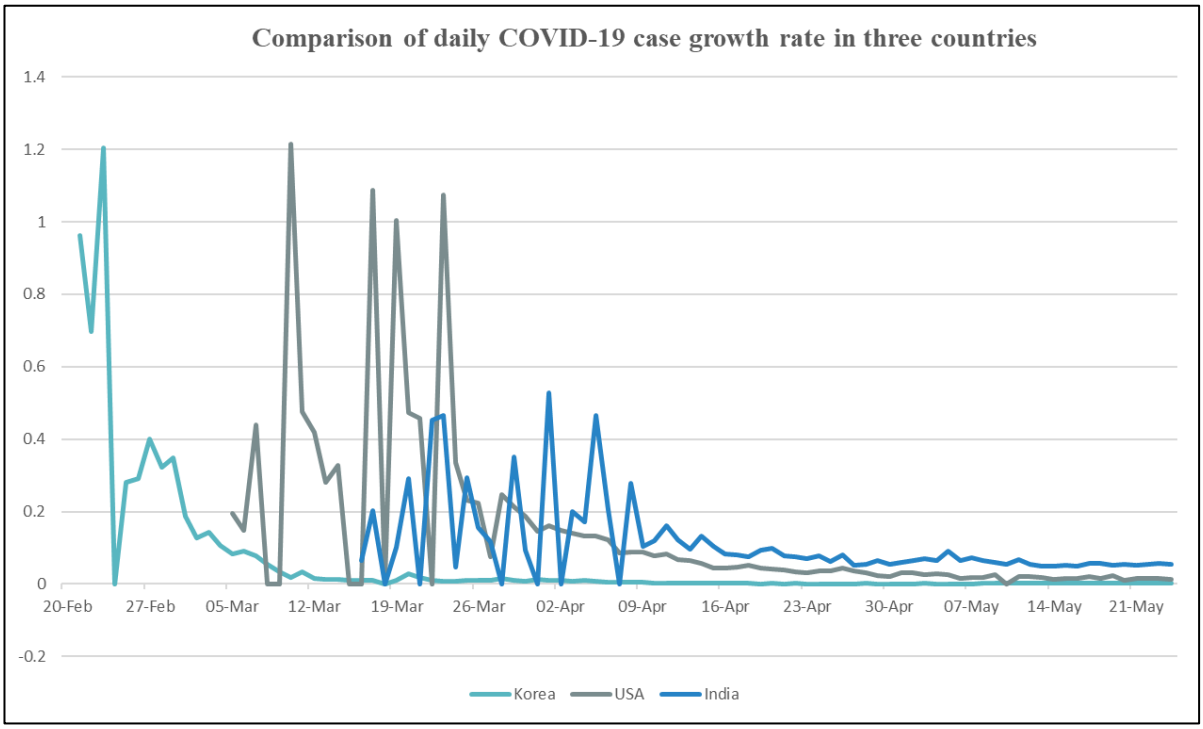

Figure 7: Comparison of growth rate of daily new cases of COVID-19 in India, USA and South Korea

Comparison of growth rates of daily new cases depicts how Korea witnessed a sharp decline in the rate post implementation of control measures and how India has been able to maintain a low rate of infections owing to the lockdown measures undertaken in comparison to USA.

- **Overview:**

Surveillance attributes		**Observations**
Completeness	Internal	• Low for ICMR database • 7.8%- Aarogya Setu
	External	Low
Validity	Internal	Cannot be estimated based on secondary research
	External	
Sensitivity		94%
Specificity		Not applicable
Representativeness		100%
Timeliness		Effective as on 24/05/20

Table 1: Overview of surveillance attributes

2. To identify the challenges in indicator-based surveillance of COVID-19

India is currently passing through an epidemiological transition. Many states in India like Kerala have good health delivery systems while other like Uttar Pradesh are lagging far behind. Health problems are predominantly due to communicable diseases and non-communicable diseases. Disease surveillance has long been recognized as an important tool for measuring the disease burden, studying morbidity and mortality trends and early detection of outbreaks for instituting effective control measures in a timely manner. Though the health infrastructure in our country has grown immensely over the years, disease surveillance system did not get the desired attention. The outbreaks of plague in 1994 in Surat, Gujarat further highlighted the weaknesses in the surveillance system. Even though our country has come a long way since then in terms of surveillance there are still many challenges that oppose an effective surveillance system in the country. This section will highlight the main challenges being faced in surveillance of COVID-19 in India.

