



# COVID-19 THIRD WAVE & BEYOND

## Action Plan - June 2021

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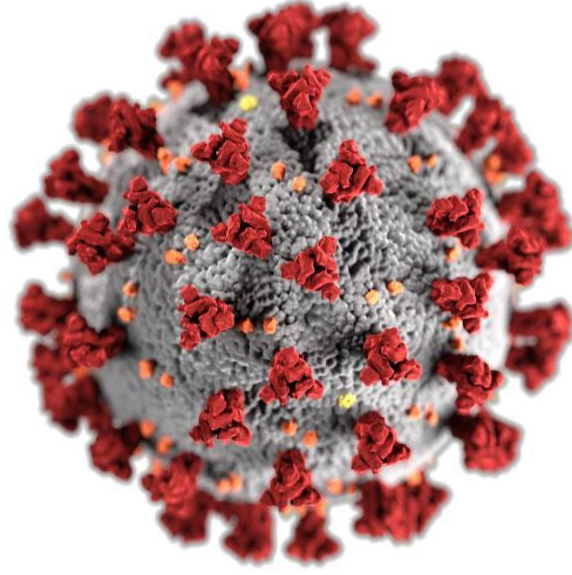
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# ***COVID- '19***



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## Prologue

**Research For Resurgence Foundation** is a wide ranging, multi-disciplinary, multi-institutional network of genuine researchers. 105 universities, 12 industries and 8 research institutes have entered formal MOU with RFRF till date. Through its innovative activities like 'Conference of Academic Leadership (CAL) - 1,2,3', Meet The Scientist (MTS) and 5 international conferences, it has a live & active connect with another 250 institutions, industry leaders and policymakers. Creating a purposeful and benevolent paradigm of academic research through methodology orientation, relevant intervention in PHD guidelines etc.; synergy in research for national needs through joint projects & mission mode projects are some of the effective measures taken by RFRF since its inception in 2016.

During the unprecedented Pandemic the world is facing, RFRF endeavoured to contribute humbly in creating scientific evidence-based awareness, forging an alliance of MSMEs with academics to solve the problems of the industry and achieve the lofty goal of 'Atma-Nirbhar Bharat'. RFRF associates promoted much needed innovations to create preventive products like UV sanitiser box, herbal sanitisers, ventilation splitters etc. As virtual mode for academic and other communicative activities became a necessity, RFRF launched a competition for developing an indigenous app for video conferencing. Another out of box contribution was creation of a well-researched scientific Protocol for mask disposal. All this was done with the active participation of academic associates.

When the second wave hit, most of the people and institutions were caught unawares. Though experts had been warning and government issuing guidelines as early as December 2020, when the new variant hit in mid-March 2021, it was brutal. Policymakers and others have learnt their lessons. Government has formed a high-level committee and preparations for facing the third wave, if & when it hits, are on in full swing. In one of the meetings of academic heads, it was suggested that RFRF also prepare a document enlisting the projections & preparations for the third wave. This may serve as a second opinion for the planners. After discussion in the core team of RFRF trustees, a Task Group of reputed experts

from various fields was constituted under the convenorship of Prof. Sarit K. Das, an active RFRF participant and former Director IIT Ropar.

The first meeting of the group was virtually held on 14<sup>th</sup> June 2021. After discussion, sub-themes were identified and responsibilities shared by the members. Additional experts were added wherever necessary. The consensus was to prepare an action plan with recommendations for government, educational institutes and civil society. Time was short, hence preliminary presentations were scheduled within a week. All the team members worked on war footing. After presentation and feedback from other members, the final draft was prepared. This was again debated and modified accordingly. The result is a comprehensive document titled '**COVID - '19 Third Wave & Beyond - Action Plan**'.

All the Task Group members are very busy in their professional & institutional responsibilities. It is indeed a noble expression of sense of responsibility & national duty on their part to have devoted so much of time and energy for a selfless job. RFRF does not have the vocabulary to express the gratitude towards monumental contribution of all the experts & their teams.

RFRF does not want to claim or have the audacity to profess that 'projections & preparations' enlisted in this document are in any way perfect, final or exhaustive. We can just assure that this is an honest effort to contribute humbly to the best of our enterprise. We plan to send this document to all the relevant authorities of central & state governments, educational institutes, research laboratories and to the general public hoping that it augments their preparations.

**Mukul Kanitkar**

**Trustee, RFRF**

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# 1. Introduction

Modern history is replete with several pandemics which have shaped our understanding of their epidemiology, transmission, and management. In the past 200 years, at least four strains of influenza, seven waves of cholera, tuberculosis, and the human immunodeficiency viruses (HIV) have accounted for the deaths of nearly 100 million people.

The world witnessed the COVID-19 (corona virus disease 2019) pandemic that affected the lives of many million people across the globe in the year 2020-2021. It is caused by **Severe Acute Respiratory Syndrome- Corona Virus-2 (SARS-CoV-2)**, and disease so caused came to be known as **Corona Virus Disease-2019 (COVID-19)**. First index case of COVID 19 was reported from Wuhan, China on 30th December 2019.

Seventeen years earlier SARS (Severe Acute Respiratory Syndrome) epidemic was first deadly corona virus epidemic triggered in 2002. It went to kill 1 in 10 people, it infected. A decade later, in 2012, another deadly corona virus emerged- the Middle East Respiratory Syndrome (MERS). Like SARS, it spread to dozens of countries, killing 1 in 3 infected. COVID-19 is the third deadly corona virus to emerge since the turn of century.

## 1.1 Bats and Corona Virus

Most of the coronaviruses appear to have arisen originally in bats, which are good primordial natural hosts for coronaviruses. But breaching the species barrier to infect human appears to have involved intermediate hosts in whom coronavirus can adapt, amplify and access human population. In the case of MERS, the intermediate hosts were found to be camel. In case of SARS, masked palm civet cat, an animal prized for its meat and purported aphrodisiac qualities of its penis, appeared to be intermediate host.

The current thinking is that the COVID-19 virus originated in bats, but then jumped to humans only after passing through an intermediate host. The leading suspect for the intermediate host of the current pandemic is the pangolin. Pangolins are the most trafficked mammal in the world due to high demand for their meat as a delicacy and their scales for their use in traditional medicine. Regardless of which animal was the intermediate host for the current outbreak, menu of dinner table of few deviants has costed mankind, trillions of dollars and millions of lives, and it continues.

Over 18 months later, after the report of first cluster of a typical pneumonia of unknown origin in late 2019 in Wuhan, China, world is yet to determine the origin of COVID-19 with certainty. Lab hypothesis origin is yet to be substantiated, nor spill over from its natural reservoir in bat and intermediate host of cross over. China's cooperation with WHO and ongoing US investigations will be crucial. If the virus had been bioengineered, the genetic sequencing may reveal the pathway of spread.

Sometimes, these discoveries pinpointing the source of global pandemic becomes very strenuous and several years lapse, before the final conclusive discoveries are revealed. Viral sample of 1<sup>st</sup> index case of COVID '19 in Bharat on 30<sup>th</sup> January 2020 in Kerala, an imported case from Wuhan, China becomes a very invaluable sample. Bharat has a strong presence of biotechnology and bioinformatics hub in various institutions in the country. They should endeavour together to unravel the mystery of SARS-CoV-2 origin, and Bharat should volunteer to be an active partner in this process, if undertaken by WHO.

The spread of this virus has taken an exponential pathway. Therefore, on 11<sup>th</sup> March 2020, the World Health Organization (WHO) announced COVID-19 as a "global pandemic". Due to the outbreak of COVID-19, a public health emergency situation was created, whereby the authorities of various countries and continents had to put restrictions on the movement of people and non-essential activities. Some of these restrictions included imposing lockdowns, maintaining social (read- physical) distancing, work from home in academics, and business continuity plans. The spread of COVID-19 has left a significant impact on the environment as well as on the lifestyle of human beings. Almost all educational institutions were closed, sports leagues were cancelled, and people were advised to work from home and perform contactless financial transactions using various digital platforms.



The recent outbreak of COVID-19 in several countries is similar to the previous outbreaks of SARS and Middle East respiratory syndrome (MERS) that emerged in 2003 and 2012 in China and Saudi Arabia, respectively, as discussed earlier. They all affected the respiratory tract and caused major disease outbreaks worldwide. So far, there is no particular treatment available to treat COVID-19. Reports suggest that humans do not have immunity to this virus, allowing its easy and rapid spread among human populations through contact with an infected person. SARS-CoV-2 is more transmissible than SARS-CoV. The two possible reasons could be (i) the viral load (quantity of virus) which tends to be relatively higher in COVID-19-positive patients, especially in the nose and throat immediately after they develop symptoms, and (ii) the binding affinity of SARS-CoV-2 to host cell receptors is higher than that of SARS-CoV.

## **1.2 Impact of COVID-19 in Bharat and the Global Economy**

To protect against the deadly virus, the Central government has taken necessary and strict measures, including establishing health check posts between the national borders to test whether people entering the country have the virus. First wave of COVID started in Bharat in mid-February and took a toll of 1 lakh lives. Bharat, with a population of more than 1.36 billion (2019) will have difficulty treating severe COVID-19 cases in the third wave because of multiple issues. It would be difficult to identify sources of infection and those who come in contact with them. This would necessitate multiple strategies to handle the outbreak, including computational modelling, as well as statistical and quantitative analyses, to rapidly develop new vaccines and drug treatments. With such a vast population, Bharat's medical system may be grossly inadequate.

Bharat is engaged in trading with its international trade partners in a very vibrant way today, with its total global trade value of \$769 billion, which has been adversely affected due to COVID 19 pandemic. Outbreak of such viruses and their transmission would significantly affect the Indian economy in the third wave as well. The outbreak in China could profoundly affect the Indian economy, especially in the sectors of electronics, pharmaceuticals, and logistics operations, as trade ports with China are currently closed. Economists assume that the impact of COVID-19 on the economy will be high and negative when compared with the SARS impact during 2003. It has been estimated that COVID-19 will hurt emerging market currencies and also impact oil prices. From the retail industry's perspective, consumer demands are likely to decline.

So far, several factors have thus been identified as having a major economic impact: labour mobility, lack of working hours, interruptions in the global supply chain, less consumption, and tourism, and less demand in the commodity market at a global level, which in turn need to be adequately analysed by industry type. It has now been estimated that Bharat's GDP by the International Monetary Fund has been cut down to 1.9% from 5.8% for the FY21. The financial crisis that has emerged owing to the worldwide lockdown reflects its adverse effect on several industries and the global supply chain, which has resulted in the GDP dropping to 4.2% for FY20, which was previously estimated at 4.8%. Nevertheless, it has been roughly estimated that Bharat and China will be experiencing considerable positive growth among other major economies.

### **1.3 Diagnosis**

The ICMR recommends using the US-FDA-approved closed real-time RT-PCR systems, such as GeneXpert and Roche COBAS-6800/8800. In addition, the Trunat™ beta CoV test on the Trulab™ workstation validated by the ICMR is recommended as a screening test. All positive results obtained on these platforms need to be confirmed by confirmatory assays for SARS-CoV-2. All negative results do not require further testing. Antigen-based rapid tests were validated at NIV, Pune, and found to be satisfactory. Many of such tests are approved for mass screening. As a step further, on the technological aspect, the Union Health Ministry has launched a mobile application called “Arogya Setu” that works both on android and iOS mobile phones. This application constructs a user database for establishing an awareness network that can alert people and governments about possible COVID-19 victims.

### **1.4 Vaccines for the Prevention of COVID 19**

Recently, multiple vaccines developed by Oxford–AstraZeneca (Covishield/Vaxzevria), Pfizer–BioNTech (Comirnaty), Moderna, Johnson & Johnson's Janssen, Bharat Biotech (Covaxin), Gamaleya Research Institute of Epidemiology and Microbiology (Sputnik V) etc. have been approved in several countries and are given on priority to susceptible populations and those with co-morbidities. However, the production and distribution of vaccines at a massive scale to cover a very large population remain a formidable challenge.

## **1.5 Traditional medicines**

Bharat is known for its traditional medicines in the form of AYUSH (Ayurvedic, Yoga and Naturopathy, Unani, Siddha, and Homeopathy). The polyherbal powder Nilavembu Kudineer (Siddha) showed promising effects against dengue and chikungunya fevers in the past. With the outbreak of COVID-19, the ministry of AYUSH has released a press note “Advisory for Coronavirus,” mentioning useful medications to improve the immunity of the individuals. Ayush 64, another polyherbal preparation by Ayurveda has been approved by Ministry of AYUSH for prevention and adjunct to treatment in proven cases.

## **1.6 Preparation in Bharat for the third wave and Preventive Measures**

More than one year since COVID-19 was declared a pandemic on March 11, 2020, by World Health Organization (WHO), the deadly SARS-CoV-2 virus continues to disrupt public life across the world. First wave of pandemic subsided in Bharat during September 2020. Starting mid-February 2021, second wave commenced which peaked in April-May 2021. It continues till date, though on a declining path.

An easy way to decrease SARS-CoV-2 infection rates is to avoid virus exposure. People from Bharat should avoid traveling to countries highly affected with the virus, practice proper hygiene, and avoid consuming food that is not home cooked. Necessary preventive measures, including COVID-appropriate behaviour, should become a way of life.

With a potential threat of third wave of COVID 19 looming at large, necessitates that we learn from previous two waves of COVID 19 and behave in a responsible manner. Government is doing its job well by doing free immunization and scaling it to vaccinate entire eligible population by the end of this year. We all should observe COVID-appropriate behaviour to help contain the spread of this dreaded pandemic. In the long run, healthy life style and our living in harmony with all living beings are the only guarantee of peaceful existence of humankind on this planet.

## 2. Spread Speed

### 2.1 Purpose and Objectives

First Index case of COVID 19 in Bharat was seen on 30<sup>th</sup> January 2020, which was an imported case from Wuhan, China. First wave of COVID 19 started in Bharat in March '20 and peaked in September 2020. Second wave started in 1<sup>st</sup> week of March 2021 and April – May 2021 were the worst. On 7<sup>th</sup> May '21, 4.14 lakh new cases were reported, and country witnessed >4500 deaths on many days during this period. First wave trajectory was slowed due to early lockdown and more strict compliance to use of mask, distancing and hand hygiene. During second wave, lockdown was left to states, and there was a palpable delay in enforcement of the same. Consequently, there was a steep rise in number of cases and peak was sharper. Based on the trend of previous waves, it is most uncertain to predict that how the next wave will behave.

It is quite likely that third wave may affect children more predominantly, as they are most exposed unprotected as no vaccine is available in Bharat for them, at this point in time. So, focus has to be on children and their parents, particularly mothers, who could be care givers, in case children get afflicted. Children with co-morbidities need to be protected most.

Rural regions of the country- where disease has already made inroads during second wave and low level of simmering disease there, it may drive the 3<sup>rd</sup> wave powered by new mutations, like- Delta, Delta plus, or anything newer.

Understanding of all the above may become very crucial for our preparation against the anticipated third wave of COVID 19 in Bharat.

### 2.2 Spread Speed

In Bharat, the first COVID-19 case was reported on January 30, 2020 as an imported case from Wuhan, China. In true sense of pandemic, 1<sup>st</sup> wave of COVID 19 started in Bharat in the month of March '20. First wave of COVID 19 claimed one lakh lives spread over a

period of 7 months from 11th March to 2<sup>nd</sup> October, when the first wave subsided. At the peak into 1<sup>st</sup> wave in mid-September, 97,860 new cases were seen on 16<sup>th</sup> September '20 and 1140 people died of COVID 19 on the same very day.

### **2.3 Second Wave**

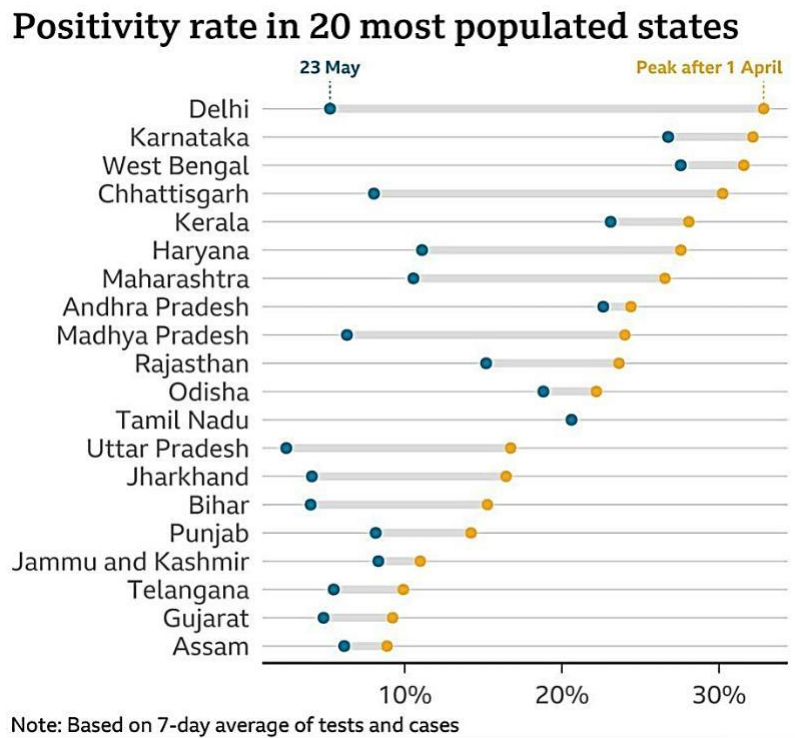
Peak of 1<sup>st</sup> wave of COVID was seen in September '20. Since then, there was a consistent decline in cases. Starting in March '21, Bharat witnessed second wave of COVID 19 which had a sudden surge in cases during the month of April '21. Government and public, both lowered their guards, which was primarily attributable to this sudden rise in cases. It was also driven by the new mutant stains of virus, a double mutant Indian variants, alpha and delta variants. Few super spreading events also played their role in spread, viz. elections, Kumbh Mela, sporting events etc., (though infection surged in those states also, where there were no elections or religious gatherings). Lockdown was relaxed and international and internal air travel were opened. People were partying and holidaying, markets were bustling with business as usual. And probably, there was a little delay in imposing lockdown which was left to states during the 2<sup>nd</sup> wave. Ill-conceived idea was floating around during the first wave, that Indians have some form of better immunity to tide over such pandemics. Though the vaccination drive was launched on 16<sup>th</sup> January '21, but it was not possible to vaccinate significant percentage of population by this time. This wave was significantly worse than the 1<sup>st</sup> wave. Though, the UK variant (B.1.1.7) was detected in Bharat in September '20, but no concerted work was done to gene sequence 5% of positive cases by lab consortium. Double mutant or Indian variant (B.1.617) was detected late last year. South African variant (B.1.351) and Brazilian variant (P.1) were found during the same period.

By the end of March '21, a full-blown second wave of COVID 19 had taken the country in its grips. By this time, 80% of cases were contributed by six states- Maharashtra, Kerala, Punjab, Gujarat, Chhattisgarh and Karnataka. These six states contributed to 80% of mortality also, with high deaths reported from Tamil Nadu as well. Early on in the second wave, it was driven by rapid surge in metropolitan cities of the country. Gradually, disease spread to rural hinterlands, probably because of labour force again migrating to their rural abodes, electioneering and super spreading religious congregations exposing the rural folks visiting those mega events.

First week of May '21 witnessed the peak of 2<sup>nd</sup> wave with 4.14 cases reported on 6<sup>th</sup> May and highest single day mortality of more than 4500 deaths reported on 18<sup>th</sup> May '21. Sudden surge of cases led to acute shortage of hospital beds, medical oxygen, critical medicines and trained manpower to take care of huge number of patients thrown into the system.

## 2.4 Second Wave Dynamics

By February 2021, daily cases had fallen to 9,000 per-day. However, starting in March '21 and surge in cases in Early-April 2021, a major second wave of infection took hold in the country; and on 9<sup>th</sup> April, Bharat surpassed 1 million active cases, and by 12<sup>th</sup> April, Bharat overtook Brazil as having the second-most COVID-19 cases worldwide. By late April, Bharat passed 2.5 million active cases and was reporting an average of 300,000 new cases and 2,000 deaths per-day. Some analysts feared this was an undercount. On 30<sup>th</sup> April, Bharat reported over 400,000 new cases and over 3,500 deaths in one day. There was a very high positivity reported from many states (as shown in the graph, below).



