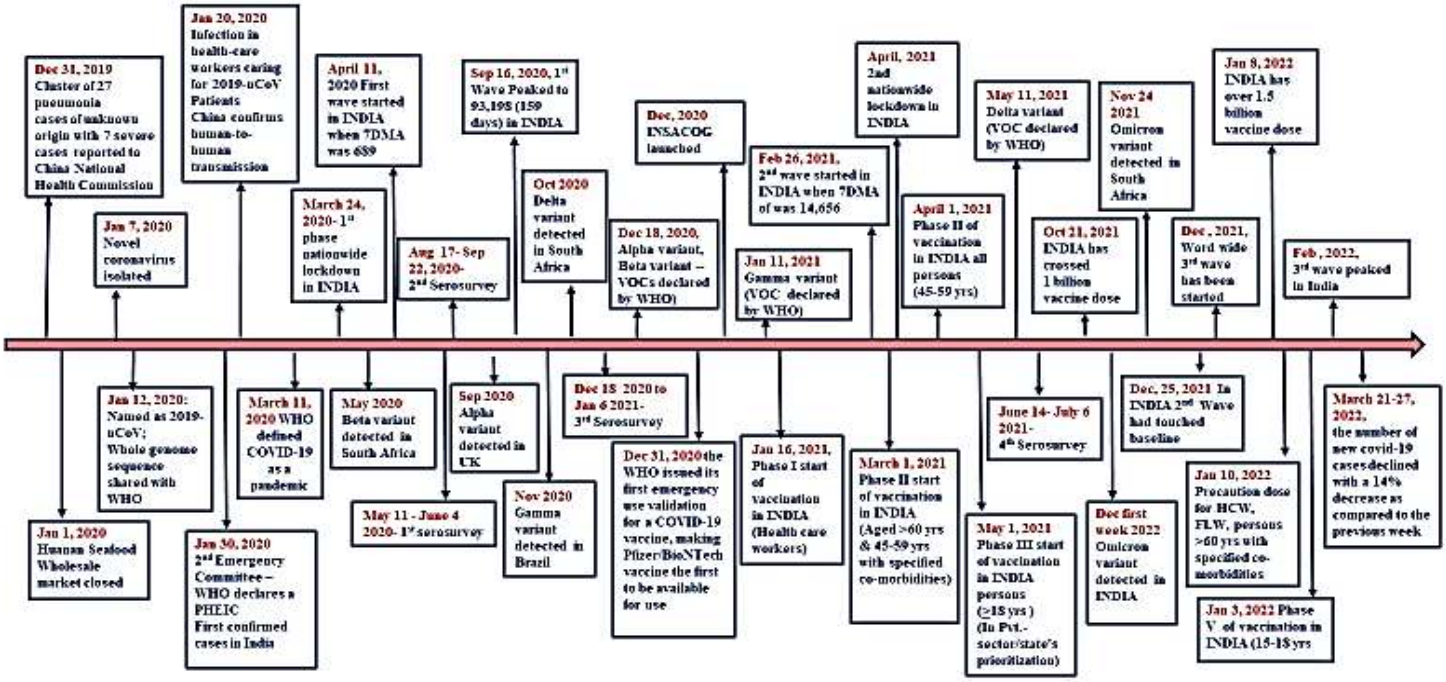
Evolving Public Health Strategies-
COVID-19 Pandemic

INTRODUCTION:

As Covid-19 spread across the world, countries have experienced several waves of the epidemic at different times. This is usually marked by a complex interplay of detection of newer variants, changing immunological profiles of population from exposure to natural infection or vaccination and increased population mixing due to withdrawal of Covid-19 restrictions. In this constantly evolving scenario, India followed a flexible, evidence based, and scenario based public health approach to tackle the different waves of Covid-19 that swept through the country between 2020 to 2022. During the response, critical tools such as community surveillance through Integrated Disease Surveillance Programme, expansion of testing capacities, coordination with the International Health Regulations etc. were constantly strengthened. Additionally, screening of international passengers, testing of suspected cases, contact tracing, screening of high-risk groups, sero-survey and genomic surveillance have been the dominant tools for monitoring the disease. As we move ahead, the use of tools like sentinel surveillance coupled with environmental surveillance and more comprehensive genomic surveillance is of paramount importance.

EVOLVING PUBLIC HEALTH STRATEGIES

The evolving Covid-19 pandemic – necessitated graded and differential public health responses, which varied from day to day at first, subsequently from week to week and thence, from month to month. The nation's public health response delivered by various institutions of the Ministry at the national level and coordinated by their counterparts at state and district levels, focused initially on containment and mitigation, progressing to adaptations and modifications of the legal framework, empowering the domestic R&D as well as manufacturing sector, ensuring the logistics to enable high quality devices-related to testing kits, oxygen supplies, ventilators and PPEs, crafting a media strategy that informed the public and kept misinformation at bay. In the initial period of the pandemic from January to November 2020, the proactive and pre-emptive approach was followed by the government to tackle the pandemic. From January to November 2020, the pandemic moved with rapidity across the country, and this required that policy decisions, strategy design, and endorsement by states, kept pace with the spread of the virus. The Covid-19 pandemic demanded that the Central government respond promptly to the evolving situation and in a manner that would facilitate rapid scaling up of the responses. The strategic approach also needed to be calibrated to the varying maturity of health systems across various States/UTs to respond to the pandemic. Thereafter, the public health responses initiated after November 2020, the focus gradually started shifting from containment, surveillance and treatment to mass vaccination.



Evolution of the COVID-19 pandemic (31 December 2019 – March 2022)

Strategic approaches used for COVID 19 containment:

India followed a scenario-based approach for the following expected scenarios:

i. Travel related cases reported in India
ii. Local transmission of Covid-19
iii. Large outbreaks amenable to containment
iv. Wide-spread community transmission of Covid-19 disease
v. India becomes endemic for Covid-19

a. Strategic Approach for when "only travel related cases reported from India"

(i) Inter-ministerial coordination (Group of Ministers, Committee of Secretaries) and Centre-State Co-ordination was established.