- **Data quality**

  It is often perceived as a major barrier to using passive surveillance for disease monitoring. The data may be delayed due to adoption of an indicator-based surveillance rather than an event-based surveillance or it may be missing due to the ineffectiveness of the testing strategy being used.

  - **Poor data quality due to indicator-based surveillance**

    Indicator based surveillance involves direct reporting of data from hospitals and labs whereas an event-based surveillance involves reporting of data from various credible sources like news reports, blogs etc. The ICMR surveillance system is an indicator-based surveillance system as it involves reporting of data only from laboratories registered under its network. There are a number of real time event-based surveillance systems like CovIndia and Corona tracker which are tracking district wise COVID cases in India. A comparison between the three datasets depicts how the ICMR data has very poor data quality in terms of delay in reporting of cases as the event-based surveillance systems are tracking a cumulative number of 5000 additional cases in comparison to the ICMR database.

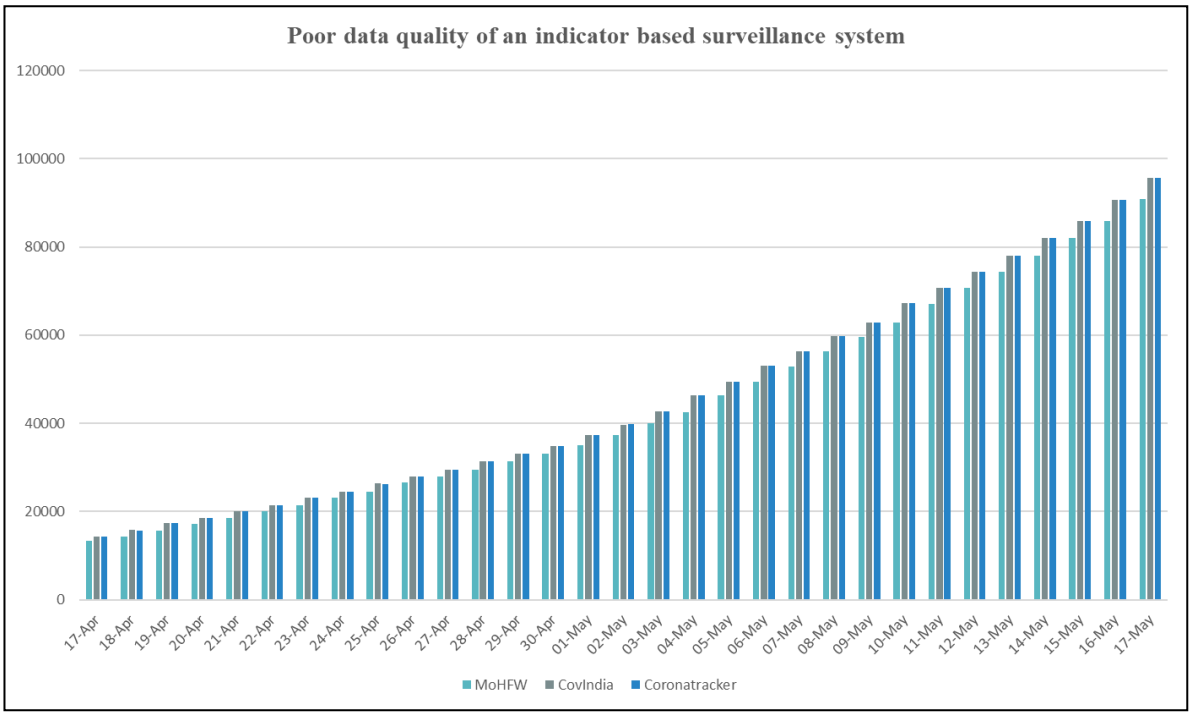

Figure 8: Representation of poor data quality of an indicator-based surveillance system