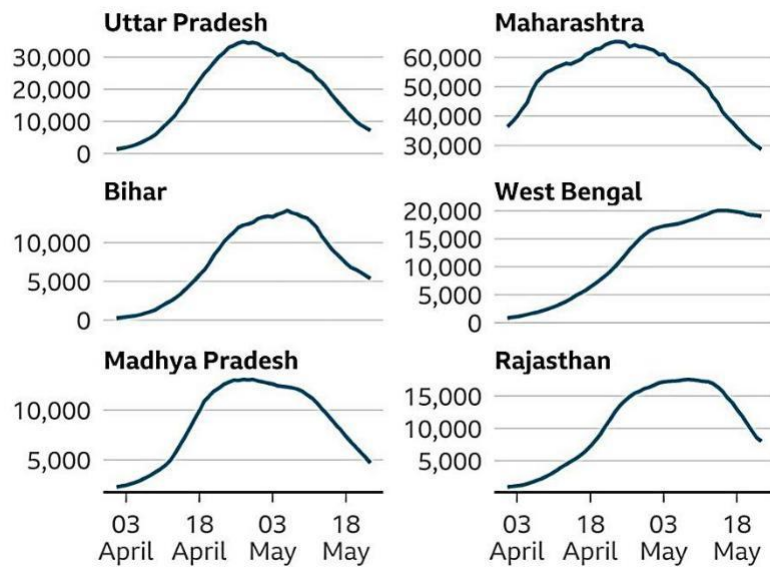
Source: BBC

Bharat began its vaccination programme on 16 January 2021. On 19 January 2021, nearly a year after the first reported case in the country, Lakshadweep became the last region of Bharat to report its first case.

States that peaked early were Maharashtra, Delhi, Uttar Pradesh, Jharkhand, Chhattisgarh, Bihar, Telangana, and Madhya Pradesh. States that peaked somewhat later included Karnataka, West Bengal, Kerala, Odisha, and Tamil Nadu. Case trajectory of six most populous states in Bharat are shown in the graph below:

### Case trajectory in 6 most populated states

7-day average of daily new cases



Note: Data up to 23 May 2021

Source: BBC

Super-spreading events in indoor settings, eg. house parties, social gatherings etc. can trigger local outbreaks, if COVID-appropriate behaviors are not followed. This was what happened in the second wave. Because some virus variants are more infectious and highly transmissible, and because micro-containment zones were not being monitored as effectively as containment zones last year, we saw entire families going down with the virus. Contact tracing guidelines were not being followed as rigorously as in the first wave. All

asymptomatic direct and high-risk contacts of confirmed cases are to be tested once between day 5 and day 10 of coming into contact, but they can continue spreading the infection if they return a false negative result. Also, during this surge, there has been a long waiting period for testing. Until the results were available, many asymptomatic persons violated isolation guidelines and continued to spread the infection.

The infection in the second wave spread at a faster pace in every age group. At present, there is very little data that shows how long the immunity lasts in the younger population. However, those who have comorbidities at a young age are certainly at a higher risk.

<b>MORTALITY RATES</b>		
<b>Age group</b>	<b>1st wave</b>	<b>2nd wave</b>
<10	0.27%	0.34%
10-20	0.53%	0.31%
20-30	2.08%	1.72%
30-40	5.27%	5.39%
40-50	11.98%	10.82%
50-60	23.29%	21.23%
60-70	28.76%	28.21%
70-80	19.99%	22.17%
80+	7.82%	9.81%

Data released by the Central Government shows that in seven age groups up to 70 years, the prevalence of deaths in the second wave was comparable to the prevalence in the first wave (table above). However, in the age groups 70-80 and above 80, mortality rates were higher in the second wave. It is still the older population who is at higher risk and needs to be protected in the third wave also. However, the number of deaths were high in all age groups, because there were more cases. And with the virus becoming more infectious and some mutations escaping the immune response, the younger population needs to strictly follow COVID-appropriate behaviors in the third wave as well.



## 2.5 How the Third Wave may behave in Bharat

Second wave of COVID 19 pandemic in Bharat is likely to decline by July '21, according to prediction of Department of Science and Technology, GOI. By that time per day cases are likely to decline to 20,000. These predictions are based on SUTRA (Susceptible, Undetected, Tested and Removed Approach) model.

Principal Scientific Advisor, GOI- Dr. K. Vijay Raghavan said on 05 May '21 that a 3<sup>rd</sup> wave of COVID 19 is inevitable in Bharat and country needs to be prepared for the same. *"Plausibility of a third wave of COVID 19 in India: A mathematical modelling, based analysis"* has been published in the Indian Journal of Medical Research (preprint available on 24<sup>th</sup> June 2021) which concluded that 3<sup>rd</sup> wave of COVID 19 could be substantially mitigated by the expansion of vaccination. Four possible mechanism of 3<sup>rd</sup> wave were considered: (i) Waning immunity after the infection may make individuals susceptible, (ii) New mutant strains may evade immunity rendered by previous infection, (iii) New highly transmissible variants driving infection or, (iv) Recent relaxation in lockdown may offer opportunities for transmission. Keeping all plausible factors, it was concluded that 3<sup>rd</sup> wave is unlikely to be as severe as second wave. These kinds of models are subject to many uncertainties, however vaccination coverage need to be scaled up for mitigation (which has already been done) and despite relaxation in lock-down, people should not lower their guards, as they did after the 1<sup>st</sup> wave and invited the surge in 2<sup>nd</sup> wave.

## 2.6 Indicators of 3<sup>rd</sup> Wave

Following 4 requisite criteria are needed to declare the onset of third wave.

- Second wave should have been contained, which means that reproduction rate is below 1, for 2 weeks.
- The low rate of infection has to remain sustained for 1 month.
- Cases to continue increasing for 2- 3 weeks thereafter, and
- Cases to continue to rise steadily after crossing the effective reproduction number ( $R_t$ ) of 1.5.

We may not have control on the behavior of virus, however we can have a control on our behavior by observing COVID appropriate behavior, which will be most crucial in the coming weeks and months. People should participate voluntarily in vaccination, and vaccine hesitancy need to be tackled at all levels. Children and women, particularly in rural, and remote areas must be the focus of any public health strategy to mitigate the sufferings of anticipated third wave of COVID.

## 3. Epidemiological modeling for the third wave

### 3.1 Background

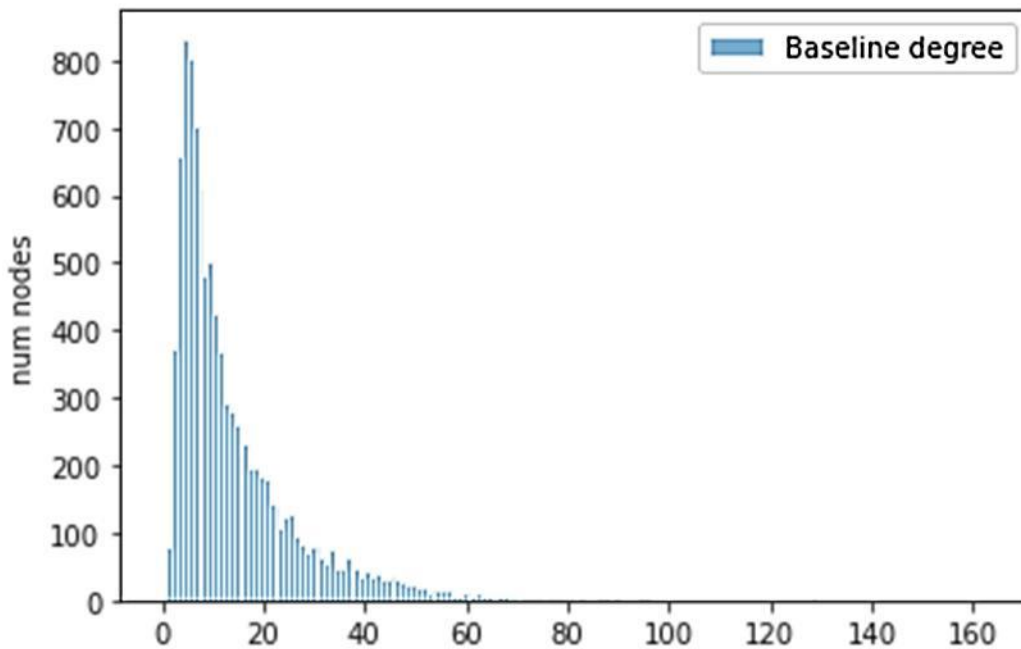
Since the beginning of COVID-19, mathematical models of varying complexities have been used in the nation to inform policy response, guide non-pharmaceutical interventions, and guide medical preparedness including interventions required to maintain ICU and oxygen availability during the peak. We note that epidemiological modeling is a complex exercise, which is highly sensitive to underlying data and required multitudes of socioeconomic, demographic, and Tracing, Testing, and Intervention related parameters. Moreover, the spread of highly infectious diseases including COVID-19 critically depends upon reliable estimates of underlying social networks, which show high variation among different age and working groups.

### 3.2 Design of experiments

In this study, we highlight for better understanding and hence preparation of the third wave, why there is an urgent and imperative need to establish a data-sharing pipeline between government stakeholders, and research groups as epidemiological modeling is a multidisciplinary problem, which can neither be solved by epidemiologists nor by mathematical modelers alone. Solutions lie at the confluence of social sciences, clinical practices, network science modeling, and mathematical modeling.

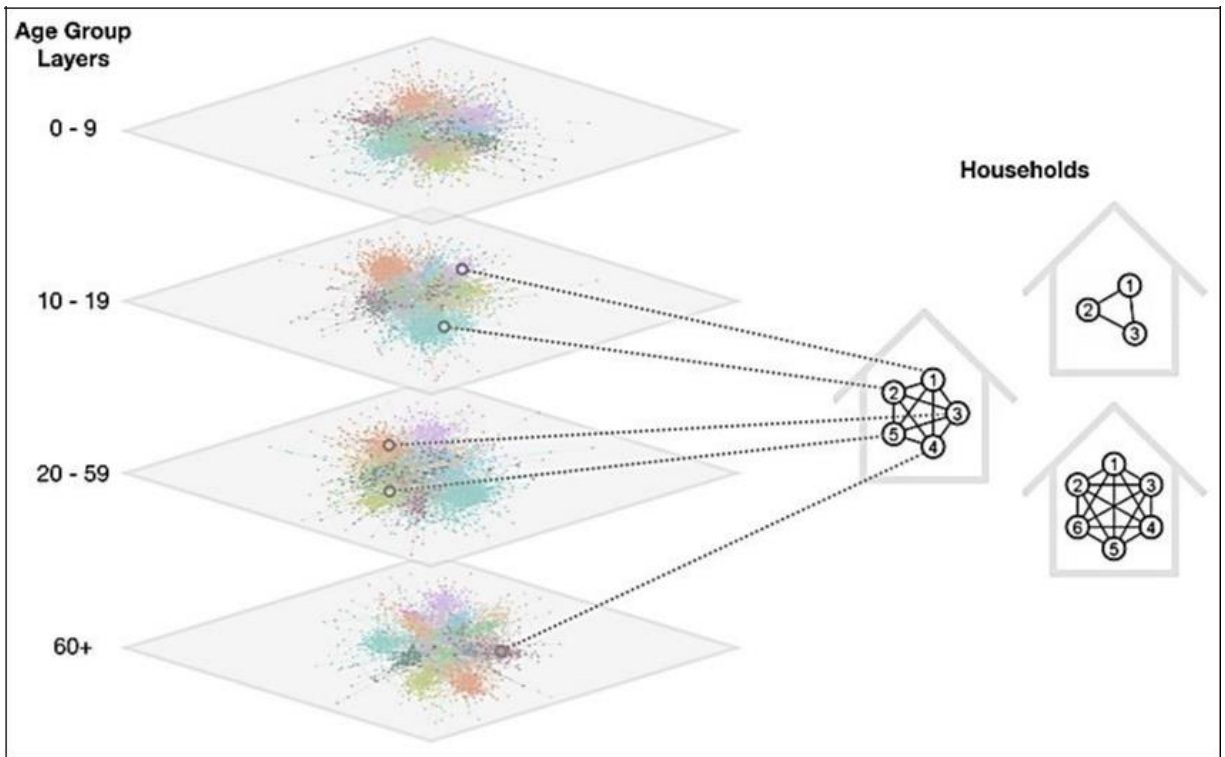
We simulate a real social setting with a 10000-population community and divide the entire population into age brackets using the information from Census data. We define a function for generating community-level contact networks with realistic network properties as well as age-stratification, households, and communities (e.g., schools, workplaces) that are calibrated to demographic statistics for a population of interest (Bharat in this case). FARZ network layers are generated to represent the out-of-household regular contacts amongst individuals of certain age groups (i.e., children, adults, seniors). FARZ networks

have a community structure, parameterized in this function such that half of an individual's connections are with members of their own community and half of their connections are with individuals from outside their own community. Separate FARZ network layers are generated for the 0-9 age group (communities can be thought of as primary schools), the 10-19 age group (communities can be thought of as secondary schools), the 20-59 age group (communities can be thought of as workplaces), and the 60+ age group (Figure 3.1 and 3.2). Details of these models can be found in [15].



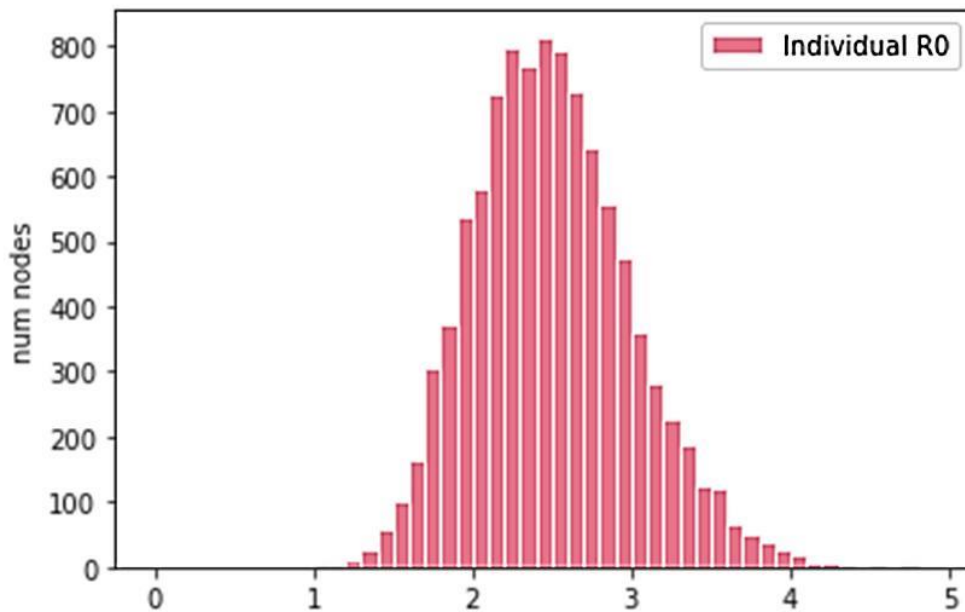
**Figure 3.1** Distribution of the number of interactions an individual would have in our network. Individuals on the far right side of the curve would classify as super-spreaders.

For any epidemiological model, clinical parameters (such as transmissibility, recovery time, asymptomatic rates, hospitalization rates, R values, etc.) are critical for a realistic representation of the disease epidemiology. We use the known parameters from wave 1 and wave 2 and generate distributions for each of these parameters to represent the uncertainty that may arise either from missing data or from ongoing mutations.



**Figure 3.2 FARZ networks** for different age groups capture differences in the magnitude of interactions across the age groups and households of different sizes.

For example, figure 3.3 shows the distribution of  $R_0$  (one of the key parameters that define how many individuals will get exposed to an infected individual (on average)).



**Figure 3.3** Distribution of  $R_0$  for the individuals in the network.

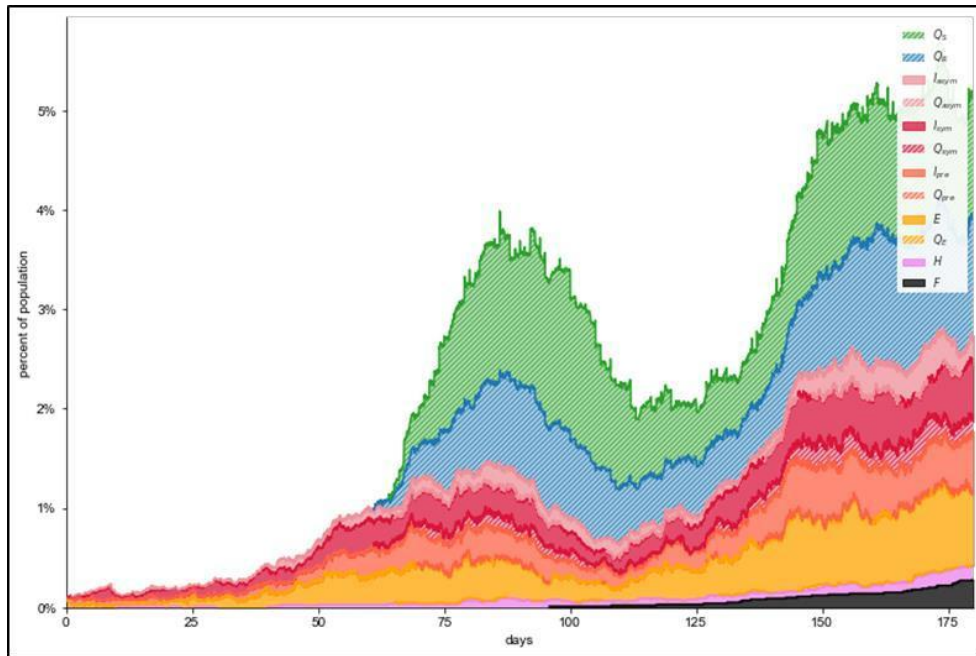
### 3.3 Policy Parameters

Finally, to realistically simulate the impacts of lockdown and tracing, testing and intervention (TTI) protocols, we use the following TTI protocol:

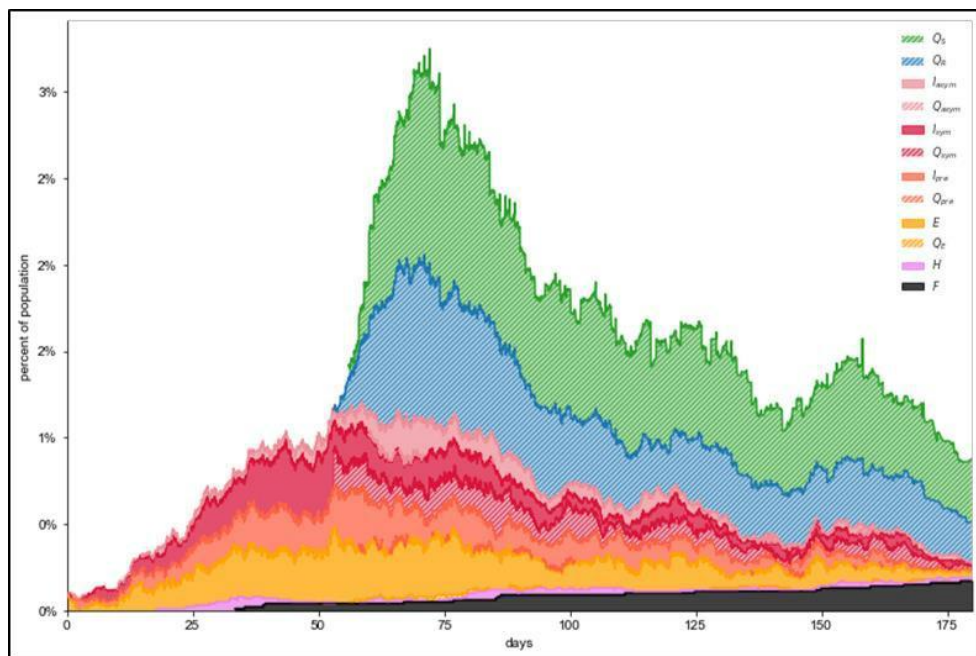
- On each simulation day:
  - Introduce exogenous exposures randomly
  - Some fraction of symptomatic individuals self-isolate (without a test)
    - Some fraction of groupmates of self-isolating symptomatic individuals may also self-isolate (without a test)
  - Some fraction of traced contacts of positive cases self-isolate (without a test)
    - Some fraction of groupmates of self-isolating traced individuals may also self-isolate (without a test)
  - Administer a fixed allotment of tests:
    - A portion of the day's tests are used on some fraction of symptomatic individuals that seek a test on their own
    - On designated testing cadence days:
      - A designated portion of the day's tests are used on individuals that have been identified by contact tracing
      - The remainder of the day's tests are used on randomly selected individuals from the population
    - The aforementioned tests are conducted with sensitivities that depend on each individual's disease state and how long they've been in that state.
    - For each individual that tests positive:
      - Isolate the positive individual, if compliant (after a designated turnaround time)
      - Isolate the positive individual's groupmates, if compliant (after a designated turnaround time)
      - Add the positive individual's contacts to the contact tracing queue, if compliant (to be tested after a designated tracing lag time)

### 3.4 Results

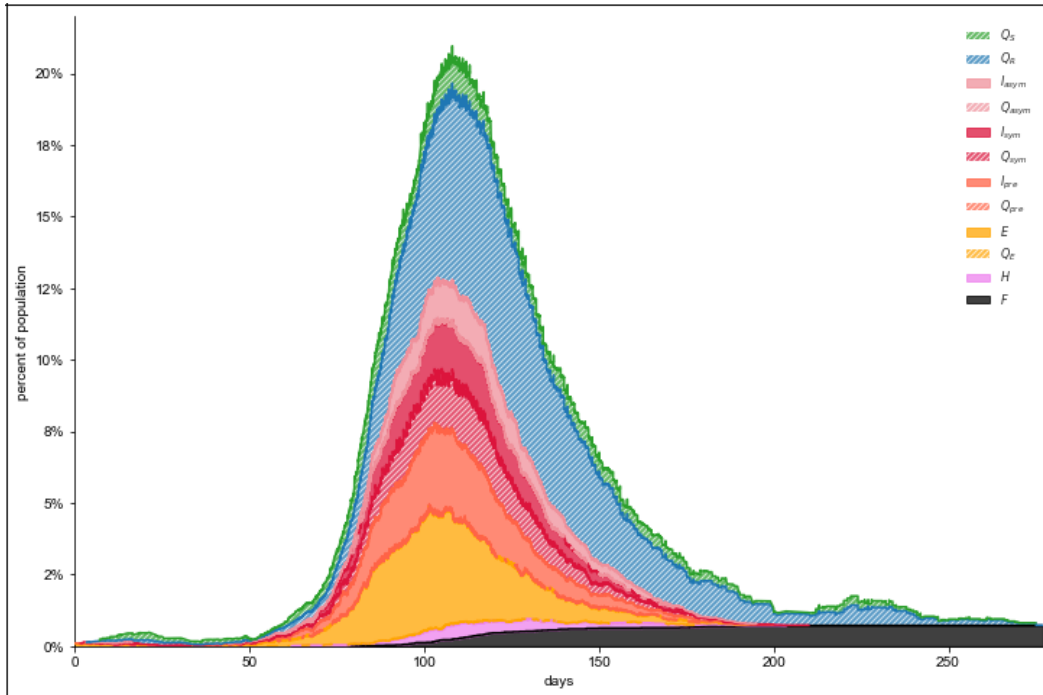
For investigation purposes, we run a finite combination on the controlled population using the demographical details of a representative state (Uttar Pradesh in this case) and try to understand the impact of various TTI protocols on the spread (Figures 3.4 – 3.6).