(ii) Early Detection through Points of Entry (PoE)screening of passengers coming from affected countries through 30 designated airports, 12 major ports, 65 minor ports and 8 land crossings.

(iii) Surveillance and contact tracing through Integrated Disease Surveillance Programme (IDSP) for tracking travellers in the community who have travelled from affected countries and to detect clustering, if any, of acute respiratory illness.

(iv) Early diagnosis through a network lab of ICMR which were testing samples of suspect cases.

(v) Buffer stock of personal protective equipment was maintained.

(vi) Risk communication for creating awareness among public to follow preventive public health measures was undertaken in an aggressive manner.

b. Local transmission of Covid-19 disease

In addition to above measures, cluster containment strategy was initiated with:

- Active surveillance in containment zone with contact tracing within and outside containment zone
- Expanding laboratory capacity for testing all suspect samples, close contacts, ILI and SARI

- Establishing surge capacities for isolating all suspect / confirmed cases for clinical management.
- Implementing social distancing measures.
- Intensive risk communication.

c. **Large outbreaks amenable to containment:** The strategy remained the same as above but varied in extent depending upon spread and response to be mounted to contain it. Geographic quarantine and containment strategy included:
   - Defining large area of operation and applying strict perimeter control
   - Active search of cases, early isolation, contact listing and tracking, quarantine and follow up of contacts
   - Testing all suspect cases, symptomatic contacts, asymptomatic direct and high-risk contacts of a confirmed case and ILI/ SARI cases as per the guidelines issued from time to time.
   - Clinical management based on risk profile
   - Social distancing measures
   - Administration of hydroxychloroquine (HCQ) in healthcare workers and contacts as per defined protocol
   - Raising awareness on hand hygiene, respiratory etiquettes and sanitation

Overall**,** the objective of the containment plan was to break the chain of transmission thus reducing the morbidity and mortality due to Covid-19.

As mutations in SARS CoV2 are common and occur during the process of replication, some mutations result in alteration of transmissibility, immunogenicity and pathogenicity of the virus. These also adversely affect Covid-19 countermeasures related to testing kits, vaccines and treatment measures like monoclonal antibodies. To strengthen preparedness for early detection of SARS CoV2 variants, whole genome sequencing was imperative. The use of tools like sentinel surveillance coupled with environmental surveillance and more comprehensive genomic surveillance are now guiding the public health policy and response.

COVID-19 PANDEMIC: NCDC'S ROLE IN THE PUBLIC HEALTH RESPONSE

This document highlights the response of the National Centre for Disease Control (NCDC) to the Covid-19 pandemic and outlines the way forward in Covid-19 pandemic management through newer public health strategies. National Centre for Disease Control (NCDC), being the premier public health institute in the country, has played a proactive and important role in Public Health responses since the advent of Covid-19 pandemic, starting from operationalising first 24X7 Call Centre to answer rising queries from the public to contact tracing and strengthening disease surveillance in the country by establishing a decentralized state-based surveillance system to detect early warning signals for effective public health actions. NCDC, has been closely monitoring the situation and has been an active forerunner in the Ministry of Health's response in scaling up country preparedness and response

operations. During this course, NCDC being a part of Joint Monitoring Group (JMG), various guidelines, SoP's and advisories were developed as a part of public health interventions.

The key activities which were carried out by NCDC included inspection of Points of entry (designated airports, land borders and self-reporting forms) review of Quarantine facilities, operationalization of 24X7 control room, provided technical expertise and guidance for early detection and response, surveillance (Strengthening SARI surveillance and in-country surveillance of suspects/ contact tracing), National referral laboratory system, infection prevention and control practices, genomic surveillance through INSACOG network, deployment of rapid response teams, case management, logistics, procurement & supply management, risk communication, community engagement, drafting of technical guidelines, SOPs & travel advisories, PIB press releases, inter-sectoral coordination, communication with WHO, CDC & other stakeholders and this document encapsulates these activities.

Every Covid-19 surge presented with different set of challenges and NCDC spear headed the key Public Health Responses to combat them. (Table 1)

Table 1: Key Public Health Response of NCDC

Initial Phase (Jan – March 2020)	**March to June 2020**	**First surge (Aug-Sept 2020)**	**2nd Surge (Mar-May 2021)**	**3rd surge (Jan-Feb 2022)**
• JMG, NTF, EG-1 • Control room 24X7 • IHR: coordination with WHO focal points • Alert issued to States for ensuring preparedness	•Early detection of clusters, •Monitoring strategy	•Containment zone plans Technical guidance to states	Early detection of surges/ exponential rise	RRTs & Frontline Epi-trainings • ARI/ILI trends
Activation of SHOC • IT surveillance network • Inspection of Points of entry • Community surveillance through IDSP • Quarantine of Evacuees	• Containment strategy	Central teams to high case load districts and states	•INSACOG establishment •Genomic survey •Sentinel surveillance	Monitoring community transmission, • Vaccination coverage • Breakthrough infections
Enhanced testing by Magnapure and Cobas 6800	District level Incident Command and control center	• Technical planning • Sero-surveys • Continuous monitoring of the situation through IDSP	Super-spreader events, Exponential rise, Vaccine efficacy	• Genomic mutations Epidemiological correlation • Sero-prevalence • Revised surveillance strategy
Cluster containment	ARI/ILI surveillance		Monitoring VOCs, VUI, mutations	

In the COVID 19 Pandemic, NCDC assisted surveillance and response activities and supported the testing and genomic sequencing of Covid-19.

•**JMG, NTF, EG-1**- NCDC has been an active member of Joint Monitoring Group (JMG), National Task Force (NTF) and Empowered Group (EG)-1, constituted to provide regular updates and technical guidance on risk assessment and reviewing preparedness and response.

•**24X7 Control room** - On 25th January 2020, a 24x7 NCDC Call Centre (+91-11-23978046 or 1075) was operationalized. The call centre was utilized to provide information related to the disease, its prevention, management and any other details to callers seeking clarification. Later, the existing 104 call centre for Grievance Redressal and Health Helpline were integrated with 1075 NCDC call centre.