- **Poor data quality due to asymptomatic cases of COVID-19**

It has been estimated that 80% of all cases of COVID-19 are asymptomatic in nature. The testing strategy formulated by ICMR might have compromised India's fight against the pandemic. The initial focus of the strategy was testing of symptomatic cases with history of international travel or contact with a confirmed case while completely ignoring the symptomatic cases from categories other than these. The highly restrictive testing strategy used could have a major contribution in the spread of COVID-19 in India as several symptomatic cases which didn't fit under the stringent criteria were declined for testing and these could have been the index cases for various clusters. Also, the strategy had no provision for testing for community spread till mid-April thus further aggravating the situation. A tricky reporting pattern that emerges repeatedly in cases of poor data quality is an apparent increase in disease incidence that is actually caused by increased surveillance efforts and/or diagnostic capacity thus highlighting the asymptomatic cases. The case of

Maharashtra can be used to highlight how increased testing has highlighted the poor data quality. Maharashtra accounts for 35% of the total confirmed cases of COVID 19 in India and this high statistic could be attributed to delayed screening and inability to maintain social distancing in highly dense areas like Dharavi.

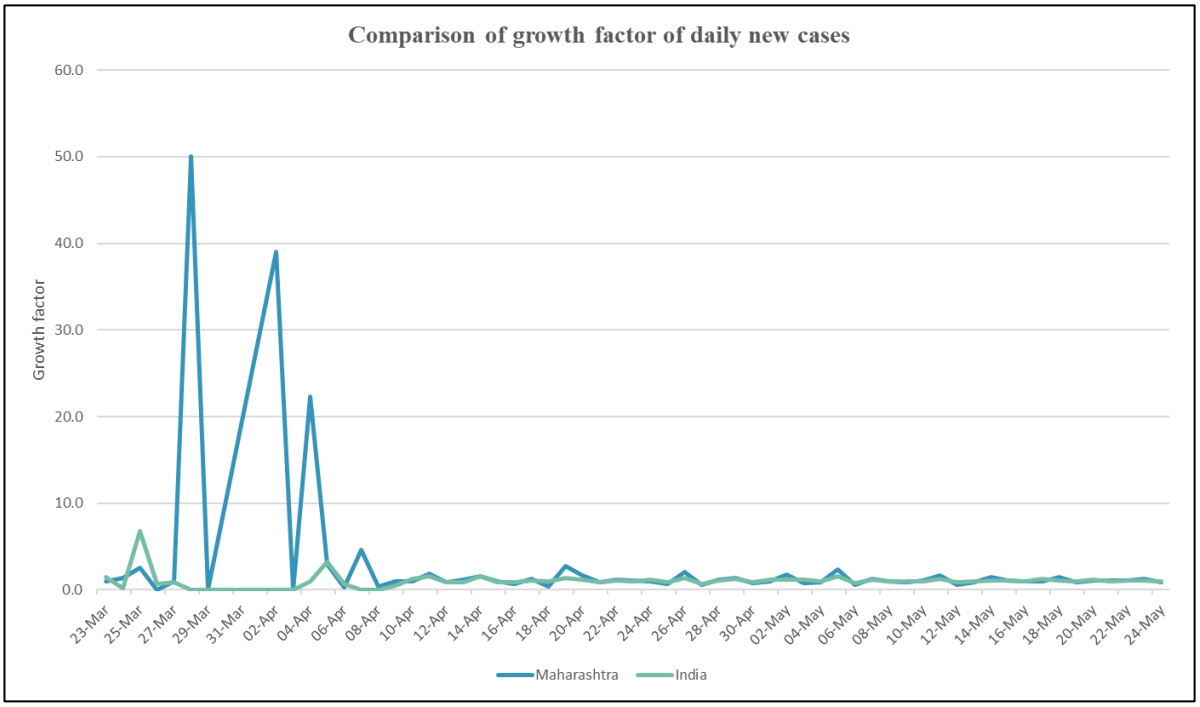

Figure 9: Comparison of growth factor of daily new cases of Maharashtra and India