**Figure 3.4** Early interventions from the Government with limited compliance of the citizens



**Figure 3.5** Simulations with early interventions with stricter compliance



**Figure 3.6** Simulations with delayed interventions.

Figure 3.4 shows early interventions from the Government with limited compliance, figure 3.5 shows the simulations with early interventions with stricter compliance, and figure 3.6 shows the simulation results with delayed TTI interventions with the same level of compliance as Figure 3.4. It is interesting to note the drastically different behavior across the scenarios for perturbation in protocols where we were able to mimic and partition the relative contributions of different cases during the propagation of the disease. We notice typical dual wave patterns in figure 3.3, whereas figure 3.4 exhibits a relatively flatter peak. Figure 6 shows that delayed interventions can result in a much sharper peak with 20% positive cases around the peak. **Our limited simulations provide a sneak-peek into why “one-size-fits-all” modeling approaches can give a deceiving picture. Moreover, there is an imperative and urgent need to embed uncertainties and worst-case scenario projection in our studies for proactive planning and management.**



### 3.5 Recommendations for government agencies/stakeholders

- **Sharing real-time data at finer scales:** Credible planning and proactive management of highly contagious disease critically rely on credible forecasts, which in turn, depends upon reliable datasets (number of cases, tests, age-wise disease severity, mobility data, etc.). Sharing these datasets with researchers/data scientists can help us monitor the real-time transmissibility (or R values) at the district level. Creating a robust data pipeline can help us not only prepare for the third wave but would set a system in place even for another communicable disease.
- **Embracing uncertainty in our decision-making:** The situation with COVID-19 is evolving with changing dynamics and transmission characteristics. Hence, there is a need to understand the range of uncertainties from outputs of these epidemiological models and align the planning to be modular enough to look at the best and worst-case scenarios for pragmatic management of the pandemic.

## 4. Health Impacts

### 4.1 Purpose and Objective

People with COVID-19 have had a wide range of symptoms reported – ranging from mild symptoms to severe illness. Symptoms may appear 2-14 days after exposure to the virus (latent period). Anyone can have mild to severe symptoms. Many may remain asymptomatic, particularly younger people.

People with these symptoms may have COVID-19:

- Fever or chills
- Cough
- Shortness of breath or difficulty in breathing
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

### Symptoms in children

- Fever or chills
- Cough
- Nasal congestion or runny nose
- New loss of taste or smell
- Sore throat
- Shortness of breath or difficulty in breathing
- Diarrhea

- Nausea or vomiting
- Stomach ache
- Tiredness
- Headache
- Muscle or body aches
- Poor appetite or poor feeding, especially in babies under 1-year-old

## **4.2 Issues**

### **4.2.1 Difference between COVID-19 and Flu**

Influenza (Flu) and COVID-19 are both contagious respiratory illnesses, but they are caused by different viruses. COVID-19 is caused by infection with a new coronavirus (called SARS-CoV-2), and flu is caused by infection with influenza viruses.

COVID-19 seems to spread more easily than flu and causes more serious illnesses in some people. It can also take longer before people show symptoms and people can be contagious for longer. More information about differences between flu and COVID-19 is available elsewhere.

Because some of the symptoms of flu and COVID-19 are similar, it may be hard to tell the difference between them based on symptoms alone, and testing may be needed to help confirm a diagnosis.

### **4.2.2 Newer mutant strains in Bharat**

Kappa, also known as B.1.617.1, and Delta, also called B.1.617.2, are considered subtypes of what's been referred to as the Indian variant — B.1.617. These mutant strains are associated with novel symptoms as follows:

- Loss of hearing: Loss of hearing has been reported in individuals with mild, moderate as well as severe Covid-19 infection. Since the beginning of the recent second wave of

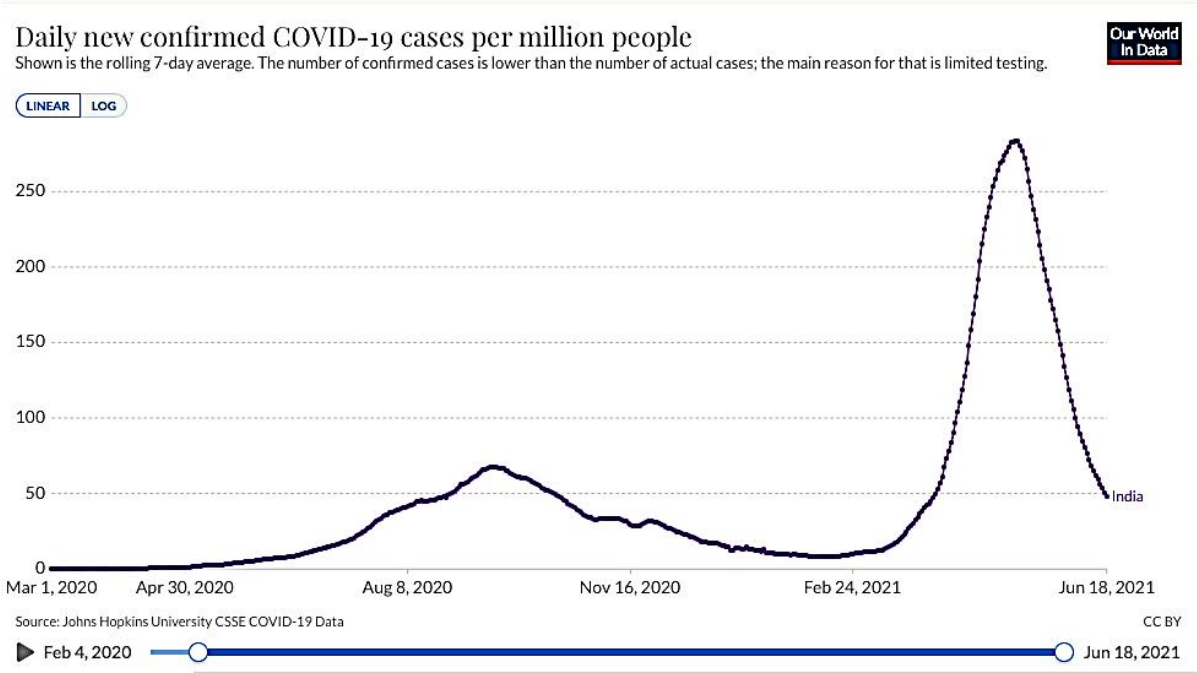
the second wave of COVID-19 pandemic, hearing loss has been confirmed as a new symptom.

- **Pink eye/Conjunctivitis:** The new mutant strain of COVID-19 in Bharat has been observed to affect the eyes as well, with sudden bouts of conjunctivitis. Unlike regular conjunctivitis, this disease will only affect one eye but it may also cause irritation and sensitivity to light in the other.
- **Extreme weakness:** Weakness and fatigue continue to be symptoms of COVID-19 in the second wave as well.
- **Gastrointestinal tract:** It is obvious that any disturbance to our main digestion organs can hamper our overall health. Symptoms of GI tract infections may indicate COVID-19 infection, and this includes vomiting, abdominal pain, loose stools and hunger as well.
- **Bone-dry mouth and reduced secretion of saliva:** Yet again a similar symptom like the older variant of COVID-19, oral manifestations of this disease can include dryness of mouth, changes in color and texture of tongue, sore blisters, difficulty in eating and dry tongue.
- **Severe and long-lasting headache:** A very prominent symptom observed in the second wave of COVID-19 appears to be headache. It can continue for a long period of time and will not sober down with normal painkillers.
- **Diarrhea:** Diarrhea has been reported to be a prominent symptom of COVID-19 during the second wave. It could last from 1 to 15 days.
- **Rashes and skin irritation:** Studies have proven that rashes on the skin in different parts of the body, such as hands and feet, also called acral rashes, are a result of the immunological response to the virus.

#### **4.2.3 Differences in epidemiologic patterns**

While women accounted for 27% of all the deaths in the first wave, they have accounted for nearly 33.5% of all the deaths thus far in the second wave. But the gender distribution of cases remains the same, with women accounting for 40% and men 60%.

Similarly, while those aged 21-60 accounted for 38.7% of the deaths in the first wave, they have accounted for 43.6% in the second wave. In comparison, the percentage of those aged 60 and above among the deceased has declined from 61% in the first wave to 56.3% in the second wave. However, there has been no major shift in the reported cases. In fact, the percentage of the elderly among the cases has increased from 13.1% in the first wave to 14.4% in the second wave.

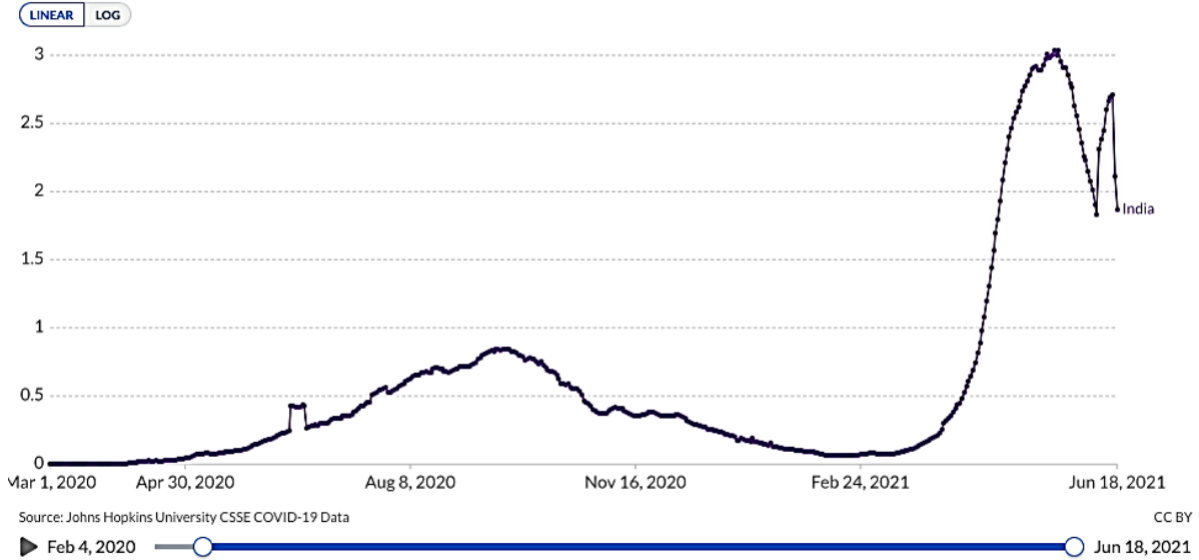


Source: <https://ourworldindata.org/covid-deaths>

The number of deaths reported daily during the second wave has been on a steep rise, with more than 1,200 deaths occurring in certain one-week periods alone, during the early second wave. In comparison, during the 12-week period from July to September, there were a total of nearly 7,900 deaths. However, the case fatality rate appears lower, at least for now, than in the first wave. While the case fatality rate was around 1.62% at the peak of the first wave from July to September, it is around 1.03% as of now in the second wave. While the decline in the case fatality rate is seen among all age groups and gender, it is more pronounced among the elderly. They, however, remain the most vulnerable with a case fatality rate of 3.91%, compared with the overall rate of 1.03%.

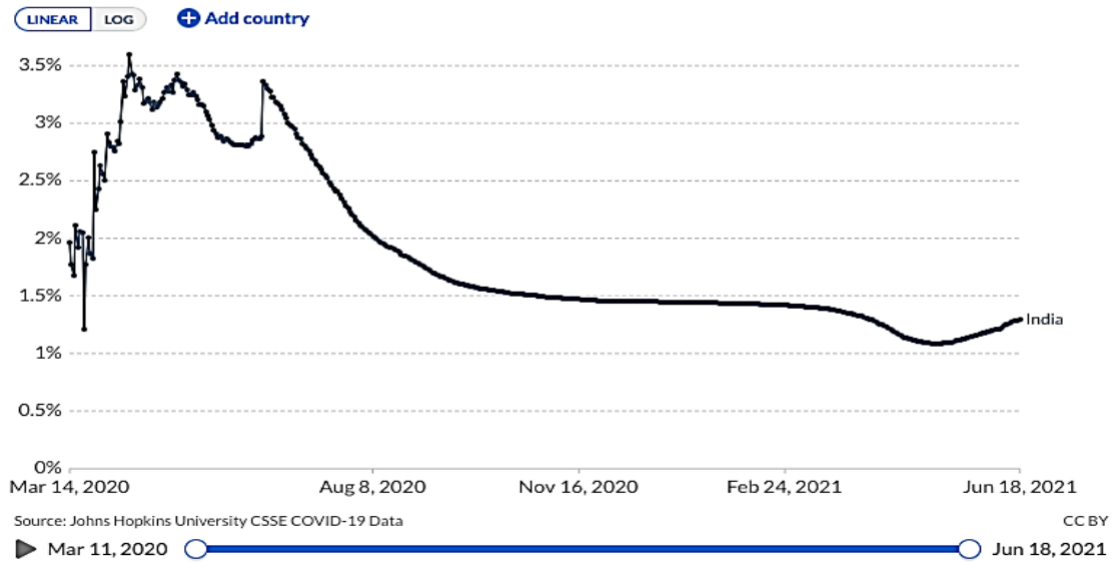
## Daily new confirmed COVID-19 deaths per million people

Shown is the rolling 7-day average. Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.



## Case fatality rate of the ongoing COVID-19 pandemic

The Case Fatality Rate (CFR) is the ratio between confirmed deaths and confirmed cases. During an outbreak of a pandemic the CFR is a poor measure of the mortality risk of the disease. We explain this in detail at [OurWorldInData.org/Coronavirus](https://ourworldindata.org/coronavirus)



Source: <https://ourworldindata.org/covid-deaths>

Bharat's case fatality rate has come down from nearly 3.6% in the first wave of the pandemic to about 1.3% at present in mid-June 2021.

### **4.3 ACTION PLAN**

#### **A) FOR GOVERNMENT**

- Notification of symptoms
- Notification of new symptoms in adults and pediatric populations
- Updating epidemiology based on current information on a regular basis based on age, sex, socio-economic patterns etc.
- Notification of early symptoms and signs of Mucormycosis

#### **B) FOR ACADEMIC BODIES**

- Research focused on association of new symptoms with epidemiological parameters
- Research on association of classical COVID symptoms with newer strains

#### **C) FOR PUBLIC**

- Properly following government mandated instructions of using face masks, hand hygiene, social distancing.

## 5. Vaccination

### 5.1 Purpose and Objective

Currently, we do not have any specific anti-viral agent against COVID-19. Vaccines are the real hope for prevention of this pandemic. But we do not know, how much available vaccines will be effective on existing and newer strains and those already infected. How vaccination is likely to affect the 3<sup>rd</sup> wave of COVID 19, is another question we need to answer?

### 5.2 IPR Related Hurdles in Universal Access to Vaccine and Medicines

This is the right of every human being on this earth to get vaccine and medicines at affordable prices. The major impediment to the mass production of COVID Vaccine and Medicines is the patent laws and intellectual property rights under the provisions of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization which do not allow other pharma companies to manufacture these vaccines and medicines. Bharat and South Africa have proposed to WTO's TRIPS Council for waiver of TRIPS provisions for production of vaccines and medicines. It is to be noted that people along with their representatives, all around the World are one on this issue and are supporting the proposal. However, greed of the companies and their supporter governments in some countries are creating hurdles in the smooth passage of this resolution at World Trade Organization (WTO).

It's now realized world over that patent laws need to be relaxed, even if it is for a limited period, to increase the production of vaccines and medicines to save the world's 7.87 billion population from the clutches of corona. In Bharat because of huge capabilities for vaccine production on the one hand and indigenously developed vaccines and proactive approach of the government, Bharat is relatively in a much better position to vaccinate majority of her population by the end of this year, free of cost. However, there is a huge requirement of COVID related medicines and other materials, in which Bharat is



handicapped to provide affordable and sufficient supplies, due to IPR hurdles (which include patents, designs and copy rights) apart from hurdles emanating from hurdles in technology transfer and trade secrets. Proposed TRIPS Waiver will help overcome these hurdles in the way of production of vaccines and COVID related medicines and other materials, to be made available in Bharat and the world. It will not be out of context to mention that whereas Government of Bharat is purchasing COVID vaccine for rupees 150 per dose, the same is being sold by big pharma in other countries at a price ranging between rupees 3000 and 5000 per dose, making it nearly impossible for poor countries to afford the same. Though this TRIPS Waiver proposal of Bharat and South Africa has explicit support of more than 120 countries, but a handful of countries, including countries of European Union, are opposing the proposal, under influence from corporate interests. All humanitarian forces should join hands to make this proposal get support from all, as failure of this proposal would endanger the existence of the humanity itself.

### **5.3 Efficacy of vaccines**

A study from the UK found that a single dose of a Pfizer or AstraZeneca vaccine against coronavirus disease can reduce transmission by up to 50 per cent. The study led by UK's Public Health England (PHE) showed that people who took the first dose of either the Pfizer or AstraZeneca vaccines -- and who became infected three weeks later -- were between 38 per cent and 49 per cent less likely to pass the virus on than unvaccinated people. In the study, protection against COVID was seen from about 14 days after vaccination, with similar levels of protection regardless of age of cases or contacts. The protection was in addition to the reduced risk of a vaccinated person developing symptomatic infection in the first place, which is around 60 to 65 per cent -- four weeks after one dose of either vaccine.

Two vaccines were granted emergency use authorization by the Central Drugs Standard Control Organization (CDSCO) in Bharat, Covishield® (AstraZeneca's vaccine manufactured by Serum Institute of India) and Covaxin® (manufactured by Bharat Biotech Limited). Sputnik - V has been granted EUA in the month of April 2021. Both the Indian COVID-19 vaccines have completed their Phase I & II trials. Now the phase 3 trial data for

Covaxin is also being made available by the company, paving the way for WHO approval. Covishield® has completed its Phase III trials in UK and the bridging trial in Bharat.