•**IHR coordination with WHO focal points:** Coordination and communication with WHO, NFP of other countries and local stakeholders for event verification, notification, contact tracing, etc. was carried out by NCDC. Notification of first three cases of COVID19 to WHO was done**.** NCDC worked with WHO country office and ICMR for guidance on testing and research and development related to Covid-19. Technical support was provided by WHO for strengthening Covid-19 Special Surveillance System through the Integrated Health Information Platform (IHIP). WHO along with UNICEF supported NCDC in developing communication campaigns for raising community awareness for Covid-19.

IT surveillance network and activation of Strategic Health Operation Centre (SHOC): SHOC managed by IDSP was activated for coordinating surveillance & monitoring of Covid-19 response activities from 8th February' 2020 and actively monitored the situation. Alerts were issued by CSU to States for ensuring preparedness.

The role of technology in the Covid-19 pandemic, especially related to the use of IDSP surveillance, telemedicine, IGOT platform and the Covid-19 portal, significantly facilitated the delivery of essential services, enabled capacity building of various cadres of workers and enabled, mapping of various aspects of health system readiness and requirement for an adequate response.

Inspection of Points of entry

In the initial phase of the Pandemic, NCDC supported the surveillance of International travellers who had history of exposure/travel to Covid-19 affected countries. Protective measures started from January 2020 itself for containing the virus's entry and spread in the country. Several steps were taken in this regard which included reviewing system preparedness, issuing advisories to states/UTs, for testing, diagnostics, surveillance, prevention and control, and risk communication, and working on strengthening capacities for timely detection and case management. Immigration officers were also sensitized for early detection and management, through inter-ministerial coordination. MoHFW issued guidelines to support States/UTs on surveillance and contact tracing, surveillance at all Points of Entry (airports, seaports, land borders), laboratory samples collection, packaging and transport, clinical management protocol and infection prevention and control in healthcare facilities. Guidance and training for surveillance was targeted at health workforce involved at all points of entry (designated international airports) and community surveillance in Integrated Disease Surveillance Programme (IDSP). Guidelines for thermal screening of foreign travellers from South East Asian Countries in addition to China and Hong Kong were issued and briefed to all the concerned, across 23 airports of the country.

Special case of handling Indo-Nepal border: Central teams deployed at bordering districts of Nepal and Bangladesh to coordinate screening at International check posts and quarantine of suspects.

Central teams constituting officers from NCDC visited bordering districts of Indo-Nepal border and all villages and communities near the porous border with Nepal were sensitized, in special gram sabhas, about symptoms of the disease, its spread and reviewed the district level preparedness.

Quarantine of Evacuees: NCDC coordinated with Defence and paramilitary forces in managing quarantine of returnees from Wuhan and Iran in ITBP/ Army quarantine facilities.

Community surveillance

The community-based surveillance focuses on the early detection of unusual events in the community, such as large outbreaks, an unusual presentation of cases, mortality, etc. CSU monitored the pan-India situation through its IDSP network.

Cluster containment NCDC carried out Epidemiological investigation into cluster containment and super-spreader events. Central teams constituting members from NCDC were deployed to various States for cluster containment such as the Agra cluster; Bhilwara cluster; SAS Nagar cluster in rural areas of Punjab; and Dharavi cluster in Mumbai.

Monitoring strategy

Containment strategy and Perimeter control: The cluster containment strategy was developed to contain the Covid-19 transmission within a defined geographic area by early detection, breaking the chain of transmission and thus preventing its spread to new areas. This included geographic quarantine, social distancing measures, enhanced active surveillance, testing all suspected cases, isolation of cases, home quarantine of contacts, social mobilization to follow preventive public health measures.

District level Incident Command and control centers were established and related SoPs were drafted and shared with the States/UTs by NCDC.

ARI/ILI surveillance: ILI & SARI Surveillance cases were detected by active house to house searches by field teams in non-affected areas to detect hidden transmission.

Enhanced testing by Magnapure and Cobas 6800: NCDC took cognizance of the need to expeditiously expand Covid-19 testing facilities so it started preparing for establishing Real Time RT-PCR based assay as per standard protocol in mid-January 2020 and testing was established by 29th January 2020. At that moment, it was the first lab in North India and second lab in country to establish testing. Subsequently laboratory testing capacity of NCDC was also significantly enhanced by new COBAS-6800, automated RNA extractors and Next Generation Sequencer for Genome sequencing.

Containment zone plans & Central teams to high case load districts and states- Central teams constituting officers from NCDC were deployed for periodic review of surveillance and containment measures in high case load districts. Delhi, Gujarat, MP, Maharashtra, TN, Karnataka, NE states, J&K, Ladakh, UP and other states were supported during various stages.

• **Technical guidance to states;** NCDC also prepared various technical guidelines for contact tracing, quarantine in home and health facilities, surveillance in containment zones, house-to house case search, trainings at land border crossing, district control room, dead body management, disinfection of

health facilities and quarantine centres which guided the country through this pandemic in its containment and mitigation.

• **Technical planning and Sero-surveys:** Sero-surveillance in Delhi, Indore (MP), Bhopal and Gujarat were carried out to assess the infection exposure. Delhi's first Sero-prevalence study of Covid-19 was commissioned by Ministry of Health and Family Welfare in June 2020. The study was conducted between 27 June 2020 and 10 July 2020, by the National Centre for Disease Control NCDC in collaboration with Government of National Capital Territory of Delhi.

Early detection of surges/ exponential rise: Continuous monitoring of the situation in all the phases of pandemic was done through CSU, IDSP to detect surge in the number of cases and inputs were shared with the MoHFW for key policy decisions.

INSACOG establishment: To fully understand the spread and evolution of the SARS CoV-2 virus, and to tackle its future spread sequencing and analysing the genomic data of this novel corona virus was required. A multiagency Indian SARS-CoV-2 Genomics Consortium (INSACOG) was formulated in December 2020, leading to rapid systematic expansion of whole genome sequencing of SARS-CoV-2 across the nation. National Centre for Disease Control established Whole Genome Sequencing of SARS-CoV-2 by setting up of Next Genome Sequencer (Illumina and Nanopore) at Biotechnology Division and was one of the first laboratories in the country to sequence the first case of SARS-CoV-2 identified in the northern part of the country. NCDC was identified as the nodal agency for Indian SARS-CoV-2 Genomic Consortium (INSACOG) responsible for monitoring VOCs, VUI, mutations.