The above graph represents the significantly higher growth factor of Maharashtra in comparison to India. Even though the growth factor of India has now attained a value of 0.9 as on 24th May 2020 the growth factor of daily COVID cases in Maharashtra remains 1 which might be indicative of exponential growth of cases

Lack of participation from private sector

One of the main challenges for surveillance of infectious diseases in India is lack of participation from private healthcare sector.

It is imperative to incorporate the private health sector in disease surveillance programs to avoid severe under-reporting of cases. However, in case of COVID-19 ICMR is the controller of all testing being done in India and the restrictions imposed by it on private labs such as price capping has not received a positive response so far. This could be resulting in lack of reporting from the private sector as they still might be testing on their own terms. Based on previous analysis on comparison of indicator and event-based surveillance systems a lack of participation from private sector labs can be suggested. The graph given below depicts the proportion of missing cases from the ICMR database over a period of one month. The ICMR database has been compared to CovIndia which is a real time event-based surveillance system being used to COVID-19 cases in India.

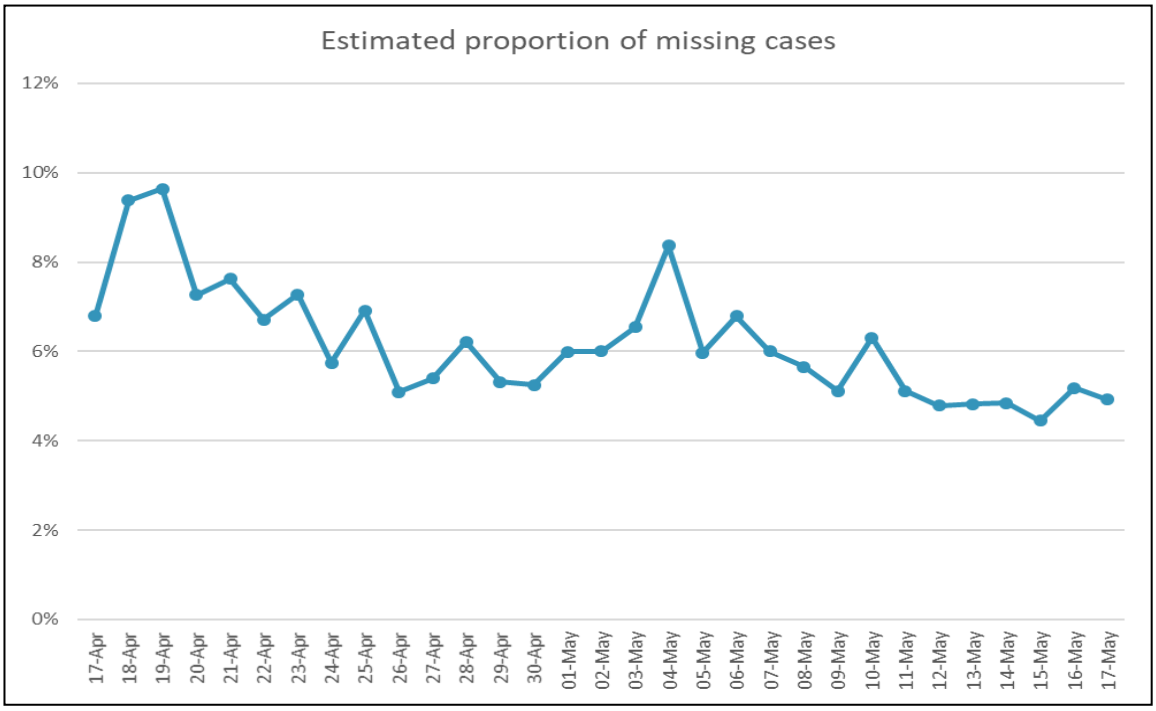

Figure 10: Representation of estimated proportion of missing cases

- **Lack of detailed data**

The data released by ICMR on a daily basis provides an overview of increase in total number of cases on a daily basis while providing no knowledge regarding proportion of asymptomatic cases in the population. Knowledge about a proportionate increase in asymptomatic cases is essential to the mitigation and containment strategies being developed. Lack of information leaves states surveillance efforts in disarray.