Based on the potential availability of vaccines, the Government of Bharat has selected the priority groups who will be vaccinated first as they are at higher risk. The first group included healthcare and frontline workers. The second group to receive COVID-19 vaccine was the persons over 60 years of age and persons between 45 and 59 years of age with comorbid conditions. From April 1st, 2021, People above the age of 45 years (born before 1st Jan, 1977) are eligible to get the COVID-19 vaccine. From May 1st, 2021, all eligible citizens above the age of 18 years can get the COVID-19 vaccine.

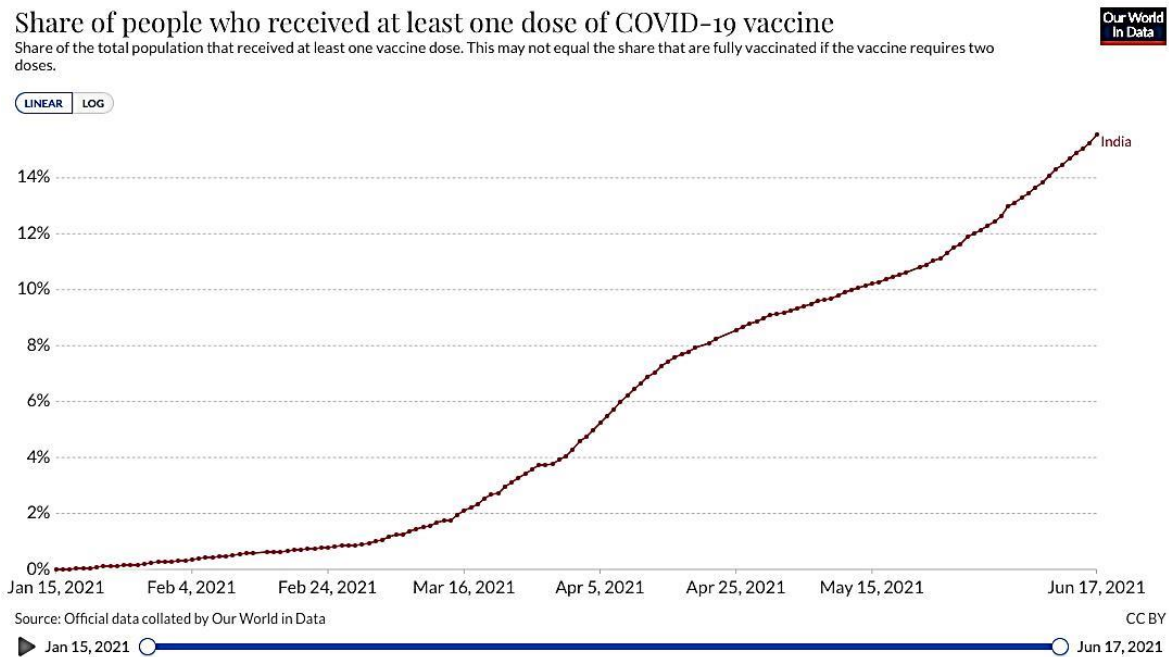
Bharat has currently vaccinated more than 25 crores of its population, while approximately 6 crores are fully vaccinated which translates to roughly 5% of its population.

#### **5.4 Availability of Vaccines**

- **For adult population-** 4 types of vaccines, viz. Covaxin, Covishield, Sputnik and Novavax are available in Bharat. GoI is committed to vaccinate all eligible adult population by December 2021. This is a herculean task undertaken which looks to be achievable. The way the vaccination program is running in the country currently and assured supply of required number of vaccines, it seems to be done in time.
- **For Children-** There are ongoing trials of Covaxin for children and also Pfizer and Novavax vaccines. COVID vaccine in the form of Nasal spray when available may become a boon for child immunization program.

COVID vaccination was launched in Bharat on 16<sup>th</sup> January 2021. Based on the availability of vaccines, the Government of India selected the priority groups who will be vaccinated on priority as they are at higher risk. The first group included healthcare and frontline workers. The second group to receive COVID-19 vaccine were the persons over 60 years of age and persons between 45 and 59 years of age with comorbid conditions. From April 1st, 2021, people above the age of 45 years (born before 1st Jan, 1977) were eligible to

get the COVID-19 vaccine. From May 1st, 2021, all eligible citizens above the age of 18 years can get the COVID-19 vaccine.



Source: <https://ourworldindata.org/covid-deaths>

Bharat has currently vaccinated more than 25 crores of its population, while approximately 6 crores are fully vaccinated which translates to roughly 5% of its population, while 22% of Indian population (approximately 26 crores) have received at least one dose of the vaccine. **Government of India intends to vaccinate all eligible population by December 2021.**

#### 5.4 ACTION PLAN:

##### A) FOR GOVERNMENT -

- Updating and maintaining record of vaccination
- Recording details of persons who become COVID infected even after vaccination
- Recording adverse events following immunization (AEFI)

## **B) FOR ACADEMIC BODIES**

- Research on effect of vaccines with newer strains and re-infection
- Research on persistence of antibodies in the sera of patients recovering after COVID infection or post-vaccination

## **C) FOR PUBLIC**

- Properly following government mandated instructions of using face masks, hand hygiene, social distancing
- Getting themselves Vaccinated on time

# 6. Health Service Preparations

## 6.1 Purpose and Objective

The second wave of the coronavirus pandemic highlighted the need of adequate preparation and coordination at a national level for effectively mitigating the threat caused by the virus.

## 6.2 Issues

Adequate hospital facilities, adequate beds for COVID, supply of oxygen and ventilators, availability of essential drugs for managing COVID.

## 6.3 ACTION PLAN:

### A) FOR GOVERNMENT

- COVID hospitals – Allocation of new hospitals, designation of certain parts of hospitals as COVID centers, dedicated standalone COVID hospitals
- PPE, Sanitizers, Gloves – Ramping up production to become self-sufficient
- Ventilators – Ramping up production, allocation through PM CARES fund
- Drug availability – Ensuring availability and supplies of necessary drugs, increasing production of essential drugs
- Beds, oxygen, medicines – Increasing production, maintaining daily updated online records, ensuring centralized availability
- Providing rations – Allocation of food grains, rations for food security
- First wave – Lockdown was very effective which reduced spread and case fatality, however, in Second wave – Lockdown was left to states. GoI to take initiative during anticipated third wave.
- Maintaining balance between minimizing COVID spread and not causing loss to economy

- Budget allocations – Special allocations made by the PM and other union ministers at different times in a coordinated manner.

## **B) FOR ACADEMIC BODIES**

- Education and research for a health plan to manage the third wave effectively by a combined approach from administrators and health service professionals

## **C) FOR PUBLIC**

- Not to panic in case of a third wave
- Registering at the concerned medical facility for care, and vaccination of all eligible.
- Going through proper channels to obtain care
- Not to spread rumors

# 7. Issues of Lowered Immunity

## 7.1 Purpose and Objective

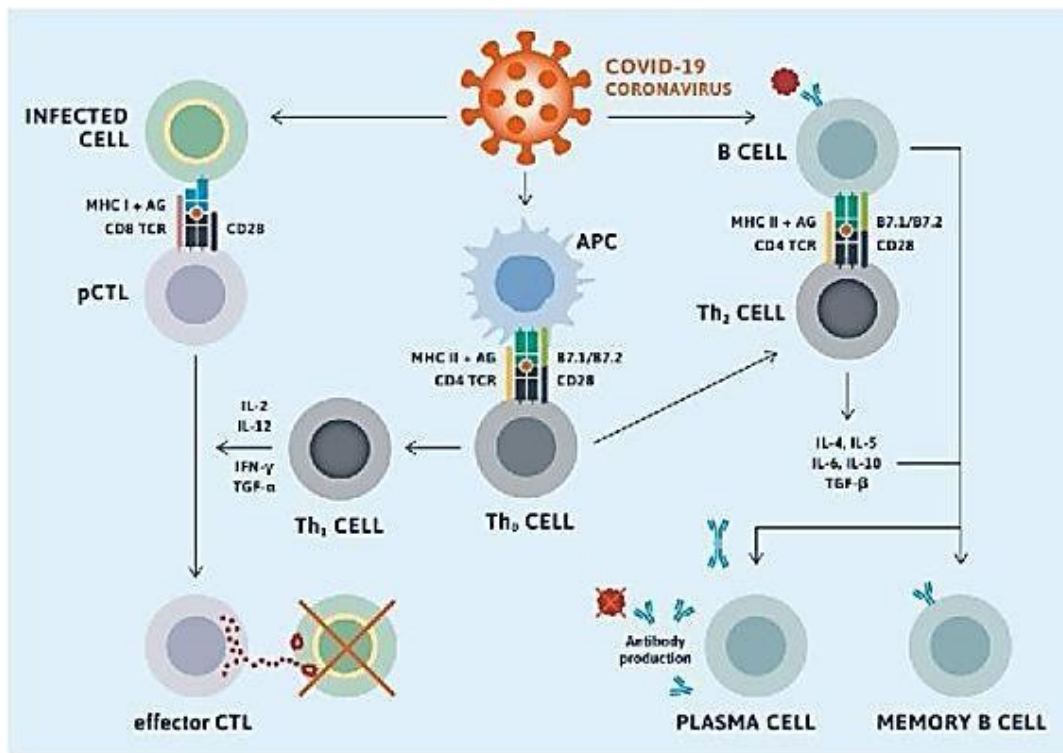
Lowered immunity due to the COVID infection

Lower Immunity is associated with higher morbidity and mortality

Lower immunity prolongs recovery

Normal immune response is modified by COVID

## 7.2 COVID Immune Response



**Source:** Mohammad Asaduzzaman Chowdhury, Nayem Hossain, Mohammad Abul Kashem, Md. Abdus Shahid, Ashraful Alam. Immune response in COVID-19: A review. Journal of Infection and Public Health. Volume 13, Issue 11, 2020, Pages 1619-1629

The immune system protects against viruses and pathogens by producing antibodies to kill pathogens. This review presents a brief overview of the immune system regarding its protection of the human body from COVID-19; illustrates the process of the immune system, how it works, and its mechanism to fight virus.

Researchers are attempting to improve the immune system against COVID-19. Ten proteins are encoded by the COVID-19 genome; one of them is the S protein, which is a glycoprotein. The S protein is a significant therapeutic target, ensured by its location, and it is targetable using antibodies. The formation of neutralizing antibodies' immunization of animals with S protein-oriented vaccines is very effective in preventing infection by homologous coronavirus. If human cells are infected by virus entities, epitopes from any of that viruses' proteins can theoretically be bound and presented by MHC-1 receptors on host cell surfaces, leading to the stimulation of CD4 and CD8 T cells to provoke antibody-mediated and cell-mediated immune responses.

### **7.3 Issues**

Bacterial co-infections and secondary infections are commonly identified in severe influenza (23% in a meta-analysis) and other severe respiratory viral infections, in which they are associated with increased morbidity and mortality. National and international COVID-19 guidelines vary in their recommendations on empirical antimicrobial therapy— some recommend empirical antimicrobial therapy in severe disease, whereas others do not. Some international guidelines advise against empirical therapy when lower respiratory tract infection is thought to be due to COVID-19, without specific evidence of bacterial infection. Living systematic reviews and meta-analyses have reported a low prevalence of confirmed bacterial co-infection (8%), but a high proportion of patients with COVID-19 received antimicrobials (pooled prevalence 75%). The collective implications of these studies are a widespread failure of antimicrobial stewardship with the potential to worsen the global antimicrobial resistance crisis. The most common infections are respiratory, blood-stream and urinary infections; and in respiratory infections, the most detected pathogens were gram-negative bacteria, following by gram-positive bacteria, virus, fungi, and others. In Bharat, there has been alarming number of cases of mucormycosis as an opportunistic fungal



infection, precipitated by presence of comorbidities like diabetes, indiscriminate use of steroids without doctor's supervision, and non-reporting of early symptoms.

First, are there synergic interactions between the SARS-CoV-2 virus and certain coinfecting bacteria? Second, does coinfection with antibiotic-resistant bacteria affect disease severity? Indeed, some of the pathogens detected in COVID-19 patients can be antibiotic resistant, which could reduce the efficacy of treatments administered to patients. It is impossible to determine from the available data whether certain bacterial species or whether antibiotic-resistant strains correlate with outcome severity or mortality. However, the presence of antibiotic-resistant bacteria could potentially explain the high rates of bacterial coinfections in critically ill patients despite extensive antibiotic treatments in those cohorts. Finally, the battle with COVID-19 may accelerate the worsening of our already dire situation with respect to antibiotic-resistant pathogens. The rising number of multidrug-resistant bacteria and our decreasing capacity to eradicate them not only render us more vulnerable to bacterial infections but also weaken us during viral pandemics. To tackle this serious issue, we urgently need to investigate the effects of bacterial coinfections during viral infections and find new antimicrobial compounds to eradicate multidrug-resistant pathogens.

## **7.4 ACTION PLAN**

### **A) FOR GOVERNMENT**

- Attempts at improving immunity for the general public
- Legislation against the unopposed use of corticosteroids
- Drugs should be strictly used under the prescription of a physician, regulate over the counter (OTC) drugs
- Issue of guidelines on antibiotic policy in Covid 19

### **B) FOR ACADEMIC BODIES**

- Research on persistence of antibodies in sera of patients recovered from COVID
- Research on persistence of antibodies in sera of patients vaccinated for COVID

- Patterns of re-infection
- Estimation of antibodies in patients suffering secondary bacterial and fungal infections, to assess if there is a direct correlation between quantitative estimation of IgG levels and secondary infection
- Research on antibiotic resistance in Covid 19

### **C) FOR PUBLIC**

- Avoid indiscriminate use of medicines, especially antibiotics and steroids
- Don't use medicines without the prescription of a physician
- Avoid panic and avoid unnecessary potions, supplements without advice from experts

## 8. AYUSH Integration

Ayurveda, Yoga, Homeopathy and Other Traditional Health Systems need to be Integrated with Modern Medicine by developing proper standardization & Clinical Trial Parameters.

### 8.1 Purpose and Objectives

AYUSH as whole was not optimally utilized in our fight against COVID 19, though individual efforts of great success were reported.

- How the infrastructure of AYUSH doctors, medical colleges & hospitals can be integrated in the fight against COVID 19 in future, in our preparation for anticipated third wave?
- How AYUSH physicians can be integrated with modern medicine for health care delivery: For Prevention of COVID 19, Promotion of Health and Immunity, and treatment of patients.
- Creation of evidence for AYUSH knowledge for its acceptance by modern world and its practitioners of various streams of medicine all over the globe.
- How the traditional knowledge of home remedies, plant-based preparations can be used for prevention of disease and promotion of health, particularly keeping in view the third wave of COVID 19.

### 8.2 Issues

1. Bharat has 8 lakhs certified AYUSH doctors, who were not optimally utilized in the COVID 19 crisis. They need to be integrated with 12 lakhs Allopathy doctors.
2. About 1 million village-based AYUSH community-based workers need to be integrated in the COVID 19 care.

3. 800 AYUSH medical colleges/ universities (as on 7. 11. 2020; MOHFW, GOI)- 60% of them being Ayurvedic Degree Colleges have to be optimally involved in COVID care.
4. There is an Urban > Rural mismatch of manpower, as well as institutions and services. Rural is primarily served by government doctors and infrastructure. (Presence of AYUSH doctors is 7 times more in urban areas per 1000 population).
5. Absence of enough modern scientific evidence on AYUSH products and procedures, in majority of medical conditions, including COVID 19.
6. Usefulness of Healthy life style, regular *din charya, ritu charya* for healthy life, prevention of disease, promotion of health in reference to COVID 19.
7. To supplement the frontline work force of healthcare providers with the Internship students, Ayush PG and final year UGs, and Paramedical students to augment the healthcare provider work force, many of whom are fatigued and in post-COVID recovery phase.

### 8.3 Preparatory Action Plan

#### 8.3.1. Action Plan at Government Level (Central/State):

1. Running AYUSH OPD and IPD services for COVID 19 in all Government and Private medical colleges and hospitals.
2. At least 10% of AYUSH hospital beds to have provision of bedside oxygen supply.
3. Encouragement and Financing of the research in following areas:

**a) SHORT TERM/ IMMEDIATE RESEARCH FOR ROLE OF FOLLOWING ON PREVENTION and TREATMENT of COVID:**

- **AYURVEDA:** *Chyawanprash, Ashwagandha, Giloy, Trikatu, Triphala, Bal Chatur Bhadra churna/syrup, Swarna Prashan etc.*
- **HOMEOPATHY:** *Arsenicum album, Camphor, Aconitum, Belladonna, Bryonia, Eupatorium, Ferrum phoshoricum, Gelsemium etc.,*
- **SIDDHA:** *Kaba Sura Kudineer, Amukkara churnam, Neelikkai Ilagam, Thalishathi vedagam, Seenthil churnam, Adathodai Mannapagu, Brahmananda Bairavam, Theepili rasayanam, Swasa Kudori Mathirai, etc.*

Similarly, research on the preparations and procedures prescribed by other **Indian System of Medicine (ISM)** need to be researched. The research on AYUSH 64 (repurposed) was successfully undertaken. Original research in other areas in collaboration with other systems of medicine also to be encouraged.

**b) LONG TERM RESEARCH ON THE FOLLOWING TO BE ALSO UNDERTAKEN:**

- Role of Yoga (*Ashtang Yog*) in prevention of viral infections (COVID 19 included).
- Role of yoga on prevention and treatment of Diabetes, Hypertension, Sleep disorders; which all have bearing on COVID 19.
- Role of Healthy Life Style, Regular *Din Charya and Ritu Charya* in health and disease; (and other tenets as Propounded by *Mahrishi Vagbhatt* in *Ashtang Hridayam*).
- Role of Yoga in Post -COVID recovery.
- Role of Oil Pulling (*Kavala or Gundusha*) and Oil *Nashya* for prevention of Viral, bacterial and fungal infection during and post-COVID 19 recovery phase.
- Role of oil *Nashya* for prevention of viral infections in children.

**8.3.2 Role of Civil Society/ Voluntary Organizations/ Sewa Sangthans for Public Awareness**

- Public Awareness and Health Education for prevention of COVID 19: COVID Appropriate Behavior (CAB)- ***Do gaj ki doori, Mask hai Jaruri***, avoiding crowded congested places and un-ventilated indoors and hand washing with soap-water/ alcohol-based sanitizers.
- Health education on AYUSH guidelines ([main.ayush.gov.in](http://main.ayush.gov.in)): **National Clinical Management Protocol Based on Ayurveda and Yoga for Management of COVID 19, and Home Care Guidelines for Children, Ministry of Ayush, GOI.**
- Awareness about Homeopathy guidelines (**CCRH Revised Guidelines, 2021**).

- Public awareness using **Arogya Bharti** Guidelines for general public, **Corona Arogya Mitra Prashikshan Pustika**.
- Health Education about healthy life style, Regular *Din charya*, and *Ritu charya*, including regular exercise, Surya Namaskar, Yagasan, Pranayam and Dhyan.
- Awareness, popularization and use of Ayush 64.
- Public Awareness about Guduchi (Giloy), Ashwagandha, Chyawanprash, Trikatu, Triphala, Turmeric, Pepper, Pippali, citrus fruits, Amla, Ginger, Mulethi, etc which are found to be useful in infections/Covid 19.
- Popularization of *Gundusha*, and *Nashya*.
- Eating of regionally grown and seasonally available fruits and vegetables.
- Few minutes of sun exposure during morning of summer or sun bath in winters for vitamin D.
- Adequate Rest and sleep (6-8 hours).
- Avoidance of processed and preserved food, alcohol, drugs and smoking, sugar and excessive salt intake.
- Practice of *Paropkar* (Benevolence) and *Karuna* (Compassion) for mental health.

### **8.3.2.1 Resource Persons**

- I) Volunteers of Arogya Bharti, NMO, Sewa Bharti- Arogya Mitra and swayam sewaks.
- II) *Arogya Mitra* of Ayushman Bharat Yojna (PM Jan Arogya Yojana).
- III) ASHA and Anganwadi workers and Multi-Purpose Health Workers of Provincial Health Services.
- IV) Staff of Wellness Centers (150,000 in number) of Ayushman Bharat Yojana.
- V) Other Voluntary organizations, like Vivekanada Youth Forum, Youth in Action, Rotary club, Lions club, Red Cross Society etc.