IGSL list is placed at Annexure I.

INSACOG Sentinel Surveillance network

The INSACOG sentinel surveillance system is adapted from WHO guidance for establishing SARS CoV-2 genome sequencing surveillance in developing country settings (which requires sequencing of a minimum of 150 samples per month). The network leverages the existing NCDC Integrated Disease Surveillance Programme (IDSP) platform and has established more than 300 sentinel sites across India. The network comprising of RT PCR labs and secondary/ tertiary hospitals to capture cases representing the entire spectrum of illness (mild to severe). Additionally, a surge sampling track is also in place for rapid sampling of outbreak/ unusual case rises.

Notable strengths of this system are the regular collection of numerous representatives (by age-group, clinical presentation and geographic location) specimens from across the country and characterizing virus sequences with epi and clinical data.

INSACOG sampling strategy:

a. Prospective surveillance

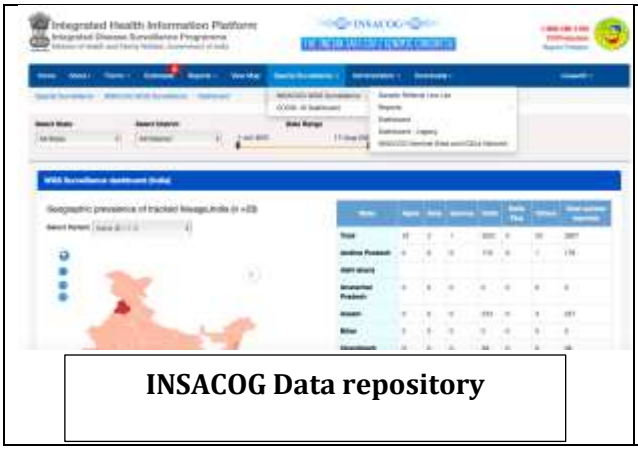
i. **Sentinel Surveillance**: Each state has identified ten sentinel sites (5 RT PCR labs and 5 tertiary health care facilities) and sends a minimum of 300 SARS CoV 2 samples for sequencing per month. The samples from health care facilities are collected from patients with severe illness, vaccine breakthrough infections, long haulers and other atypical clinical presentations, etc.

ii. **WGS** for districts with COVID 19 clusters or rise in cases: A representative nos. of samples as per the sampling strategy finalized by SSO/ CSU are sent to RGSLs.

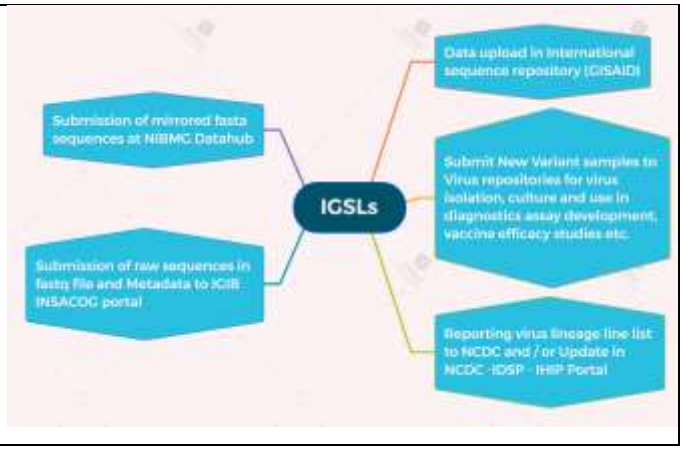
Integrated Health Information Portal

The Integrated Health Information Portal (IHIP) is a secure electronic database of NCDC/ MoHFW that links the PANGO lineage data from sequencing to patient epi and clinical outcomes. This enables near real time availability of results for Covid-19 related policy making and quick public health actions. The sentinel sites, district surveillance units (DSUs) and State Surveillance Units (SSUs) of IDSP are the key linkages in ensuring a smooth flow of samples to the designated IGSLs for WGS. An automated dashboard is available in the IHIP that facilitates "at a glance" results output. The IHIP outputs are routinely used by both central and state governments.

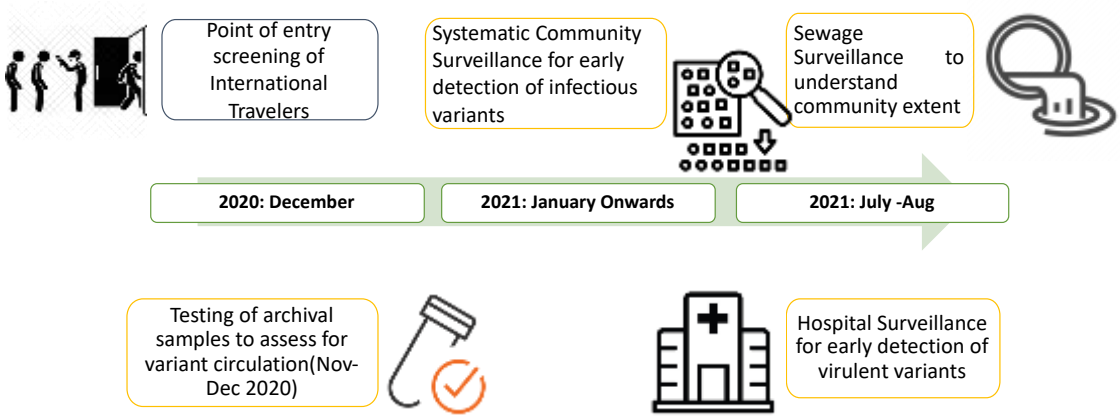
The INSACOG has several data repositories. Sequencing data (FASTA/ FASQ files) is deposited into the servers of Dept of Biotechnology (DBT) institutions—IBDC and NIBMG for deeper analysis. The Pango lineage data is deposited into the IHIP portal. In the larger interest of serving the scientific community, sequencing data and associated meta data is also deposited into the publicly available repositories such as GISAID.