- **Lack of uniformity in data being reported by different surveillance systems**

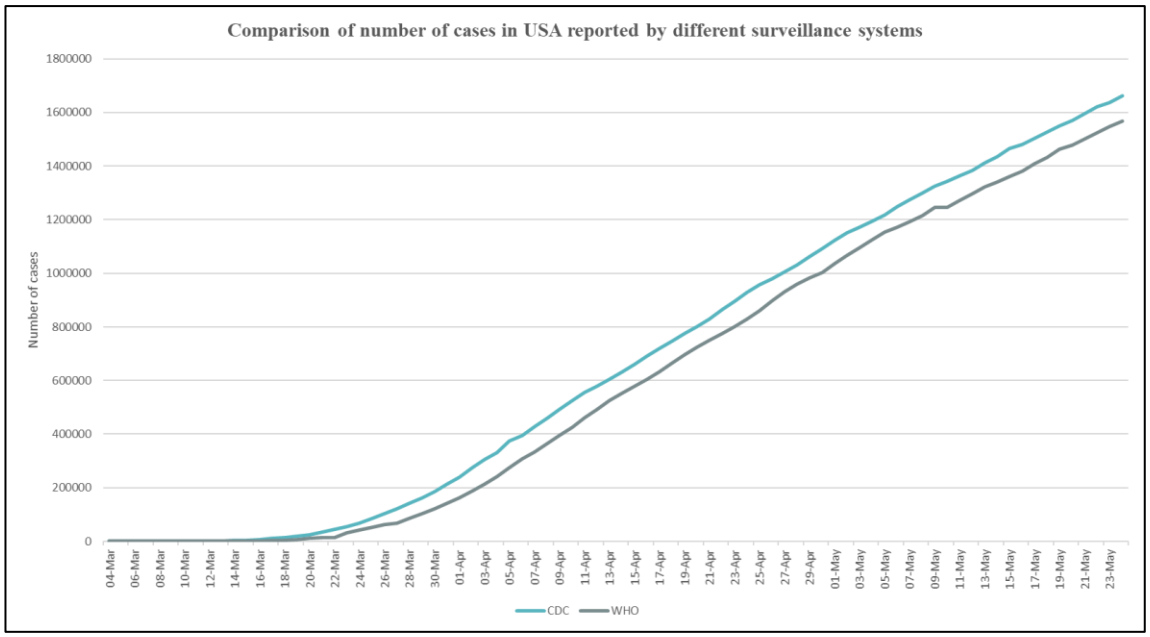

Figure 11: Comparison of number of cases in USA reported by different surveillance systems

The above graph represents the difference the total number of cases of COVID-19 reported for USA by two official surveillance systems- WHO and CDC despite the fact that the source of WHO data is the CDC itself. Such discrepancies in data makes it difficult to estimate the true prevalence of disease in the country.

DISCUSSION

The 1994 outbreak of pneumonic plague in Surat was a wakeup call for India as it highlighted the weaknesses of the disease surveillance system being used at that time. NCDC was launched ten years later as the backbone of the disease surveillance system in India to deal with unsolved problems like malaria and tuberculosis and new and re-emerging infection. IDSP was launched in 2004 for maintenance of a decentralized surveillance system in India to monitor disease trends and detect outbreaks. It is an indicator-based surveillance system but it could also be considered as a event based surveillance system as media scanning is an integral part of the system. Over the years various surveillance systems have also been setup for monitoring of specific diseases like Nikshay under RNTCP to monitor the tuberculosis cases in India.