### **8.3.3 Action Plan for Public at Personal and Social Level**

#### **8.3.3.1 General Guidelines**

1. Maintenance of hygiene and sanitation in community.

2. Avoidance of crowding and gatherings, and outdoor visits,
3. Staying indoor in well ventilated places.
4. Avoidance of meat, poultry and especially wild animals: Primordial host- Bat→ Intermediate host- (Civet Cat, Camel, Pangolin)--→ Human transmission.
5. Daily gargle with warm water added with turmeric & salt.
6. Freshly cooked, easily digestible food for both, healthy and COVID patients. Avoid processed, preserved and deep-fried food.
7. Avoid excess intake of fat, oils, sugar and salt.
8. Follow the AYUSH guidelines issued by Ayurveda, CCRH guidelines, Siddha guidelines, and Arogya Bharti guidelines: by public at large.

#### **8.3.3.2 Guidelines with Reference to COVID 19 infection and Patients**

1. Special attention to persons with higher risk (elderly, co-morbid health conditions) and vaccination to all such eligible.
2. Sick patients of COVID 19 to take nutritious, freshly cooked and easily digestible food, adequate water intake, sufficient rest and sleep (6- 8 hours, daily).
3. Monitoring of sick persons for temperature and oxygen saturation at least twice a day.
4. Prone positioning, initially 2 hours at a time or as tolerated, 4- 5 times a day, when O<sub>2</sub> saturation goes below 94%.
5. Limited movement of sick.
6. Avoidance of cold drink, ice cream, refrigerated water and beverages.
7. Use of herbal concoctions, warm beverages, and steam inhalations.
8. Avoiding use of air conditioning.
9. Personal hygiene and sanitation of bed room and wash room.

## **9. Research Activities for handling 3<sup>rd</sup> Wave**

### **9.1 Scopes**

As we are aware, that COVID-19 has posed a great challenge to humanity globally. The pandemic has disrupted life in a way that most have not seen in their life time. To protect against the virus infecting us and spreading to others, many immediate measures of mask wearing, sanitisation and social distancing measures were followed by the government as soon as the virus broke out towards the end of 2019. In Bharat, the pandemic broke out sometime in March, 2020. The measures taken differ from country to country and in Bharat, there are special problems related to the high density of population, behavioural heterogeneity and other social factors.

Despite the immediate measures taken, it is clear that to effectively protect against the pandemic and come out of it, great efforts have to be put up in research and innovations are required. At present, as Bharat has come out of the second wave, many countries are facing 3<sup>rd</sup> wave and thus, effective research needs to be done to combat the 3<sup>rd</sup> wave and any effects beyond. Research on fundamental understanding of the virus, prevention and control of the virus are required. This is related to the prognosis and diagnosis of infectious diseases in general. At the same time, development of vaccine and drugs to combat the COVID are essential. The objectives and the action items of research are focussed towards this. Quite a few issues related to policy, research on environment and pollution, improvement of healthcare facilities are also related to this. These have been addressed in this sub-document on Research Activities.

### **9.2 Objectives**

With the above background, the objectives and scopes of the research activity to be taken up can be divided into short term and long term.



### **(a) Short Term**

In the short Term, we need to develop vaccines to contain different mutations of the COVID virus. As we are aware, in different phases, mutations of the original SARS COVID-2 virus are likely to come up. It is important to have a broad vaccine covering different mutations with proper tests. Such research is being carried out globally and should be an immediate thrust of the country. At the same time, it is important to develop drugs for those who are affected by COVID. Vaccine for prevention and drug for cure should be the motto. In this respect, the objective of immediate research should be to develop repositioned drugs. An important objective for research should be to protect environment and management in terms of healthcare.

To facilitate the above, one important objective is to make data available for research and carry out data analytics for research. In terms of research management, the objective should be to evolve policy decisions based on immediate research outcomes and protect.

### **(b) Long Term**

In the long term, it is important to understand the biology of virus, structure and mechanisms of the virus attack. At the same time, it is even more important to carry out research on prevention or control of future infections.

## **9.3 Action Plan**

### **9.3.1 Short Term**

The document specifies action items to be taken up in the short term, although action items for long term research are also given in the document under subsection (9.3.2). Based on the research objectives, the following action items are recommended in the short term;

- a) Encourage virology research and develop vaccines against different mutations of the covid-19 virus. In fact, in this country, there are very few places where virology research is highlighted. However, Institutes' are encouraged to initiate virology research towards the focused objective of finding a vaccine in labs and interfacing with industries for larger scale development.

- b) Repositioning of existing drugs is a very important research that should be undertaken. This will involve collection of the data for published and unpublished research. To achieve this, research on repositioning of drugs should be an important thrust. At the same time, the government should support the ongoing drugs repositioning research within academic/research institutes, industry academia collaboration as well as directly industries. At the same time, traditional medicines based on our natural products, like haldi, neem extracts etc. should be explored as alternative medicines. It is important to retrieve traditional medicines with a need to unravel the power of nature to nurture the post-COVID scenario.
- c) Better primary data management and data analytics should be a major action item for mapping the initiation and its spread pattern of the infection for restricting spread further.
- d) Better air quality and effluent management at and around primary, secondary health care places are required for restricting further spread in pandemic. (e.g. SARS-Cov-2 virus is being detected in the water body that is contaminated with the untreated water from these health centers.
- e) Emphasis on testing on a large scale should be an action item on research. More reliable options to RT-PCR tests should also be explored vigorously. Hence innovation and product development to have mass production (availability) of inexpensive testing kits should be encouraged. Reliable testing kits at a large scale will go a long way in managing COVID by isolation of affected people
- f) Another important immediate research should involve medical waste minimization and management. Medical waste is coming up as a major threat to the environment.
- g) An immediate need is to strengthening medical facilities, in particular, Ventilators, O<sub>2</sub> concentrator and O<sub>2</sub> plants/ generators and to develop healthcare infrastructure, especially in rural areas. This includes emergency beds, critical care medicines, supplies. The infrastructure, once developed, should not be allowed to fall into a ruin, so that these can be revived based on need in a future date. Equipped safe home facilities, as most Indian homes do not have dedicated rooms for each member hence social distancing is not effective.
- h) We need to encourage effective bio-bubble for core sector industries and for industries that are associated with energy production (thermal or hydro-electric

electricity and nuclear power) for sustaining the economic challenges posed by pandemic. This may also be linked to a reduced job loss situation.

- i) It is apparent that the states that have consistently invested in social sectors benefited from the associated positive externalities during the crisis that helped them manage the pandemic better. Can we lean and extrapolate our learning for better management of the future pandemic?
- j) Effective communication and information dissemination of research should be done with the large population as an important research outreach program. While research is important, its quick dissemination helps the society to get immediate benefits of research.

Finally, better support service should be provided to stop mass migration of daily wage/ contract workers/ laborer to reduce the vulnerability of such people and transmission possibility and open locality or sector wise government funded or local Industry supported center. Government and other agencies need to redefine the research funding scope with COVID in mind and allow all scientific data on the public domain to attract more research initiatives

### **9.3.2 Action Items under long-term**

In the long term, the following research challenges need to be addressed.

- a) Human to human transmission (High Zoonotic potential)
- b) Higher rate of cross-species transmission
- c) SARS-CoV-2 and its probable mutated strains are highly infectious and lethal in nature
- d) SARS-CoV-2 is a BSL-3 pathogen and lack of BSL-3 facility in and around the country
- e) Pathophysiologic information is only available based on mainly hospitalized patient data
- f) Lack of scientific knowledge and awareness
- g) Lack of safe environment for diagnostics and to study the deadly pathogen
- h) Improvement of Molecular Diagnosis and understanding the pathogenesis of COVID-19 to design is another important area in the long run. These involve;

- Significant research needs, improvements in RT-PCR, to avoid issues of False Negatives from Testing of Viral RNA from patient samples. Development of alternative nucleic acid amplification techniques, incorporating CRISPR technology for point-of-care (POC) applications, validation of POC tests, and sequencing of viral RNA and its mutations.
- Needs for Improving Serological Tests of Antibodies: Public health surveillance benefits from large-scale analyses of antibodies in serum, although the current serological tests do not quantify neutralizing antibodies.
- Needs for Studying Viral Proteins as a confirmatory test. Mass spectrometry and proteomic techniques will play important roles in the characterization and quantitative determination of viral proteins.

The recent outbreak of the SARS-CoV-2, along with other common respiratory and haemorrhagic fever-causing viruses and Mucormycosis (black fungus), in Bharat has caused an urgent demand to create *safe laboratory environment (BSL-3)* to investigate and understand the following:

- Biology of the SARS-CoV-2, Mucormycosis (black fungus), common respiratory and haemorrhagic fever-causing viruses in understanding the Genomic control of pathogenic properties to design effective therapeutics.
- Generation of a virus free cell based assay system for screening a broad spectrum of antivirals
- Establishing Humanized ACE-2 (SARS-CoV-2 receptor) expressing experimental mouse model in hybrid BSL-3 wet lab and BSL-3 animal facilities to understand the pathogenesis of the Risk-III level pathogens.
- *Collaborative effort to set up a non-human primate model to understand the pathogenesis (ambitious aim but worth to take challenges to take up for clinical trials of potential screened small molecules antivirals, repurposed drugs and new therapeutic targets).*

***Establishing Hybrid BSL-3 wet lab and BSL-3 animal facilities and a few, one in every region, BSL-4 facilities should be a major Government initiative in the long run for COVID research.***

# 10. Educational Impacts

## 10.1 Introduction

Nobody has ever thought or imagined the Corona virus pandemic situations in our world would affect all the fields of human activity. Nobody has ever dreamt of the Lockdowns and social distancing. From March 2020, the pandemic was everywhere, resulting in the closure of all the schools, colleges and universities in Bharat. During the pandemic, our education system has gone through the difficult times and tremendous hardship for students, teachers, parents, employees and administrators. One of the reasons why it happened was that this was something which was unprecedented. Nobody knew about this either before the first wave and even before the second wave and nobody anticipated such a big surge within such a short time. As a result of that, educational institutions, government and everybody were unprepared or underprepared. At that instant of time it was difficult for the students first, then academicians to adopt the new methods of teaching and there were problems such as cyber connectivity, rural urban divide, evaluations etc. Finally, the uncertainty in the minds of the students because they did not know the final examinations dates and formats created social and psychological problems. Now that already we have gone through the two waves and the possibility of the third wave is being examined, using our past experience, it is important that we are better prepared and have a concrete plan for tackling the problems in our education system not only for the third waves, but even after that.

## 10.2 The issues related to our Education System

- **Primary Education:** This is the most impacted but least spoken about the sector of education. Majority of the students in primary education are from poorer and marginalized families and they are unable to provide online access to the children. The vast majority of primary schools particularly in the rural and semi urban areas lack basic facilities like drinking water, hygienic toilets and sufficient number of teachers. Online education is almost a luxury for such cases. Primary education on the

other hand teaches not only the academic subjects but values like morality, character, friendship, respect etc. which is very difficult to impart without direct interaction with the students.

- **Secondary Education:** This is another prime sector of education. Even here the online mode of education appears to be difficult due to the huge numbers and available resources. To the students it is important since the career of the students going for higher education are decided by the class X, class XII examinations. In the past 2 years, the decisions about class X, class XII and national entrance examinations like JEE, NEET etc., were taken at the last moments. As a result, the students faced a lot of pressures due to perceived uncertainty and suffered a lot due to this even psychologically.
- **Higher Education:** COVID-19 accelerated the adoption of digital technologies to deliver higher education quite effectively. Most of the educational institutions and Universities moved digitally towards online classes, webinars, virtual class rooms, teleconferencing and digital exams. Even with its success some of the students found the ways to skip the classes and started to adopt unfair means in exams since the education system had to be liberal due to the pandemic situation. The pandemic situation caused a lot of hardship to the research scholars since they couldn't continue to carry out their research works in the laboratories of the institutions and Universities. Their scholarships got exhausted without making expected progress towards research degree.

### 10.3 The Suggested Actions for our Education System

- **Primary Education:** the suggestion can be a massive TV based program using dedicated government channels and making it mandatory for private channels also in Hindi/ English and Regional Languages to have well-coordinated programs on formal education as well as value based programs for the kids. A special task force should be constituted for this purpose.
- **Secondary Education:** A mixture of TV and downloadable online content should be launched. The discussion of 2022 exams should start now to avoid the last minute

decisions which put pressure on the students and brings unnecessary judicial intervention. The decisions about class X, class XII and national/state entrance examinations like JEE, NEET etc., should be taken latest by September 2021 with provisions for the two/three different possibilities depending upon the Corona situation. Even if offline exam is possible, the class performance should be taken into consideration which will keep the students engaged throughout the entire period.

- **Higher Education:** University Grants Commission (UGC) should prepare a document about the various possibilities on UG and PG courses teaching and evaluation and send it to the universities clearly mentioning how they can exercise their autonomy. The same can be done by AICTE for the professional courses and IIT and NIT Councils for those institutions. The research degrees like PhD, M Phil should be decided by the universities and institutions with respect to the various ways and means that can be used to help the scholars. The government should think of a minimum subsistence allowance for an extended period for research scholars and reduction of tuition fees for COVID impacted students.

#### **10.4 Other important issues and Suggestions**

Due to immediate concerns of the board and entrance examinations, the National Education Policy (NEP) has taken a back seat. The government should work on a war footing to prepare the plan of action for implementing NEP. The current disruptions and innovations can go a long way in deciding the mode of implementation of NEP.

The most hit government initiative by Corona is the skill India mission. A relook at this is necessary. There is a need to integrate the skill initiative and existing ITI and Polytechnic education. Government should create a task force to assess the situation and to recommend the way forward.

# 11. Economic Preparations and Mass Migration of Labours

## 11.1 Introduction

The public health emergency, COVID 19 which led to lockdown has resulted in disruption of economic activities across the country. Under the period of lockdown, we have been losing roughly 2 lakh crores of Rs. Per week. The industries which are hit hardest are those which are related to the consumers i.e. entertainment, hospitality, both hotels and restaurants. Sectors of the economy that are most vulnerable and have not had much disruption for the last 50 or 100 years i.e. Health Care and Education. There could be a natural disaster, there could be a strike but it has never happened in this magnitude globally. The economy experienced an unprecedented fall in GDP leading to a reduction in the revenue of the Government to a great extent.

The health of the economy and health of people both are equally important we need economic preparations to tackle such kind of crisis which can occur now and then. Experts believe the third wave is going to hit Bharat probably by October this year. There could be a spike in the cases, people should not be casual this time around, and they should maintain social distance and follow COVID protocol strictly. People became very casual in the last wave of COVID, they were going into huge gatherings, which resulted in havoc and many people lost their lives especially in the second wave. Now the unlocking process has started in various states, offices, markets, shops have opened and the general belief is that everything is over. However, in the third wave, the new delta virus variant could be deadly as it has higher transferability and unfortunately, the cases of delta plus have already been detected in the state of Maharashtra, Karnataka and Kerala. Scientists are still working to understand the virus so the weapon available is a social responsibility to prevent delta plus. However, the solutions and instruments used to handle the second wave of CORONA may not give the guarantee of handling the situation of the third wave in a successful manner. For facing a new situation and new challenges some other new measures need to be evolved.



## **11.2 Objectives of the study**

This study is having a limited scope of exploring the possibilities of making an action plan for tackling the problems relating to the economic situation including the mass migration of labor that may arise out of the third wave of COVID.

- i) To understand and identify the priority areas of the economy considering the existing situation and likely impact of the third wave of COVID.
- ii) To find out the possibilities of ways of handling the economic crisis that may arise due to the third wave of COVID.
- iii) To examine the possibilities of making preparations that would be required to tackle the problem of migration.
- iv) To evolve a broad framework of solutions to keep the economic activities moving.

## **11.3 Methodology**

To prepare the action plan the policies declared by the Central and State Governments from time to time were studied along with the norms prescribed by W.H.O. for providing health facilities. Views of experts working in the field of social sciences were studied. The information available through the internet and various leading newspapers were also collected. Articles published during the pandemic along with discussions held on various T.V. channels were also considered for the preparation of this note. Additional inputs were obtained through discussions with various stakeholders like shop keepers, employees of various organizations, workers working in MIDC factories, etc.

We have the shadow of CORONA, in this situation drawing a balance between health and economy is the greatest challenge facing the economy. This is not the proper time to accelerate economic development in all the sectors simultaneously. Considering the social, economic, cultural and political background of the economic priorities are to be decided.

#### **11.4 The threat of a potential third wave**

The existing health care system in rural areas of the country is dismal and weak to face the problem of pandemics and varies from State to State. Data from the National Health Profile 2019 shows Bharat has 600 hospital beds in public hospitals per million persons (10 lakh). This is far away from the norms recommended by W.H.O. which is 5,000 beds per million persons. In Bihar and Andhra Pradesh, the number of beds per million persons is 171 and 1231 respectively shows variations in the availability of infrastructure facilities. There is a need to prioritize the spending of the State and Central Governments, especially in rural areas. The first point of contact in Public Rural Health Care is the Community sub-centre, each sub-centre cover an average of four villages and a population of 5,729. These sub-centres need to be strengthened by developing quality infrastructure and by appointing health workers. W.H.O. recommends a ratio of one doctor for every 1000 persons. In Bharat, there is a government doctor for every 10,189 people.

The first wave reported 19 lakh cases, which soared to 40 lakhs during the second wave considering this trend there is a possibility that in the third wave total COVID cases could double compared to the second wave. This requires increasing expenditure of public health facilities and develops robust health care facilities. To some extent, the present problem of acute unemployment can also be tackled by the recruitment of health care professionals. This would serve the purpose of improving health facilities along with creating employment.

During the first and second wave of COVID-19 Adhoc arrangements were made by the Governments and facilities were established temporarily (COVID Hospitals). Considering the threat of a potential third wave these arrangements can be converted permanently. The experience shows that after a pandemic number of people below the poverty line suddenly goes up; a quick estimate indicates that more than 60 lakh people fall below the poverty line due to loss of jobs, curtailment of work, etc. Rural areas, Lower Middle Class and Children probably would be the hardest hit as they escaped the virus in the first two waves or have depleted antibodies. There is a need to prioritise these sections of society.

Ministry of Health and Family welfare got just 0.3 per cent of GDP including states' health budgets. This needs to be substantially enhanced to supplement hospitalization that takes place in private facilities (55.3%).

### **11.5 Lockdowns do control the virus**

It is true and proved that lockdowns help to control the spreading of a virus; however, the side effect of this lockdown in terms of affecting livelihood is also a serious concern. How to protect lives and livelihood is itself a challenge in the present situation? Activities that contribute to improving the economic situation and help in increasing value addition need to be continued and promoted. Some of the events like holding elections, the religious congregation have to be avoided.

In any economy, construction, transportation, restaurants, automobile are the sectors contribute substantially in generating incomes and have strong linkages with other business activities. The places where these activities would be allowed to conduct should be made COVID safe along with COVID appropriate behaviour. In the third wave, it would be difficult to declare lockdown at a large scale level throughout the country. To revive the economy, the most important issue is relating to demand creation and allowing the cycle of production and consumption to continue. The present situation warrants revival of the economy by creating purchasing power, this is possible by allowing the economic activities to operate. Direct cash transfer may not be the feasible solution considering the severe problem of fiscal strain and inadequate generation of revenue for the Government.

Messaging and Vigilance are the instruments that will have to use extensively not alone by the Government but by the communities. Securitization of health with the help of the Police force cannot be sustainable and therefore there is a need to engage communities and they should take ownership of monitoring the COVID protocol. Spreading awareness is the task that is to be undertaken by the local governments.

## **11.6 Relevance of Decentralization**

Killing the economy is like killing people and therefore the health of people and the health of the economy are equally important. We are facing double shock i.e. supply and demand both and demand shock are more serious occurring mainly because of unemployment and lack of adequate purchasing power. There is a need to distribute opportunities rather than distribute the output. The intensity and gravity of the pandemic vary from place to place and solutions at the national level may not help to solve the problem at the local level. To revive the economy, we may have to consider District as a unit of implementation for policies.

Every District must have a small group of experts/ public health experts/Microbiologists or Virologists and administrators to monitor. Vocal for local can be governed effectively if the policy of decentralization is implemented effectively. While it is important to focus on getting out of the health risks posed by the outbreak, we need to keep our eyes on what lies ahead. It is going to shape businesses for decades to come. There is a possibility that old Kirana shops would be gaining importance and to have the securitization there is a possibility of collaboration of retail shops in the locality. Instead of having a lockdown policy in general, as tried earlier some economic activities can be allowed to function on a rotation basis. One size does not fit all is the principle that needs to be followed in establishing a balance between the health of the economy and the health of people.