INSACOG Data repository



INSACOG Additional Implementation Arms



In addition to sentinel and surge surveillance, INSACOG has also initiated sewage surveillance in selected sites to generate early warning signals of Covid-19 case rise from the community. A hospital network surveillance is also established with the objective to evaluate the pathogenicity of new emerging variants.

Capacity building: Online trainings for competency building for use of IT tools like Arogya Setu and ITIHAAS in States of Delhi, Punjab, Srinagar, Maharashtra, etc were carried out by NCDC.

RRTs & Frontline Epi-trainings: NCDC in partnership with U.S. Centers for Disease Control and Prevention (CDC) and WHO India office, started offering a three-month in-service 3X3 Basic Epidemiology Training for Frontline Public Health Workforce. This is a tailor-made program for frontline public health workforce to strengthen epidemiological skills.

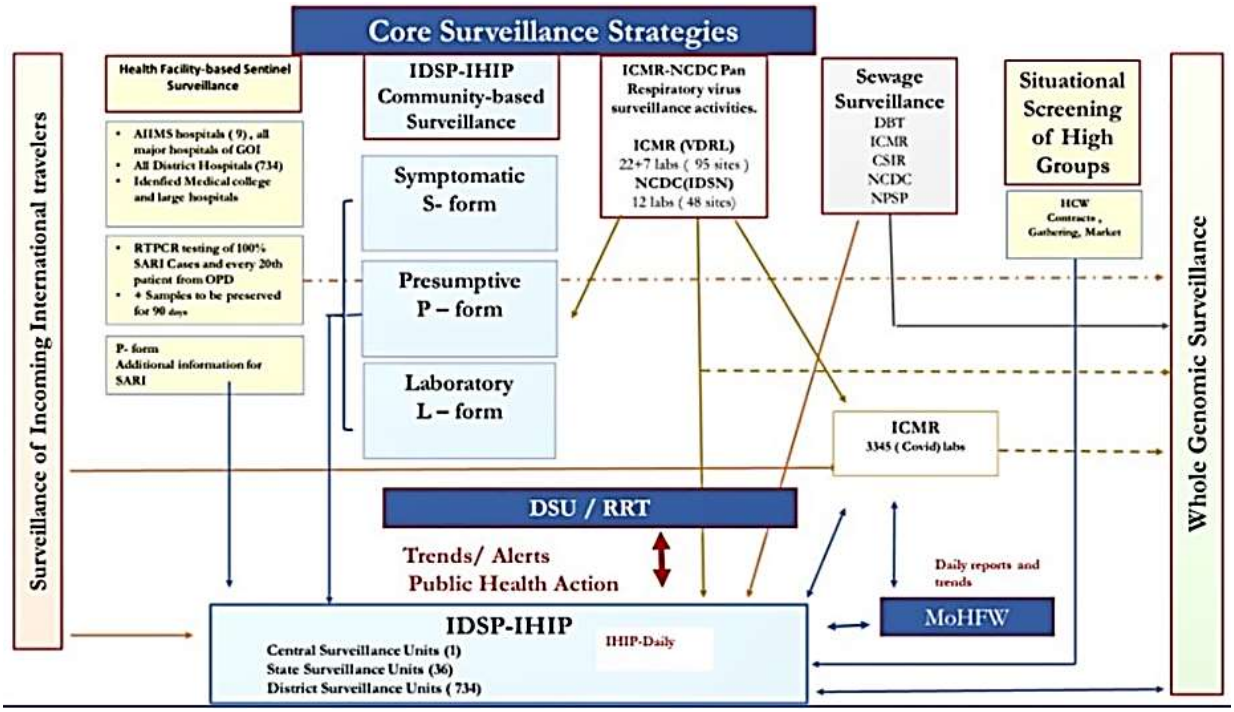
WAY FORWARD THROUGH REVISED SURVEILLANCE STRATEGY:

Post third surge in January 2022, SARS-CoV-2 disease (Covid-19) has entered a new phase in the country. A sustained low incidence level of mild clinical severity and very low rates of hospitalization due to various factors such as enhanced surveillance, focus on case management and high vaccination coverage has supported country's Covid-19 management efforts. Therefore, a revised surveillance strategy to enable a close monitoring of situation for early identification of cases has been formulated by MoHFW in June 2022.

Surveillance with focus on early detection, isolation, testing, and timely management of suspected and confirmed cases; detect and contain outbreaks of new SARS-CoV-2 variants and monitoring the trends of existing variants; monitoring of long-term epidemiologic trends through the established genomic surveillance strategy is a compelling need. The long-term vision is to fully integrate Covid-19 surveillance within existing IDSP surveillance mechanism. All State and district surveillance officers need to have continued focus on surveillance in coordination with the relevant stakeholders.

The existing strategies need to be supplemented with newer ones and linkages between them are being established. Surveillance of Incoming International Travelers, Health Facility-based Sentinel

Surveillance, Community-based Surveillance (through IDSP-IHIP), Pan- respiratory Virus Surveillance (through ICMR-NCDC), Sewage / Wastewater Surveillance, Situational Screening of High Groups & Sero-surveillance and Whole Genomic Surveillance can provide valuable insights and trends to monitor and respond to diseases of public health importance.



Linkages of various surveillance activities

Surveillance of Incoming International Travelers Screening of incoming international travellers for Covid-19 is a pivotal part of surveillance to detect entry of the virus and its variants into the country from other parts of the world. The following protocol is to be followed:

i. Randomly screen 2% of passengers in each incoming flight into India by RTPCR

ii. Subject all positive specimens to genomic sequencing.

iii. Keep passengers who test positive under observation/quarantine and manage as per prevailing guidelines. (Details of the existing guidelines available at https://www.mohfw.gov.in/pdf/GuidelinesforInternationalarrivalsupdatedon10thFebruary2022 .pdf)

Sentinel Surveillance: This shall have two components viz.