The first COVID-19 case in India was reported on 30th January 2020 post which the response curve has faced numerous spikes and dips in addition to its delayed timing. The main system being used for surveillance is the ICMR portal which is an indicator-based system into which all the registered laboratories are required to feed the patient data. This system is being used to monitor the trend of COVID-19 in India. In a country like India where there is no robust healthcare system it is very difficult to keep a track of cases via an indicator-based system. It becomes difficult to ascertain the actual number of cases given the history of ineffective participation from the private sector when it is accountable for providing services to 60% of the population. The rate of new cases in India has now achieved a low stable rate post implementation of lockdown strategies. But it is possible that the trajectory of the disease curve might have slowed down had the testing strategy been a little bit less restrictive and covered the possibility of community transmission in March itself. Also, the data released by ICMR is too sparse to formulate any effective interventions as it does not provide information on total number of asymptomatic cases in the country which is necessary to revise the containment strategy of the county.

One of the major limitations of this study is that it lacks primary evidence. It is difficult to conduct a complete evaluation of surveillance attributes on basis of secondary research alone. Attributes like validity cannot be accurately measured without primary research as the main aim is to evaluate the systemic errors of the system. The low internal completeness of

the system which maybe attributed to lack of trained manpower and overburdening of systems can very easily change the fate of the COVID response in India as lack of details such as addresses makes it difficult for the state governments to trace the cases and their contacts and thus putting India in a position to become the next USA. Adoption of an indicator-based surveillance system in a country with a history of collaboration failures between private and public sector could be responsible for the low external completeness of the system, thus making it difficult to ascertain the true prevalence of disease in the population.

The system is efficient in terms of timeliness as the containment measures seem to have borne a fruitful result so far, yet it cannot be accurately predicted for the post-lockdown scenario. The comparative analysis between USA, Korea and India provides evidence how an effective containment system can have a huge significance in determining the overall outcome of the pandemic. Korea, with its effective surveillance system was able to flatten the pandemic curve without a national lockdown. Even though India seems to following Korea very slowly, the gaps in its surveillance system might generate an entirely different result.

Numerous event-based surveillance systems have been setup by private organizations that are tracking a cumulative additive of 5000 more cases to the statistics being reported by MoHFW. There is a strong possibility that that these portals could be tracking down the true number of total confirmed cases in India given the lack of participation by private sector. The private sector failure could be attributed to capping of prices by ICMR which is making it difficult for the private sector to sustain its business model. It is highly likely that the laboratories are conducting tests at a price suitable to them which gets reported via the media if there is an increase in the total number of cases.

Another factor which might be affecting the true surveillance of COVID-19 in India is social stigma. India has a long history of stigma faced by patients be it Tuberculosis, AIDS or even non communicable diseases like cancer. The fear of being shunned by the society could be a factor for a suspect to not report to any testing center. Even though India has started sentinel surveillance there is a possibility of missing cases especially for those who are in green or orange zones.

The implementation of participative disease surveillance model-Aarogya Setu has contributed to the surveillance efforts but the intervention will not active its full potential until it is actively implemented across the country.

CONCLUSION

The indicator-based surveillance model being used to track COVID-19 in India is not a very effective model for a country in which half the population lacks access to basic health services. The system has various gaps like lack of reporting by laboratories, poor data quality and inability to provide detailed data which is required for updating the strategies being used to control the COVID-19 outbreak in India. The sudden spike in total confirmed cases post expansion of testing was reflective of the poor quality of surveillance being done which could be attributed to the restrictive testing strategy being used. Lockdowns are effective measures of containment which need to be supplemented with proper surveillance for eradication of any disease. Each state is a country in itself with varied surveillance responses. Even though Kerala has successfully managed to contain the outbreak due to their strong surveillance systems, it is very difficult to control the disease with states like Maharashtra following the path of USA in emergence of cases. There is a requirement of intertwining of surveillance efforts between the strong and the weak states and also the event and indicator-based surveillance systems. Participative disease surveillance also has a wide scope of tracking down the cases in India post its effective implementation.

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