## **11.7 Extraordinary Situation requires Extraordinary Approach**

To ensure lives and livelihoods we need factories that can turn back. It is possible to identify the industries dominating in a particular District. These can be Textile Cluster/ Electronic Industry/ MSME- Export Oriented units/ Automobile units especially spare parts etc. their functioning need to be monitored in a closed manner to ensure that COVID Protocol would strictly be followed. The industrial sector especially MSME suffered maximum as the number of units is about 8 to 10 crores with more than 15 crores of workers. The stimulus package was announced by the Government of India from time to time. However, hardest hit industries are yet to come out of the shock, we need a combination of different alternatives

as announced under Atmanirbhar Bharat, along with Atmanirbharata following are the steps that can be considered for a preparatory action plan.

- Industrial units providing a higher level of employment should be given incentives in terms of GST Rate Cuts/ Defer GST Payment.
- Give Wage subsidies to small firms or income support to contract workers to maintain their livelihood and to create overall demand in the economy.
- Offer Moratorium on loan repayment can be one of the important steps along with other policies, however, investments in the industrial sector cannot be just encouraged by providing monetary incentives. Credit can be enhanced through the banking system.
- Fiscal measures like the development of infrastructure, transportation, tax incentives would be useful to revive the economy and there is a need for Fiscal Expansion that is directed towards the bottom of the pyramid especially for rural and urban poor.
- Measures to provide immediate relief to meet working capital needs especially for the MSMEs who have not borrowed from the banks.
- PSU's are not releasing payment despite Government assurances, the same needs to be enforced and ensured.
- Interest rates reduction would help provide a real stimulus. With excess funds lying idle in banks, the banks can reduce the rate of interest on lending and increase the base, thereby increasing the profitability as well as credit affordability.
- MSME Ministry should develop a tracker software/ app to monitor the effective implementation of the package so that it reaches all the affected MSMEs. A war room can be set up for this purpose at the National/regional level.
- A well-defined mechanism for bankers needs to be established to propagate the advantages of the package and to reach out to stress MSME units.
- The scheme covers existing borrowers of scheduled commercial banks & NBFCs only and excludes all others such as co-operative banks and also units with no borrowings. Now that they have been brought under the control of RBI, the cooperative banks should be included in the ambit of the package.

- More amount of money requires to be diverted to make MNREGA further strong number of days of employment can be increased from 100 to 150 days.

### **11.8 Mass Migration of Labours**

The 2017 Economic Survey of Bharat estimates that the magnitude of inter-state migration in Bharat was close to 9 million annually between 2011 and 2016. Uttar Pradesh and Bihar are the highest source states, followed closely by Madhya Pradesh, Punjab, Rajasthan, Uttarakhand, Jammu & Kashmir and West Bengal. Major destination states are Delhi, Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh and Kerala. The internal migrant labourers migrate due to the absence of employment opportunities in their respective states. Considering the threat of a potential of the third wave following preparations would be required to handle the problems of the migrated labour force:

- The problem needs to be handled by City Administration rather than waiting for a green signal from the Centre. Transportation facilities like Shramik Trains can be provided for those who want to travel to their respective places. Planning regarding this arrangement would help to ease the pressure on civic authorities and NGO's can help in providing food and other facilities to these workers.
- Migrant labourers need to be communicated systematically through local authorities about the problem of COVID and its possible dangers. Psychologically also they need to be prepared with the help of counselling.
- There should be a separate policy to protect their interest in an emergency. It becomes difficult for some of the local industries to sacrifice the trained and skilled manpower if they fail to come back from their respective places.
- Micromanagement and planning is the way out for handling the problem of migrants. NGO's and Government administration must work in conjunction. The government recognized placement agencies should be set up to maintain data of migrant labourers. There is a need to collect data of migrant labours along with their skills. If implemented properly 'One Nation One Ration Card' would be beneficial for the migrants and can be proved to be a game-changer, as such present PDS system excludes migrants.

- Give more relaxation to employers if they employ labourers from local areas by providing vocational training to create a skill set. Some insurance schemes can also be evolved for migrant workers. Policy framing requires ensuring the protection of the interests of migrant labourers.
- Some incentive mechanism is required to be devised to attract the migrant labour back to the originating units.

### **11.9 Concluding Remarks**

Economic Nationalism with the help of Atmanirbhar Bharat requires finding ways to rebuild our critical strength. In this anticipated moment of the third wave, it is of utmost importance to keep our internal market going on. It needs to be understood that the number one victim of the COVID-19 epidemic is Globalization. The investment of the private sector needs to be enhanced by creating a conducive economic environment at present the private investment is not picking up (reduced from 24.2% to 21.5 %.). To compete globally there is a need to scale up our manufacturing sector, with more focus on increasing consumption potential needs. The major Challenges that we will have to face during the third wave are how to achieve Growth in Investment, Exports, Credit, SME's, and Employment.

On 28<sup>th</sup> June 2021, Finance Minister Nirmala Sithraman announced Rs. 6.28 lakh crore stimulus packages which comprise 8 economic relief measures. It is necessary to examine the effect of the loan format of relief. The government has announced a new credit guarantee scheme for small businesses, tourism sector. However, these measures may not help to revive the economy. It is of utmost necessity to find out how many MSME's have availed of the loan facilities provided by the Hon. Finance Minister in the last year. The problem is not of increasing production as inventories are piling up, the problem is of creating demand, and this requires employment generation and income support.

Atmanirbhar cannot be achieved by levying high import duties, but by creating a competitive advantage. A preparatory action plan requires ensuring that individuals don't fall into loneliness, hope, compassion, affection, caring and tenderness are powerful tools to handle the crisis.

## **12. Role of Different Products in Stopping Spread of Virus**

### **12.1 Purpose**

It is very necessary to understand how COVID-19 virus spreads. COVID-19 spreads between the people who are in close contact with one another for different times when infected person or a carrier talks, coughs, sneezes and breathing, releases droplets of varying sizes ranging from 50 micro meter to 1 micro meter in diameter and being so small cannot be seen by naked eyes. These droplets remain suspended in air for 8-10 hrs. depending upon environmental conditions. A cough produces approximately 3000 droplets, sneeze releases about 40,000, where as normal speaking releases more than 1 lakh droplets per minutes with size of 12-21 micrometer. These studies have clearly confirmed that droplets are responsible for air borne transmission of COVID-19. Therefore, in short COVID-19 is highly contagious.

In view of this background, it is very much essential to employ different products in stopping spread of COVID-19. We believe that such preventive measures are best remedies besides vaccination, social distancing and hand washing for control of spread of corona infections. It is important to note that one needs to employ use of combination of interventions along with various products to prevent air born transmission of COVID-19 variants such as Delta + as they exhibit increased transmissibility and virulence. We recommend following product support.

### **12.2 Corona Gun**

This is used for screening of large number of people in crowded places in short time. It checks temperature of skin surface from distance of 1-2 feet. Accuracy of Corona gun is 0.2-0.5 degree centigrade. It is important to know that 80% of Corona patients in Bharat are asymptomatic and hence Corona gun can miss such people who are infected. Medical gun should be preferably used. At individual level, use mercury/digital thermometer for checking body temperature.



Corona guns are made in Bharat by large number of institutes and industries. For e.g. Indian Navy's Naval Dockyard in Mumbai has developed corona gun which is very efficient similarly NEHU Central University Shilong in 2020 develop Corona gun beside this EVM thermal gun/ IR thermometer has been developed by EVM industries, New Delhi. Large number of Corona Guns are available in market. We recommend use of Corona guns made in Bharat over Chinese.

### **12.3 U.V. Based Equipment**

UV based disinfection is established technology as spectrum of UV radiations between 200-300 nm exhibit germicidal range. UV affects and inactivates DNA & RNA of COVID-19 virus and inactivates and hence provide great protection against it. There are large number of products made in Bharat and are available. For e.g., DRDO has developed disinfection tower called UV Blaster for sanitization of Corona virus prone areas and useful for high tech surfaces like electronic equipment's, computers and other gadgets. This is very effective for areas with large flow of people especially airports, hotels, shopping malls, offices and factories. UV Blaster is extensively used in health care industries in Bharat. Similarly, UV LEAD based disinfection equipment are robust and consume less power. Corona Oven made by Nano Tech Start Up Log 9 Materials New Delhi has developed this product and effectively disinfects all type of surfaces contaminated with corona and other bacteria and fungi. It can completely disinfect any items such as face masks, PPE kits and groceries etc. It kills COVID-19 virus in less than 10 minutes preventing surface to human transmission.

Large number of institutions and industries developed such UV based equipment. For e.g. Indian Army has developed disinfectant drone which is capable of disinfecting large areas in a minute. Similarly, IIT Bhuvaneshwar has developed UV disinfection cabinet which disinfects in 10-15 minutes. Similarly, IIT Mandi has developed UV based portable disinfection box. TRUV-V New Delhi has also developed low cost light weight disinfection bag for groceries, masks, mobiles etc. BARC Mumbai along with RRCAT Indore has developed UV cabinet called Neel Bhasmi which is very effective.

We recommend to buy UV based equipment made in Bharat over China as many such products are available in Indian market.

## 12.4 New Masks

We strongly recommend use of mask of different types and properties that have higher filtration capability for effective control of rapid spread of COVID-19 variant Delta+. Face masks are truly most protective for individual to prevent infection. Face masks are mandatory and simple barriers which help to prevent respiratory droplets of various sizes.

Face masks is most important weapon in fight against COVID-19 variants. We also recommend masks with different layers which can offer better degree of protection by creating strongest barrier for respiratory droplets. We also strongly recommend use of double masks which have proved to be most effective in preventing spread of COVID-19 and its variants. However, this is achieved only when one wears the double mask in a proper way from beginning to end of use.

- a) It also helps to protect those around you from getting infected.
- b) It also helps to stop the community transmission.
- c) Delta+ variant of COVID-19 is significantly more transferable and more dangerous in form of severity of illness.

Make sure that you wear a mask which fit properly over your face covering nose and mouth completely and does not leak respiratory droplets in and out as well as comfortable for breathing. Cloth mask alone are not recommended because of their low filterability however, they can be used along with surgical masks which makes them most effective. Surgical masks of excellent quality have inbuilt and embedded nose wire on one side of mask. When you wear surgical mask make sure that you push the nose wire gently but tightly so that it closes any gaps that may be present between the two sides of nose and face. Do not combine two surgical masks as they do not fit tightly.

N95 masks is most efficient and it filters 95% of aerosols and microorganisms. They also fit properly therefore do not combine N95 masks with other masks. While choosing any face mask, make sure that it should have a nose wire. We also strongly recommend cost

effective and most efficient virucidal coated 3D – printed mask made in Bharat as best among all masks and which reduce the very high spread of Delta+ as bacterial filtration efficiency is higher than 95%. This face mask is best among all mask When you want to go outside for some essential work, first make sure that you wear a proper face mask. Never ever go out without face mask. Kindly note that there is 90% risk of infection associated with individuals who do not wear the mask as well as do not maintain adequate social distance. However, the risk gets reduced to about 30% if the unaffected person is wearing a mask. Children below 2 years should not wear the mask. Old people should use mask which have better filtration capacity and not very tight around the face.

Wash your hands with soap and water before wearing and removing the mask. Always hold mask at its ear lobes and never ever touch front side of mask. According to Union Ministry of Health and Family Welfare, it is very important to note that COVID-19 and its variant Delta+ is rapidly spread aerosols. Therefore, it is advised start wearing masks even at home. If one is going to an enclosed space which do not have much ventilation and people are in close proximity, make sure you wear a mask having highest filtration capability. In such situations simple cloth mask has limitations. Follow guidelines of WHO for each new masks. COVID-19 third wave is expected very soon and more cases of delta variants are increasing in Bharat. Therefore, for breaking the chain of COVID-19 transmission, we must fallow all possible preventive methods. Remember face masks is your Kavach Kundal against COVID-19.

### **12.5 Disposal of Possibly Infected Items**

Infectious waste generated by COVID-19 pandemic is not mixed with general solid waste as is major environmental concern and needs proper segregation and separate treatment. Central Pollution Board of Government of India has come out with new revised guidelines published on 10 June 2020 and revised in 2021, as contaminated mask and gloves pose threat to the waste pickers. SPCB Directs to cut the masks and gloves before disposing of to prevent reuse. CPCB further urges offices, shops to dispose of PPE waste of public as per new rule.

COVID-19 can remain active on surfaces of metal, glass or plastic for up to 9 days. Therefore, mixing of infectious waste with general solid waste is more hazardous and needs to be stopped. Revised guidelines of CPCB must be followed by all stakeholders including quarantine centers. Proper disposal of used items such as masks and hand gloves is very much essential. Disposable masks are not recyclable. Masks are not flushable. Kerala start-up has launched mask disposable smart bin in 2021. The IOT based BIN-1 for collecting and disinfecting used masks.

Always paste a label “**COVID-19 Waste**”. Disposable masks should be placed in biomedical container and finally incinerated or buried at the depth of 10 feet in soil.

# 13. Sustainability Issues

## 13.1 Introduction

The positive effect of COVID-19 on the environment has more as news value than the scientific study outcome. One of the actions for controlling the spread of virus was periodic lock downs in Bharat and other parts of the world. Since the vehicular transport, industrial activities, commercial markets came to standstill or slowed down air emissions had reduced significantly in Bharat. In most of the areas, Air Quality Index, a parameter which denotes the level of pollution has seen the reduction by 60-70%. However, some challenges emerged out for the environment such as increase in biomedical waste production, increase in plastic waste etc., are already being discussed. This section delineates the various aspects of positive and negative impact of pandemic control measures on environment along with lessons learned during past 16-18 months since March 2020. Further, action points required to be address for third wave of infection in particular and overall pandemic/epidemic situations. As far as environment is concerned, this is also the opportunity for bringing a shift in regulatory standards and public awareness as well.

## 13.2 Objectives

Purpose of this section is to understand the interaction of environment and human being in terms of health risk associated with COVID-19 expected third wave and pandemic/epidemic situation in future. The objectives of this section are as following;

- Understanding environmental issues and perception with provision of pinpointed solution domains
- What can be called as best hygiene practices? Old is Gold or Newer Understanding is better or a best available compromise. Provide the methodology of improving hygiene at homes, schools, work places, hospitals, etc...
- Best practises in terms of, behavioural aspects, disciplines,
- Develop specific action plans/ studies

### 13.3 Environmental impacts of COVID-19

While discussing the environmental impacts of pandemic control measures we have referred several reported studies focused on Bharat. A few international experiences are also included. Typical positive and negative impacts of pandemic control measures are listed in the Table 13.1.

Measures	Positive Effects	Negative Effects
<ul style="list-style-type: none"> <li>• Lockdowns,</li> <li>• Use of PPE kits and other PPE products,</li> <li>• Use of sanitizers</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced air pollution</li> <li>• Reduced water pollution contributed by industrial effluents</li> <li>• Reduced Noise Pollution</li> </ul>	<ul style="list-style-type: none"> <li>• Slowed collection, segregation and disposal of solid wastes</li> <li>• Increased domestic sewage generation</li> <li>• Increased biomedical wastes and risk associated due to lack of system for management</li> <li>• Increased exposure to volatile organic carbons due to sanitizers</li> </ul>

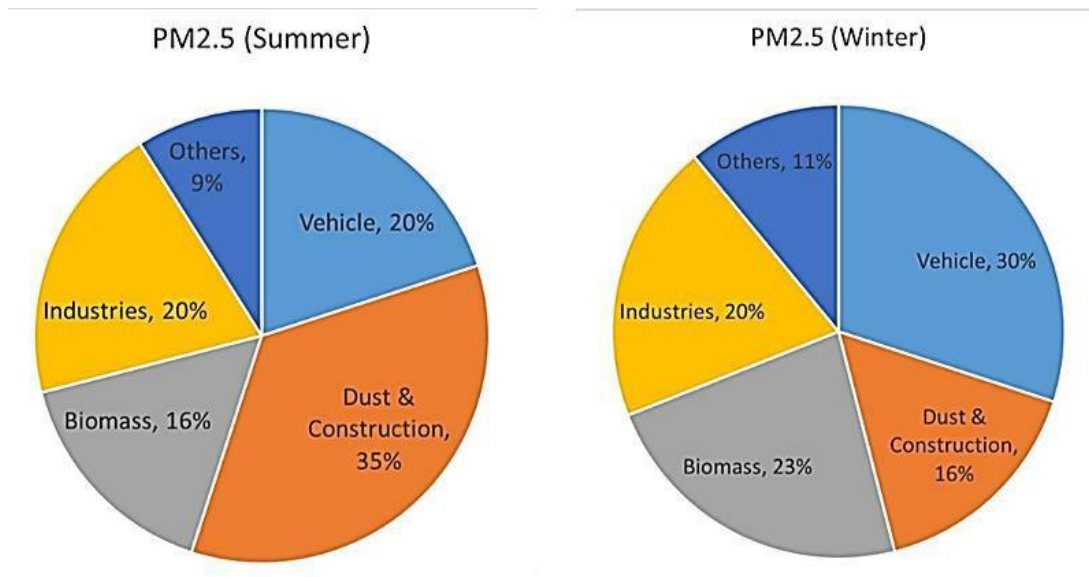
**Table 13.1** Positive and negative impacts of pandemic control measures on environment

#### 13.3.1 Positive impacts on environment

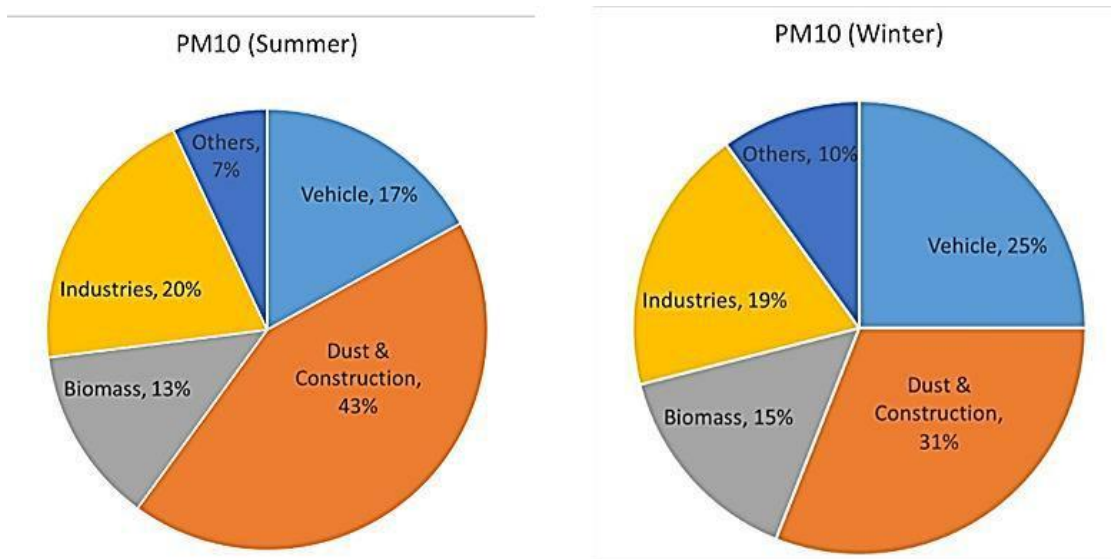
##### 13.3.1.1 Reduced Air Pollution

There are various studies undertaken for source apportionment for quantifying the pollution at receptor levels in several Bharatiya cities. The source apportionment studies typically are carried out by sampling of particulate matter (PM) from ambient air and its chemical characterization followed by some standard methods of apportionment using chemical mass balance method. According to these studies the major sources of air pollution in cities include, vehicular emission, re-suspended dust, burning of low calorific value fuels in lower income groups and industries. However, the industrial emissions are significant only in area where industries are operating. As an example a summary of results from source

apportionment study of Delhi, NCR conducted by ARAI Pune is depicted in the figure 13.1 and 13.2. Figure 13.1 shows the apportionment for PM2.5 in summer and winter seasons. In summer season vehicular emission and dust & construction are measure sources. Whereas, in winter vehicle emissions are the largest. Figure 12.2 shows the apportionment for PM10, wherein dust and construction is a single major source of PM emission during summer and winter both. Since PM emitted from vehicles are mostly below PM2.5, its contribution in apportionment based on PM10 is relatively low.