A. Health facility-based surveillance

B. Laboratory based surveillance

Health facility-based surveillance: The revised surveillance strategy emphasizes upon the need for a health facility-based surveillance of respiratory illness through 5% testing of all ILI cases reporting to OPDs and mandatory testing of all admitted SARI cases for Covid-19. All positive cases are to be referred to INSACOG labs for WGS. The entire data flow is on the IDSP-IHIP network and can be tracked on a near real time basis by the relevant stakeholders.

a. A nationwide network of sentinel facilities to monitor influenza-like-illness (ILI) and severe acute respiratory infection (SARI) shall be operationalized.

b. All ILI and SARI surveillance data to be reported through IDSP-IHIP.

c. All healthcare facilities to report ILI cases from OPD (P form reporting units under IDSP-IHIP) - DSO will be responsible to analyse the data and a proportion (1 in 20) of such ILI cases shall be referred to lab for Covid testing through RT-PCR.

d. Monitoring SARI cases in all district hospitals & selected tertiary hospitals (All the AIIMS, all district hospitals, large tertiary care government/Pvt Hospitals including Medical college hospitals of States/UTs) & their RT-PCR testing for COVID-19.

IDSP will share fortnightly reporting data of the health facilities with respect to ILI and SARI cases. Reporting to be reviewed and ensured by District Collector/Magistrate and MD NHM at the State level.

Laboratory based surveillance: Labs testing for Covid-19 should upload their data on ICMR portal.

a. ICMR should also provide the data through API to IDSP-IHIP for regular monitoring.

b. Data should also be analysed for test positivity rates and trend of Ct values (if possible)

Community-based Surveillance: The community-based surveillance focuses on the early detection of unusual events in the community, such as large outbreaks, an unusual presentation of cases, mortality, etc. This would be achieved by:

i. Event-based surveillance through media scanning and verification by IDSP cell

ii. Event alert generation on IDSP-IHIP portal

iii. Indicator based surveillance through IDSP/IHIP reporting of ILI and SARI cases

The district level rapid response teams (RRT) will assess the unusual events, and, if required outbreak investigations will be undertaken.

Whole Genomic Surveillance

A. Continuation and expansion (need based) of laboratory network under INSACOG

B. Three-pronged genomic surveillance strategy to be followed:

a. A proportion of international arrivals (based on latest guidelines of MoHFW) to be tested and all positives to be sequenced

b. Identified sentinel sites of INSACOG network to send samples for WGS on a routine basis

c. Positive samples from large clusters / outbreaks in the community and unusual events to be sent for WGS. (Detailed guidelines available at: https://www.mohfw.gov.in/pdf/INSACOGGuidanceDocumentdated15July2021final.pdf)

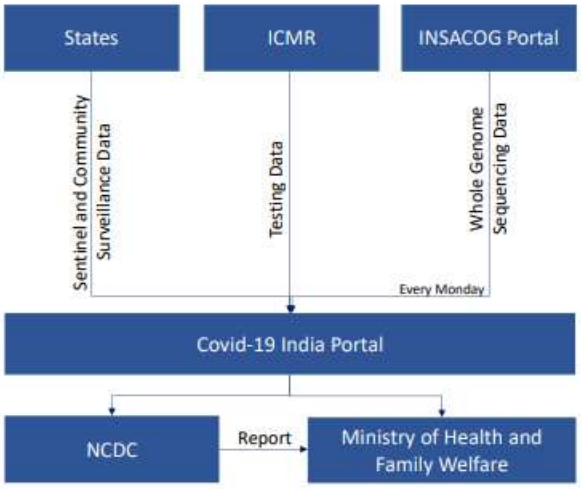
Sewage / Wastewater Surveillance: Several studies have demonstrated that increases in SARS-CoV-2 RNA can be detected in environmental samples several days before detection of Covid-19 through clinical surveillance. The Revised Surveillance Strategy for Covid-19 envisages integrating multiple systems presently existing for a pan-India sewage/wastewater surveillance with following objectives:

i. Provide early warning on the impending local surge of Covid-19
ii. Provide an estimate of the virus load in the local circulation
iii. Provide virus isolates for their genomic characterization to detect circulating mutants/variants

To have a standard methodology and avoid duplications, the activities proposed in the project will be carried out as an integrated network. As of now, this component is on a pilot basis. The network of sites for sewage/waste water samples would be finalized by INSACOG & the data from the sewage surveillance network shall be assessed for its effectiveness in guiding the public health response. The system can also be used for antimicrobial resistance monitoring activities in the future.

Sero-surveillance Sero-surveillance is a useful tool to assess exposure to the virus (and /or to vaccination). A decision for any future sero-survey may be taken based on added value that this activity shall provide in the future prevailing situation. The guidelines for the sero-surveillance activity shall be decided by the National Task Force (NTF) constituted for this purpose.

Reporting requirements are to be as per the revised surveillance strategy of MoHFW.



Flowchart of Reporting

Disease modelling techniques: Modelling the epidemiology of infectious diseases for decision analysis is critical. Disease modelling techniques for prediction of upsurges using real time spatial data, which is being collected through IHIP, may be of importance as these models may provide insights as to how the rate of vaccination coverage, social distancing, herd immunity etc. and trajectory of cases interplay.

CONCLUSION:

Covid-19 is poised to be endemic in most countries including India. Based on constantly evolving scenario and changing needs, suitable public health strategies based on science and emerging evidences' need to be evolved and implemented. The earlier strategies that have shown promise need to be incorporated into the day to day functioning of health systems. The existing strategies to deal with the pandemic need to be supplemented with newer ones as they can provide valuable insights and trends to monitor and respond to Covid-19 and other diseases of public health importance.