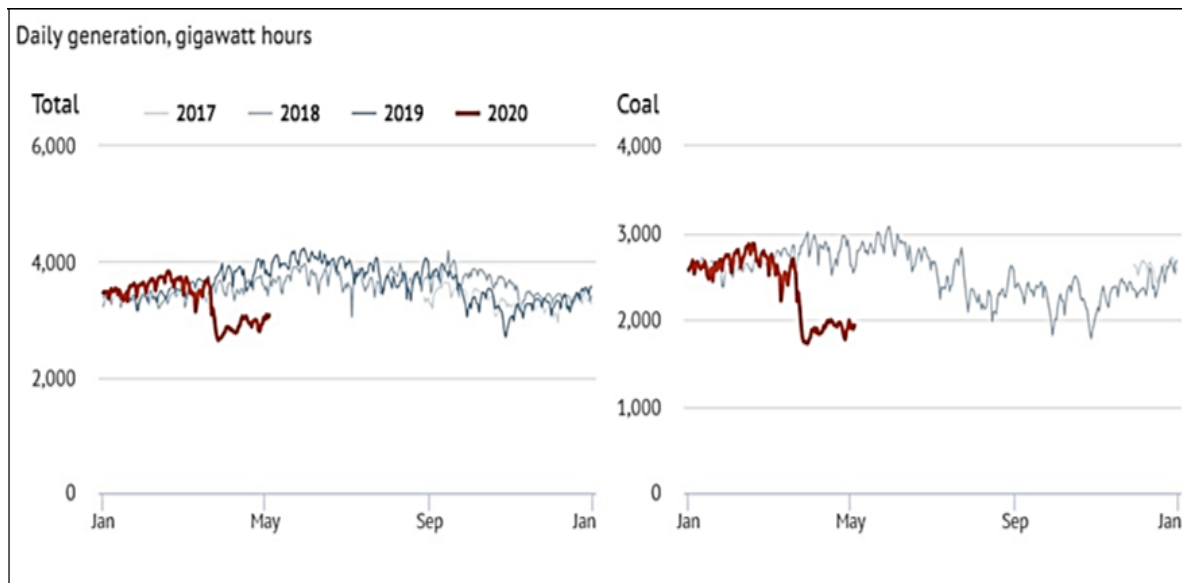


**Figure 13.1** Pollution Source apportionment based on PM2.5 for summer and winter



**Figure 13.2** Pollution Source apportionment based on PM10 for summer and winter 68

During the pandemic, due to lock down vehicular activity was reduced to negligible and therefore PM emissions from vehicle exhaust and also due to re-suspension of road dust has reduced drastically. Similarly, electricity generation/consumption in Bharat was decreased significantly as depicted in Figure 13.3. This has resulted in improvement in Air Quality Index.



**Figure 13.3** Daily generation of electricity as total and as from coal powered thermal plants. Red line is for year 2020

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

**Table 13.2** AQI ranges and related categorisation of air quality

(Source: <http://environicsindia.in/2018/12/20/air-pollution-in-india-crucial-aspects/>)



Table 13.2 indicates the AQI ranges and related categorisation of air quality from good to severe and possible health impacts as given by Central Pollution Control Board. Whereas figure 13.4 depicts the AQI of three cities Delhi, Mumbai and Kolkata. Clearly due to Janta Curfew and further lockdown AQI has improved. The similar data is for many other cities in the country.

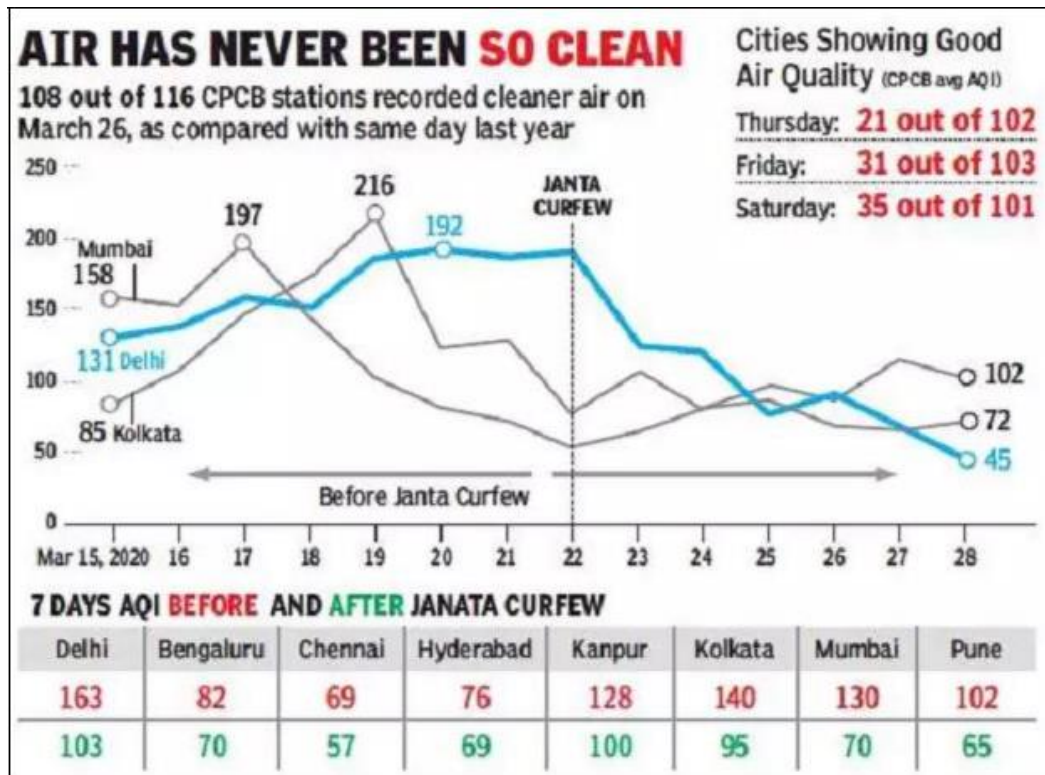


Figure 13.4 AQI for Mumbai, Delhi and Kolkata before lock down and after.

Source: CPCB data as compiled and published by TOI

### 13.3.1.2 Reduction in Water Pollution

Water pollution has different sources such as domestic wastewater, industrial effluents, agricultural run-off and storm water run-off with waste. During the pandemic major polluting source of industrial wastewater was absent. Also a few more activities such as disposal of solid waste by people in drains added in the reduction of water pollution. Since industrial water requirement went down drastically, availability of fresh water in rivers has increased which provided further dilution effect.

As reported by CPCB, that in 10 days post nationwide lockdown start on March 25, 2020, substantial increase in water quality was observed in river Ganga. According to the real-time water monitoring data of the CPCB, out of the 36 monitoring units placed at various points of the Ganga river, the water quality around 27 points was found suitable for bathing and propagation of wildlife and fisheries. On April 4th, at Varanasi's Nagwa Nala, the dissolved oxygen (DO) values were found increased to 6.8 milligram/litre against 3.8 mg/litre on March 6th, showcasing an extraordinary improvement of 79 per cent in DO values. Indian Institute of Technology, Banaras Hindu University, attributed these changes to industrial lockdown and rainfall on March 15th and March 16th, that increased the water levels of Ganga. Similar results have been reported by Uttarakhand Pollution Control Board. There was in general improvement in quality of water in rivers.

### **13.3.1.3 Reduction of noise pollution**

Various studies are reported for monitoring of noise levels at industrial, commercial and residential sites during various lock down periods. According to a study reported for Kanpur, the typically in residential areas the noise levels came down from 60-80 dB to 40-50 dB. In industrial area the reduction from in the range of 75-80 dB in regular activity to 60-65 dB in lock down period was observed. In general, there was reduction in noise level across the cities. For instance, noise level of Delhi, is reduced drastically around 40-50% in the lockdown period. Due to reduction of vehicle movement during the lockdown period, the noise levels of Govindpuri metro station (Delhi) is reduced 50-60 dB, from 100 dB. According to the Central Pollution Control Board (CPCB, 2020) of Bharat, noise level of residential area of Delhi is reduced 55 dB (daytime) and 45 dB (night) to 40 dB (daytime) and 30 dB (night) respectively.

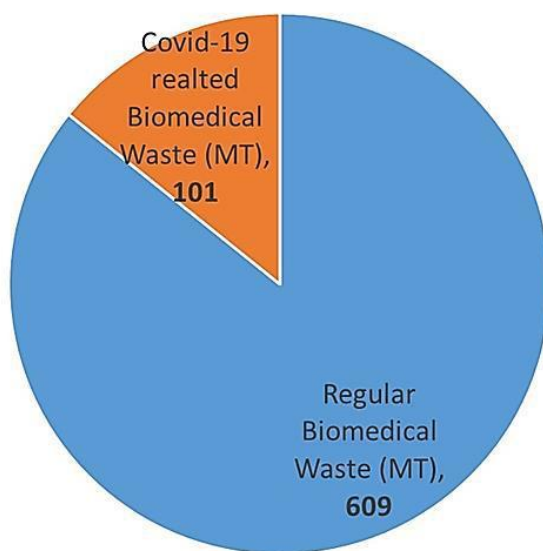
### **13.3.2 Negative impacts of Pandemic Control Measures**

#### **13.3.2.1 Increase in biomedical waste generation**

The first important prevention for the COVID-19 is avoiding contact with virus and particularly protecting respiratory track inlets. Therefore, masks have become compulsory

part besides physical distancing and use of sanitizers. The used masks have created bio-medical waste although small in quantity for individual house but a large quantity for entire country.

Similarly, use of PPE kits has increased extraordinarily not only by medical doctors but also by other health care workers, sanitation workers, people handling dead bodies, drivers etc. As per CPCB data the increase in biomedical waste is about 16%. A typical daily biomedical waste generation is shown in Figure 13.5.

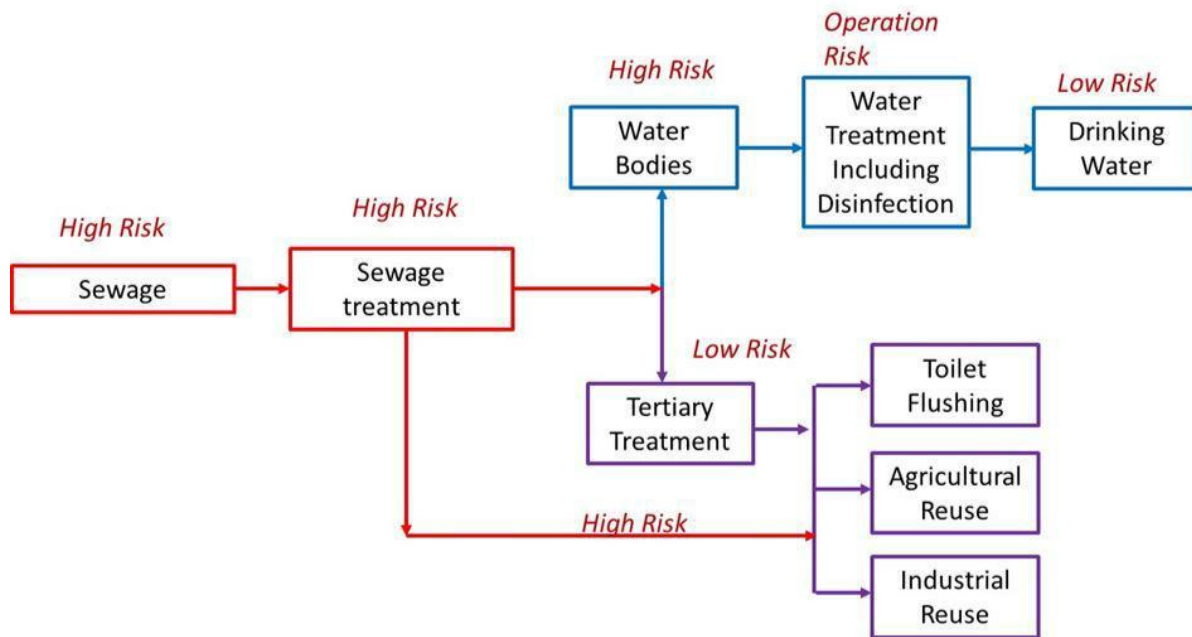


**Figure 13.5** Daily biomedical waste generation in MT

### 13.3.2.2 Risk Associated with Sewage

Sewage generated in wards of hospitals has always posed a risk of pathogenic contaminations as well as various bacteria/viruses. On the other hand, the sewage from hospitals may have high concentrations of medicinal traces such as antibiotics. This sewage generally is treated in a conventional way of treatment using secondary biological methods. The direct exposure of the sewage with high concentration of antibiotics may lead to first deactivation of bacteria used for treatment and later the microbes in secondary treatment learn to survive on the antibiotic molecules. There is risk of generation of antibiotic resistant bacteria, In case of Covid-19 there are many studies on the behaviour of virus in aquatic

environment such as sewage. A major conclusion of these studies is there is spread of virus through sewerage network. IIT Delhi has created a report wherein risk associated with sewage flows for virus spread is discussed and a few majors are suggested. A typical risk associated with sewage transportation, treatment and reuse is depicted in Figure 13.6.



**Figure 13.6** A typical risk associated with sewage transportation, treatment and reuse

### 13.3.2.3 Increased exposure to VOCs

Volatile organic Carbons are compound which has high volatility due to lower boiling points and vapour pressure. In a poorly ventilated indoor environment, the concentrations of alcoholic compounds increase the exposure. Most of the VOCs are carcinogenic in nature. Increased use of alcohol based sanitisers has potential risks for high VOCs. During pandemic the risk potential has increased to a great extent.

### 13.3.2.4 Challenges of collection and disposal of Municipal Solid Waste:

During strict lockdowns, various cities faced issue of slow collection and disposal of municipal solid waste. On the other hand, packaging for online deliveries increased solid waste generation, although marginally.

### 13.4 Action Plan for handling the environmental issues during 3<sup>rd</sup> wave of COVID-19 infection in Bharat:

Action plan on environmental issues with time line indicating the level of priorities as well as readiness level requirement is suggested as following. The same may be considered to start from mid of 2021.

Sr. No.	Activities	Time frame (months)
1	Air Quality Studies for Indoor (virus and bacteria focused)	12
2	Ventilation designs and improved methods	6-12
3	Studies on the survival of SARS-CoV-2 in water and wastewater under different operational conditions (i.e., temperature and water matrix)	12-18
4	Delineating deactivation/disinfection management strategies	6-8
5	Guidelines for reuse of only tertiary treated water even for agricultural (circular economy v/s health)	6
6	Compendium of Cost effective technologies for inactivation/disinfection and protocols	10-12
7	Safety precaution guidelines against SARS-CoV-2 exposure for Wastewater and sewage workers.	6-10
8	Water Safety Audits (capacity Building)	6-10
9	Proper disinfection and disposal of masks etc. Create house level methods and infrastructure	3-4
10	Personal hygiene improvement: Behavioural change (Schools) Community level hygiene improvement: Behavioural change and enforcement, infrastructure	3-4
11	Take up projects with UNICEF kind of organizations; prepare hygiene and safety audits of houses, community, schools, work places, hospitals. Create guideline manuals	6-8

## 14. Summary of Action Plans

*“3rd wave of COVID ‘19 is inevitable in Bharat and country need to be prepared for the same.”*

### 14.1 FOR GOVERNMENT

#### 14.1.1 Scenario, Data & Projection

##### a) Onset of third wave

Following 4 requisite criteria are needed to declare the onset of third wave.

- Second wave should have been contained, which means that reproduction rate is below 1 for 2 weeks.
- The low rate of infection has to remain sustained for 1 month.
- Cases to continue increasing for 2- 3 weeks thereafter, and
- Cases to continue to rise steadily after crossing the effective reproduction number ( $R_t$ ) of 1.5.

##### b) Epidemiological modeling for the third wave

- **Sharing real-time data at finer scales:** Credible forecasts depend upon reliable datasets (number of cases, tests, age-wise disease severity, mobility data, etc.). Sharing these datasets with researchers/data scientists can help us monitor the real-time transmissibility (or R values) at the district level. Creating a robust data pipeline can help us not only prepare for the third wave but would set a system in place even for another communicable disease.
- **Embracing uncertainty in our decision-making:** The situation with COVID-19 is evolving with changing dynamics and transmission characteristics. Hence, there is a need to understand the range of uncertainties from outputs of these

epidemiological models and align the planning to be modular enough to look at the best and worst-case scenarios for pragmatic management of the pandemic.

#### **14.1.2 Recommendation on Health**

##### **a) Health impacts**

- Notification of symptoms
- Notification of new symptoms in adults and pediatric populations
- Updating epidemiology based on current information on a regular basis based on age, sex, socio-economic patterns etc.
- Notification of early symptoms and signs of Mucormycosis

##### **b) Vaccination**

- Updating and maintaining record of vaccination
- Recording details of persons who become COVID infected even after vaccination
- Recording adverse events following immunization (AEFI)

##### **c) Health service preparation**

- COVID hospitals – Allocation of new hospitals, designation of certain parts of hospitals as COVID centers, dedicated standalone COVID hospitals
- PPE, Sanitizers, Gloves – Ramping up production to become self-sufficient
- Ventilators – Ramping up production, allocation through PM CARES fund
- Drug availability – Ensuring availability and supplies of necessary drugs, increasing production of essential drugs
- Beds, oxygen, medicines – Increasing production, maintaining daily updated online records, ensuring centralized availability
- Providing rations – Allocation of food grains, rations for food security
- First wave – Lockdown was very effective which reduced spread and case fatality, however, in Second wave – Lockdown was left to states. GoI to take initiative during anticipated third wave.

- Maintaining balance between minimizing COVID spread and not causing loss to economy
- Budget allocations – Special allocations made by the PM and other union ministers at different times in a coordinated manner.

#### **d) Issues of lower immunity**

- Attempts at improving immunity for the general public
- Legislation against the unopposed use of corticosteroids
- Drugs should be strictly used under the prescription of a physician, regulate over the counter (OTC) drugs
- Issue of guidelines on antibiotic policy in COVID '19

#### **e) AYUSH integration**

- Running AYUSH OPD and IPD services for COVID 19 in all Government and Private medical colleges and hospitals.
- At least 10% of AYUSH hospital beds to have provision of bedside oxygen supply.
- Encouragement and Financing of the research in following areas:

##### **➤ Long Term**

- **AYURVEDA:** *Chyawanprash, Ashwagandha, Giloy, Trikatu, Triphala, Bal Chatur Bhadra churna/syrup, Swarna Prashan etc.*
- **HOMEOPATHY:** *Arsenicum album, Camphor, Aconitum, Belladonna, Bryonia, Eupatorium, Ferrum phoshoricum, Gelsemium etc.,*
- **SIDDHA:** *Kaba Sura Kudineer, Amukkara churnam, Neelikkai Ilagam, Thalishathi vedagam, Seenthil churnam, Adathodai Mannapagu, Brahmananda Bairavam, Theepili rasayanam, Swasa Kudori Mathirai, etc.*

Similarly, research on the preparations and procedures prescribed by other **Indian System of Medicine (ISM)** need to be researched. The research on AYUSH 64 (repurposed)



was successfully undertaken. Original research in other areas in collaboration with other systems of medicine also to be encouraged.

➤ **Long Term**

- Role of Yoga (*Ashtang Yog*) in prevention of viral infections (COVID 19 included).
- Role of yoga on prevention and treatment of Diabetes, Hypertension, Sleep disorders; which all have bearing on COVID 19.
- Role of Healthy Life Style, Regular *Din Charya and Ritu Charya* in health and disease; (and other tenets as Propounded by *Mahrishi Vagbhatt* in *Ashtang Hridayam*).
- Role of Yoga in Post -COVID recovery.
- Role of Oil Pulling (*Kavala or Gundusha*) and Oil *Nashya* for prevention of Viral, bacterial and fungal infection during and post-COVID 19 recovery phase.
- Role of oil *Nashya* for prevention of viral infections in children.

### **14.1.3 Research Activities on handling 3<sup>rd</sup> wave**

➤ **Short Term**

- Encourage virology research and develop vaccines against different mutations of the covid-19 virus. Effort should be made to initiate virology research towards the focused objective of finding a vaccine in labs and interfacing with industries for larger scale development.
- Repositioning of existing drugs is a very important research that should be undertaken. This will involve collection of the data for published and unpublished research. To achieve this, research on repositioning of drugs should be an important thrust.

- Better primary data management and data analytics should be a major action item for mapping the initiation and its spread pattern of the infection for restricting spread further.
- Better air quality and effluent management at and around primary, secondary health care places are required for restricting further spread in pandemic. (e.g. SARS-Cov-2 virus is being detected in the water body that is contaminated with the untreated water from these health centers.
- Emphasis on testing on a large scale should be an action item on research. More reliable options to RT-PCR tests should also be explored vigorously. Hence innovation and product development to have mass production (availability) of inexpensive testing kits should be encouraged. Reliable testing kits at a large scale will go a long way in managing COVID by isolation of affected people.
- An immediate need is to strengthening medical facilities, in particular, Ventilators, O<sub>2</sub> concentrator and O<sub>2</sub> plants/ generators and to develop healthcare infrastructure, especially in rural areas. This includes emergency beds, critical care medicines, supplies. The infrastructure, once developed, should not be allowed to fall into a ruin, so that these can be revived based on need in a future date. Equipped safe home facilities, as most Indian homes do not have dedicated rooms for each member hence social distancing is not effective.
- We need to encourage effective bio-bubble for core sector industries and for industries that are associated with energy production (thermal or hydro-electric electricity and nuclear power).

#### ➤ **Long Term**

- Human to human transmission (High Zoonotic potential)
- Higher rate of cross-species transmission
- SARS-CoV-2 and its probable mutated strains are highly infectious and lethal in nature

- SARS-CoV-2 is a BSL-3 pathogen and lack of BSL-3 facility in and around the country
- Pathophysiologic information is only available based on mainly hospitalized patient data
- Lack of scientific knowledge and awareness
- Lack of safe environment for diagnostics and to study the deadly pathogen

#### 14.1.4 Recommendation on Educational impacts

- **Primary Education:** The suggestion can be a massive TV based program using dedicated government channels and making it mandatory for private channels also in Hindi/ English and Regional Languages to have well-coordinated programs on formal education as well as value based programs for the kids. ***A special task force should be constituted for this purpose.***
- **Secondary Education:** The discussion of 2022 exams should start now to avoid the last minute decisions which put pressure on the students and brings unnecessary judicial intervention. The decisions about class X, class XII and national/state entrance examinations like JEE, NEET etc., should be taken latest by September 2021 with provisions for the two/three different possibilities depending upon the Corona situation. Even if offline exam is possible, the class performance should be taken into consideration which will keep the students engaged throughout the entire period.
- **Higher Education:** University Grants Commission (UGC) should prepare a document about the various possibilities on UG and PG courses teaching and evaluation and send it to the universities clearly mentioning how they can exercise their autonomy. The same can be done by AICTE for the professional courses and IIT and NIT Councils for those institutions.
- The research degrees like PhD, M Phil should be decided by the universities and institutions with respect to the various ways and means that can be used to help the scholars.

- The government should think of a minimum subsistence allowance for an extended period for research scholars and reduction of tuition fees for COVID impacted students.
- The government should work on a war footing to prepare the plan of action for implementing NEP. The current disruptions and innovations can go a long way in deciding the mode of implementation of NEP.
- There is a need to integrate the skill initiative and existing ITI and Polytechnic education. **Government should create a task force to assess the situation and to recommend the way forward.**

#### **14.1.5 Recommendation on Economic impacts and Migration of Labours**

- Industrial units providing a higher level of employment should be given incentives in terms of GST Rate Cuts/ Defer GST Payment.
- Give Wage subsidies to small firms or income support to contract workers to maintain their livelihood and to create overall demand in the economy.
- Offer Moratorium on loan repayment can be one of the important steps along with other policies, however, investments in the industrial sector cannot be just encouraged by providing monetary incentives. Credit can be enhanced through the banking system.
- Fiscal measures like the development of infrastructure, transportation, tax incentives would be useful to revive the economy and there is a need for Fiscal Expansion that is directed towards the bottom of the pyramid especially for rural and urban poor.
- Measures to provide immediate relief to meet working capital needs especially for the MSMEs who have not borrowed from the banks.
- PSU's are not releasing payment despite Government assurances, the same needs to be enforced and ensured.
- Interest rates reduction would help provide a real stimulus. With excess funds lying idle in banks, the banks can reduce the rate of interest on lending and increase the base, thereby increasing the profitability as well as credit affordability.

- MSME Ministry should develop a tracker software/ app to monitor the effective implementation of the package so that it reaches all the affected MSMEs. A war room can be set up for this purpose at the National/regional level.
- A well-defined mechanism for bankers needs to be established to propagate the advantages of the package and to reach out to stress MSME units.
- The scheme covers existing borrowers of scheduled commercial banks & NBFCs only and excludes all others such as co-operative banks and also units with no borrowings. Now that they have been brought under the control of RBI, the cooperative banks should be included in the ambit of the package.
- More amount of money requires to be diverted to make MNREGA further strong number of days of employment can be increased from 100 to 150 days.
- The problem needs to be handled by City Administration rather than waiting for a green signal from the Centre. Transportation facilities like Shramik Trains can be provided for those who want to travel to their respective places. Planning regarding this arrangement would help to ease the pressure on civic authorities and NGO's can help in providing food and other facilities to these workers.
- Migrant labourers need to be communicated systematically through local authorities about the problem of COVID and its possible dangers. Psychologically also they need to be prepared with the help of counselling.
- There should be a separate policy to protect their interest in an emergency. It becomes difficult for some of the local industries to sacrifice the trained and skilled manpower if they fail to come back from their respective places.
- Micromanagement and planning is the way out for handling the problem of migrants. NGO's and Government administration must work in conjunction. The government recognized placement agencies should be set up to maintain data of migrant labourers. There is a need to collect data of migrant labours along with their skills. If implemented properly 'One Nation One Ration Card' would be beneficial for the migrants and can be proved to be a game-changer, as such present PDS system excludes migrants.

- Give more relaxation to employers if they employ labourers from local areas by providing vocational training to create a skill set. Some insurance schemes can also be evolved for migrant workers. Policy framing requires ensuring the protection of the interests of migrant labourers.
- Some incentive mechanism is required to be devised to attract the migrant labour back to the originating units.

Atmanirbhar cannot be achieved by levying high import duties, but by creating a competitive advantage. A preparatory action plan requires ensuring that individuals don't fall into loneliness, hope, compassion, affection, caring and tenderness are powerful tools to handle the crisis.

#### **14.1.6 Technology related to COVID**

- UV affects and inactivates DNA & RNA of COVID-19 virus and inactivates and hence provide great protection against it.
- DRDO has developed disinfection tower called UV Blaster for sanitization of Corona virus prone areas and useful for high tech surfaces like electronic equipment's, computers and other gadgets.
- It is highly recommended the usage of mask of different types and properties that have higher filtration capability for effective control of rapid spread of COVID-19 variant Delta+.
- It is strongly recommended to use of double masks which have proved to be most effective in preventing spread of COVID-19 and its variants.
- Infectious waste generated by COVID-19 pandemic should not be mixed with general solid waste as is the major environmental concern and needs proper segregation and separate treatment.
- Always paste a label "**COVID-19 Waste**". Disposable masks should be placed in biomedical container and finally incinerated or burry at the depth of 10 feet in soil.

### **14.1.7 Recommendation on Sustainability issues**

- Air Quality Studies for the Indoor virus and bacteria should be focused.
- Studies on the survival of SARS-CoV-2 in water and wastewater under different operational conditions (i.e., temperature and water matrix) should be conducted.
- Guidelines for reuse of only tertiary treated water even for agricultural (circular economy v/s health) should be implemented.
- Safety precaution guidelines against SARS-CoV-2 exposure for Wastewater and sewage workers.
- Take up projects with UNICEF kind of organizations; prepare hygiene and safety audits of houses, community, schools, work places, hospitals. Create guideline manuals.

## **14.2 FOR ACADEMIC BODIES**

### **14.2.1 Recommendation on Health**

#### **a) Health impacts**

- Research focused on association of new symptoms with epidemiological parameters
- Research on association of classical COVID symptoms with newer strains

## **b) Vaccination**

- Research on effect of vaccines with newer strains and re-infection
- Research on persistence of antibodies in the sera of patients recovering after COVID infection or post-vaccination

## **c) Health service preparation**

- Education and research for a health plan to manage the third wave effectively by a combined approach from administrators and health service professionals.

## **d) Issues of lower immunity**

- Research on persistence of antibodies in sera of patients recovered from COVID
- Research on persistence of antibodies in sera of patients vaccinated for COVID
- Patterns of re-infection
- Estimation of antibodies in patients suffering secondary bacterial and fungal infections, to assess if there is a direct correlation between quantitative estimation of IgG levels and secondary infections
- Research on antibiotic resistance in COVID 19

## **e) AYUSH integration**

- Public Awareness and Health Education for prevention of COVID 19: COVID Appropriate Behaviour (CAB)- ***Do gaj ki doori, Mask hai Jaruri***, avoiding crowded congested places and un-ventilated indoors and hand washing with soap-water/ alcohol-based sanitizers.
- Health education on AYUSH guidelines ([main.ayush.gov.in](http://main.ayush.gov.in)): **National Clinical Management Protocol Based on Ayurveda and Yoga for Management of COVID 19, and Home Care Guidelines for Children, Ministry of Ayush, GOI.**



- Awareness about Homeopathy guidelines (**CCRH Revised Guidelines, 2021**).
- Public awareness using **Arogya Bharti** Guidelines for general public, **Corona Arogya Mitra Prashikshan Pustika**.
- Health Education about healthy life style, Regular *Din charya*, and *Ritu charya*, including regular exercise, Surya Namaskar, Yagasan, Pranayam and Dhyan.
- Awareness, popularization and use of Ayush 64.
- Public Awareness about Guduchi (Giloy), Ashwagandha, Chyawanprash, Trikatu, Triphala, Turmeric, Pepper, Pippali, citrus fruits, Amla, Ginger, Mulethi, etc which are found to be useful in infections/Covid 19.
- Popularization of *Gundusha*, and *Nashya*.
- Eating of regionally grown and seasonally available fruits and vegetables.
- Few minutes of sun exposure during morning of summer or sun bath in winters for vitamin D.
- Adequate Rest and sleep, (6-8 hours).
- Avoidance of processed and preserved food, alcohol, drugs and smoking, sugar and excessive salt intake.
- Practice of *Paropkar* (Benevolence) and *Karuna* (Compassion) for mental health.

#### **14.2.2 Research Activities on handling 3<sup>rd</sup> wave**

##### **➤ Short Term**

- Effective communication and information dissemination of research should be done with the large population as an important research outreach program. While research is important, its quick dissemination helps the society to get immediate benefits of research.
- Another important immediate research should involve medical waste minimization and management. Medical waste is coming up as a major threat to the environment.

## ➤ Long Term

Improvement of Molecular Diagnosis and understanding the pathogenesis of COVID-19 to design is another important area in the long run. These involve;

- Significant research needs, improvements in RT-PCR, to avoid issues of False Negatives from Testing of Viral RNA from patient samples. Development of alternative nucleic acid amplification techniques, incorporating CRISPR technology for point-of-care (POC) applications, validation of POC tests, and sequencing of viral RNA and its mutations.
- Needs for Improving Serological Tests of Antibodies: Public health surveillance benefits from large-scale analyses of antibodies in serum, although the current serological tests do not quantify neutralizing antibodies.
- Needs for Studying Viral Proteins as a confirmatory test. Mass spectrometry and proteomic techniques will play important roles in the characterization and quantitative determination of viral proteins.
- Biology of the SARS-CoV-2, Mucormycosis (black fungus), common respiratory and haemorrhagic fever-causing viruses in understanding the Genomic control of pathogenic properties to design effective therapeutics.
- Generation of a virus free cell based assay system for screening a broad spectrum of antivirals
- Establishing Humanized ACE-2 (SARS-CoV-2 receptor) expressing experimental mouse model in hybrid BSL-3 wet lab and BSL-3 animal facilities to understand the pathogenesis of the Risk-III level pathogens.
- *Collaborative effort to set up a non-human primate model to understand the pathogenesis (ambitious aim but worth to take challenges to take up for clinical trials of potential screened small molecules antivirals, repurposed drugs and new therapeutic targets).*

*Establishing Hybrid BSL-3 wet lab and BSL-3 animal facilities and a few, one in every region, BSL-4 facilities should be a major Government initiative in the long run for COVID research.*

#### **14.2.4 Technology related to COVID**

- Proper disposal of used items such as masks and hand gloves is very much essential. Disposable masks are not recyclable. It is highly recommended to research on the disposal of COVID masks, gloves, etc.,

#### **14.2.5 Recommendation on Sustainability issues**

- Compendium of Cost effective technologies for inactivation/disinfection and protocols.
- Water Safety Audits (capacity Building)

### **14.3 FOR PUBLIC**

#### **14.3.1 Recommendation on Health**

##### **a) Health impacts**

- Properly following government mandated instructions of using face masks, hand hygiene, social distancing.

##### **b) Vaccination**

- Vaccinating themselves on time

##### **c) Health service preparation**

- Not to panic in case of a third wave
- Registering at the concerned medical facility for care
- Going through proper channels to obtain care
- Not to spread rumours

#### **d) Issues of lower immunity**

- Avoid indiscriminate use of medicines, especially antibiotics and steroids
- Don't use medicines without the prescription of a physician
- Avoid panic and avoid unnecessary potions, supplements without advice from experts

#### **e) AYUSH integration**

##### **➤ General Guidelines**

- Maintenance of hygiene and sanitation in community.
- Avoidance of crowding and gatherings, and outdoor visits,
- Staying indoor in well ventilated places.
- Avoidance of meat, poultry and especially wild animals (Bat→ Civet Cat, Camel, Pangolin→ Human transmission).
- Daily gargle with warm water added with turmeric & salt.
- Freshly cooked, easily digestible food for both, healthy and COVID patients. Avoid processed preserved and deep-fried food.
- Avoid excess intake of fat, oils, sugar and salt.
- Follow the AYUSH guidelines issued by Ayurveda, CCRH guidelines, Siddha guidelines, and Arogya Bharti guidelines: by public at large.

### ➤ **Guidelines with Reference to COVID 19 infection and Patients**

- Special attention to persons with higher risk (elderly, co-morbid health conditions) and vaccination to all such eligible.
- Sick patients of COVID 19 to take nutritious, freshly cooked and easily digestible food, adequate water intake, sufficient rest and sleep (6- 8 hours, daily).
- Monitoring of sick persons for temperature and oxygen saturation at least twice a day.
- Prone positioning, initially 2 hours at a time or as tolerated, 4- 5 times a day, when O<sub>2</sub> saturation goes below 94%.
- Limited movement of sick.
- Avoidance of cold drink, ice cream, refrigerated water and beverages.
- Use of herbal concoctions, warm beverages, and steam inhalations.
- Avoiding use of air conditioning.
- Personal hygiene and sanitation of bed room and wash room.

### **14.3.2 Technology related to COVID**

- It is recommended to use the mask of different types and properties that have higher filtration capability for effective control of rapid spread of COVID-19 variant Delta+.
- Face masks are truly most protective for individual to prevent infection. Face masks are mandatory and simple barriers which help to prevent respiratory droplets of various sizes.
- It is also strongly recommended the use of double masks which have proved to be most effective in preventing spread of COVID-19 and its variants.
- Make sure that you wear a mask which fit properly over your face covering nose and mouth completely and does not leak respiratory droplets in and out as well as comfortable for breathing.
- Cloth mask alone are not recommended because of their low filterability however, they can be used along with surgical masks which makes them most effective.

- N95 masks is most efficient and it filters 95% of aerosols and microorganisms. They also fit properly therefore do not combine N95 masks with other masks.
- It is also strongly recommended the use of cost effective and most efficient virucidal coated 3D – printed mask made in Bharat as best among all masks and which reduce the very high spread of Delta+ as bacterial filtration efficiency is higher than 95%.
- Wash your hands with soap and water before wearing and removing the mask. Always hold mask at its ear lobes and never ever touch front side of mask.

#### **14.3.7 Recommendation on Sustainability issues**

- Personal hygiene improvement: Behavioural change (Schools)
- Community level hygiene improvement: Behavioural change and enforcement, infrastructure

#### **Key recommendations:**

There are several efforts already being carried out by various agencies for improving the response to the health challenges, we provide following recommendations;

- Besides period notifying the changed symptoms, updating epidemiology based on prevailing data on age, sex, socio-economic patterns.
- Early identification and notification of post covid health complications such as mucormycosis
- AYUSH integration with allopathy treatment for improved immunity and post covid health management/recovery
- Research activities to be supported on priority for medical equipment, devices creating safe zones by deactivating virus in ambient/surfaces, comfortable PPEs, safe handling of medical waste (such as used masks) generated in every household, creating more laboratories BSL3/4 for sequencing of RNA, rapid and alternative testing methods
- In case of education different strategies for online/offline classes for primary, secondary and higher educations may be prepared. Use of mass communication media such as TV channels should be promoted for primary and secondary education. For higher education guideline document suggesting possibilities of online courses may be prepared by UGC and AICTE.

- Existing infrastructure of EDUSAT intranet may be promoted over internet to avoid the missuse of internet. Further, IT infrastructure available in other sector such as Rail Tel may be integrated.
- Domestic sewage is considered as the potential hazard for spread of virus. Delineating mandatory disinfection in sewage treatment and conducting risk assessment on pipe network for leakages is required.
- Mapping of industrial sector on the potential of providing employment and should be provided support to continue working. Also, the tax benefits should be extended to industries so as to support economy of workers.
- Awareness programme for reducing mass migration of labours may be prepared by local administration along with industries. Mix of strategies of continued activity with covid protocols and financial support may be adopted.
- Promotion of acceptance of vaccine by joining hand with local community level leaders. Key for fight against covid is effective coverage of vaccination of population in both urban and rural areas. Community level awareness by local social leadership will bring pace to vaccination by removing apprehensions.

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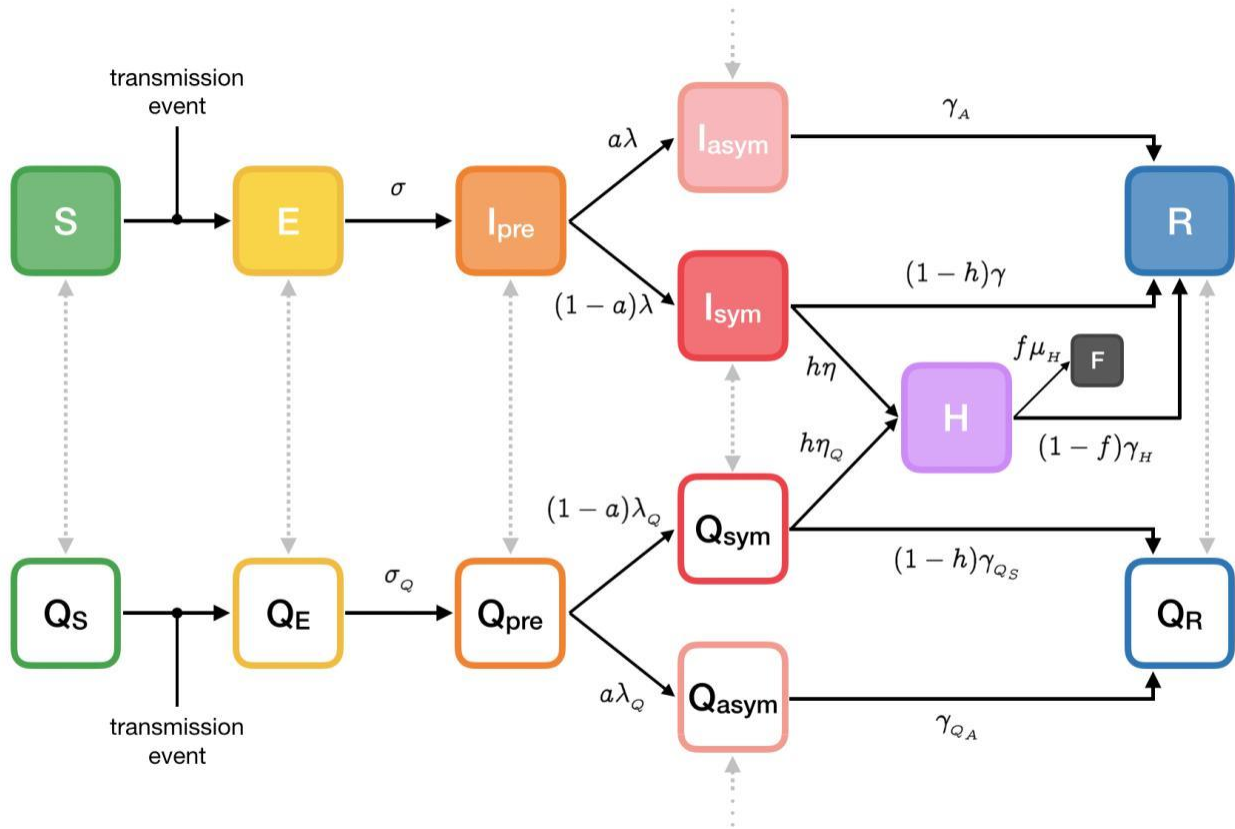
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## 16. Appendix



**Figure A:** Flowchart of the compartmentalized model used in this study (Source: <https://github.com/ryansmcgee/seirplus/wiki/Extended-SEIRS-Model-Description>)

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