Annexure I- IGSL list

S.No.	Institute	Director	Director e-mail	PI name, email and Mobile no.	Co-PI Name, email and Mobile No.	Nominee Manager/ Contact Person
1	National Institute of Biomedica l Genomics (NIBMG), Kalyani,West Bengal	Dr Arindam Das	sdas@nibmg.ac.in	Dr. Arindam Maitra,am1@nibmg.ac.in; 9903380808;9051780080	1) Dr.Sreedhar Chinnaswamy sreedharc08@gmail.com sc2@nibmg.ac.in 9035574801 2) Dr. Nidhan Kumar Biswas nkb1@nibmg.ac.in 9903015248,8240597515	Dr. Shreelekh a Dutta, manager.insacog@nibmg.ac.in, 7506362190
2	Institute of Life Science (ILS), Bhubaneshwar	Dr. Ajay Parida	director@ils.res.in	Dr.Ajay Parida director@ils.res.in 9444024019	1) Dr.Sunil K Raghav raghuvanshi2010@yahoo.co.in sunilraghav@ils.res.in 9937468600	Dr.Punit Prasad, punitprasad@gmail.com, 8420917090
3	Institute of Stem Cell Biology and Regenerative Medicine,(InSTEM)/NCBS	1) Apurva Sarin/InStemsarina@instem.res.insarinain@stem.res.in080619482002) Satyajit Mayor/NCBSmayor@ncbs.res.in 09980088033	sarina@instem.res.in;	1) Prof. Uma Ramakrishnanuramakri@ncbs.re.in 2)Dr.Dasaradhi Palakodetidasaradhip@instem.res.in 9741204999	1)Dr. Aswin Sai Narain Seshasayeeaswinsainarain@gmail.com aswin@ncbs.res.in	
4	Centre for DNA Fingerprinting and Diagnostics (CDFD)	Dr. K Thangaraj	director@cdfd.org.in	Dr. K Thangaraj, director@cdfd.org.in 9908213822	1) Dr. Murali Dharan Bashyambashyam@cdfd.org.inbashyam69@gmail.com 94907458180402474938 3 2) Dr. Ashwin Dalal adalal@cdfd.org.inashwindal@gmail.com 9392460242040-27216147	Dr.Arun Kumar arunkumark@cdfd.org.in 9840773167
5	National Centre for Cell Science, (NCCS),Pune	Dr.Arvind Sahu (9422320062)	director@nccs.res.in, arvindsahu@nccs.res.in	Dr.Dhiraj Dhotre, dhiraj.dhotre@nccs.res.in, 9890335699	1) Dr.Vasideva Sheshadri; seshadriv@nccs.res.in	
6	IGIB		director@igibres.in	Dr.Sridhar Sivasubbu, s.sivasubbu@igib.res.in 9871780662	1) Dr.Vinod Scaria vinods@igib.in 9650466002	Dr.Sridhar Sivasubbu, s.sivasubb u@igib.res.in 9871780662
7	CCMB	Dr.Vinay K. Nandicoori	director@ccmb.res.in	Dr.Karthik Bharadwaj Tallapaka karthiktallapaka@gmail.com karthikt@ccmb.res.in 09985048590	1) Dr.Divya Tej Sowpatitej. sowpati@gmail.com tej@ccmb.res.in 09849779151, 04027192960	Dr Lamuk Zaveri, lamuk@ccmb.res.in, 8095100117
8	National Institute of Mental Health and Neuro Sciences Hospital (NIMHANS), Bengaluru	Dr.Pratima Murthy	dirstaff@nimhans.ac.in	Dr.Anita Sudhir Desai,Professor, anitasdesai@gmail.com 9945075925	1) Dr.Manjunatha M, Vmanjuvswamy@gmail.com 9632448208 2) Dr. Reeta S Manidrreeta@gmail.com 08026995495 3) Dr. Gautam Arunachal Udupi udupi@nimhans.ac.in 9597023525	Sony Sharma, sonysharma34191@gmail.com, 8107232762
9	ICMR-National Institute of Virology, Pune	Dr Priya Abraham	priya.abraham@icmr.gov.in	Prof Priya Abraham priya.abraham@icmr.gov.in 08940843532	Dr.Varsha Potdar-potdarvarsha9@gmail.com, Dr.Sarah Cherian-sarahcherian100@gmail.com	Dr Varsha-potdarvarsha9@gmail.com
10	National Centre for Disease Control (NCDC)	Dr Sujeet Singh	dirnicd@nic.in	Dr Sujeet Singh, dirnicd@nic.in, 8130255553	1) Dr.Himanshu Chauhan himanshu.chauhan@nic.in 9650561940 2) Dr.Partha Rakshitpartho_rakshit@yahoo.com 9811088262	Dr.Radha Krishnan, vsrk.bio@gmail.com, 9999740359
11	North East Institute of Science and Technology (NEIST), Jorhat, Assam	Dr G.Narahari Sastry	director@neist.res.in; drrljt@csir.res.in	Dr.Jatin Kalita,Principal Scientist, E-mail: jatinkalita@neist.res.in, Mob.: 9435557824		Dr Romi Wahengbam, romiwahengbam@neist.res.in, 8876345789
12	National Chemical Laboratory (NCL), Pune, Maharashtra	Dr.Ashish Lele	ak.lele@ncl.res.in	Anu Raghunathan Sr.Pr.Scientist anu.raghunathan@ncl.res.in 9158983680	Dr.Dhanasekharan email:d.shanmugam@ncl.res.in 9420281768	Anu Raghunathan, Sr Pr.Scientist anu.raghunathan@ncl.res.in 9158983680
13	Central Drug Research Institute (CDRI),Lucknow, Uttar Pradesh	Prof.Tapas K. Kundu	director@cdri.res.in	Dr.Rajender Singh <rajender_singh@cdri.res.in>, 9044872221		Dr.Rajender Singh <rajender_singh@cdri.res.in>, 9044872221
14	National Botanical Research Institute (NBRI), Lucknow, Uttar Pradesh	Dr.S K Barik	director@nbri.res.in	Dr.Samir V.Sawant, Senior Principal Scientist, samirsawant@nbri.res.in, 9335913542		Smita Paul; smita723@gmail.com
15	Indian Institute of Chemical Biology (IICB), Kolkata, West Bengal	Dr.Arun Bandyopa dhyay	director@iicb.res.in	Dr.Saikat Chakrabarti <saikat@iicb.res.in>; 9674335050		Dr.Siddik Sarkar, siddik.sarkar@iicb.res.in, 9903936753
16	Institute of Microbial Technology (IMTECH), Chandigarh		director@imtech.res.in	Ashwani Kumar, Sr.Principal Scientist. Email- ashwanik@imtech.res.in Ph. 9216530070		Dr.Rajni Garg, rajnigarg@imtech.res.in, 9818454498
17	Institute of Bioresources and Sustainable Development (IBSD), Imphal, Manipur	Prof.Pulok Kumar Mukherjee	director.ibsd@nic.in	Dr. Nanaocha Sharma, Scientist <sharma.nanaocha@gmail.com> 8974622314		Dr. Nanaocha Sharma, Scientist <sharma.nanaocha@gmail.com>, 8974622314
18	Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram, Kerala	Prof. Chandrabhas Narayana	director@rgcb.res.in	Dr.Radhakrishnan R Nair Scientist Fradhakrishnan@rgcb.res.in +919400095951		Heera Pillai, heerapillair.sribs@rgcb.res.in 8281865811
19	National Institute for Research in Tuberculosis (NIRT), Chennai, Tamil Nadu	Dr. Padmapriy adarsini C	directornirt@nirt.res.in, 9498022949	Dr.B.Ramalinga m, Scientist E, ramalingam.b@nirt.res.in; mobile number 9677074680		Dr.B.Ramalinga m, Scientist E, ramalingam.b@nirt.res.in; mobile number 9677074680
20	Regional Medical Research Centre (RMRC), Bhubneswar, Odisha	Dr.Sanghamitra Pati	drsanghamitra12@gmail.com	Dr.Sanghamitra Pati, Scientist- G & Director sanghamitra.pati@icmr.gov.in; drsanghamitra12@gamil.com 9437093306		
21	Regional Medical Research Centre (RMRC), Dibrugarh, Assam	Dr. Kanwar Narain	knarain.rmrcne@gov.in	Dr B Borkakoty, MD Scientist-E Email:biswaborkakoty@gmail.com +919435131316		Dr B Borkakoty, MD Scientist-E Email:biswaborkakoty@gmail.com +919435131316
22	Jawaharlal Nehru Centre for Advanced Scientific Resarch (JNCASR), Bengaluru,Karnataka	Prof. G U Kulkarni (President)	kulkarni@jncasr.ac.in	Prof. Ranga Uday kumar udaykumar@jncasr.ac.in; 9480069960	Dr.Kushagra Bansal, bansalk@jncasr.ac.in, 8197935630	Dr.Kushagra Bansal, bansalk@jncasr.ac.in, 8197935630
23	All India Institute of Medical Sciencse- New Delhi	Prof. Randeep Guleria	director@aiims.ac.in; director.aiims@gmail.com	Prof. S.Sinha <sub_sinh a@hotmail.com>; Prof. Madhulika Kabra-madhulikakabra@hotmail.com; 9891543958		Dr Lata Rani, lata2111@gmail.com, 9910264096
24	Centre for Brain Research- Indian Institute of Science (CBR-IISc), Bangalore,Karnataka	Prof. Vijaylakshmi Raveendranath	viji@iisc.ac.in;	Prof. Vijaylakshmi Raveendranath, viji@iisc.ac.in, 9591470005		Dr.Khader Valli Rupanagudi, khader@iisc.ac.in, 9986791223
25	Byramjee Jeejeebho y Governme nt Medical College (BJGMC), Pune, Maharasht ra	Dr. Murlidhar Tambe (Dean)	deanbjmcpune@gmail.com	Dr Rajesh Karyakarte, karyakarte@hotmail.com; 9922402502; 8999903678		Dr Rashmita Das, das.rashmita15@gmail.com, 8327761476
26	Gujarat Biotechnol ogy Research Centre (GBRC), Gandhina gar, Gujarat	Prof. C.G. Joshi	dir-gbrc@gujarat.gov.in;	Dr. Madhvi Joshi, jd1-gbrc@gujarat.gov.in; 9978441233	Dr Ramesh Pandit, 9727340079	Dr Ramesh Pandit, 9727340079
27	Institute of Liver and Biliary Sciences (ILBS), New Delhi	Dr. Shiv Kumar Sarin	shivsarin@gmail.com;	Dr. S. K.Sarin, shivsarin@gmail.com; 9873173140	Dr.Ekta Gupta, ektagaurisha@gmail.com, 9899975974	Dr.Ekta Gupta, ektagaurisha@gmail.com, 9899975974
28	Indian Institute of Science Education and Research, Pune	Prof. Jayant B. Udgaonkar	jayant@iiserpune.ac.in	Dr.Krishanpal Karmodiya; krish@iiserpune.ac.in, 9552611227		

29	Gandhi Medical College and Hospital (GMCH), Secunderabad, A.P.	Dr./Prof. G. Prakash Rao	gmc_hyd@nic.in	Dr. G. Prakash Rao, 040- 27505560/5566,, "Dr. K.Nagamani Vice Principal Administra tion Professor & HOD, Dept.of Microbiology, nagamaniy2k03@rediffmail.com, 09966533327"	Dr. K.Nagamani Vice Principal Administration Professor & HOD, Dept.of Microbiology, nagamaniy2k03@rediffmail.com, insacogvrdlgmc@gmail.com, 09966533327	Dr. K.Nagamani Vice Principal Administration Professor & HOD, Dept.of Microbiology, nagamaniy2k03@rediffmail.com, 099665 33327
30	Mahatma Gandhi Medical College(MGMC), Jaipur			Dr. Nitya Vyas, drnityavyas@hotmail.com, 9414066401		
31	Translational Health Science and Technology Institute (THSTI), Faridabad, Haryana	Prof. P. Garg	ed@thsti.res.in	Dr.Bhabatosh Dash, bhabatosh@thsti.res.in 0129-876471, 8587010523		
32	Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar	Prof. (Dr.) N.R. Biswas	director@igims.org	Dr.Namrata Kumari, Nodal Officer COVID- 19 testing, nrainrai@gmail.com, 9102348840		Dr. Abhay Kumar- 07056140387
33	Govt. Doon Medical College (GDMC) Dehradun	Dr. Shekhar Pal	vrdlgdmc@gmail.com, hodmicrogdmc@gmail.com	Dr. Shekhar Pal, vrdlgdmc@gmail.com, 9997679392; 7023834361		
34	Sri Aurobindo Medical College & PG Institute(S AIMS-PGI) Indore,Indore- Ujjain State Highway, Sanwer Road, Near MR 10 Crossing, INDORE (M.P.) 453111, INDIA	Dr. R. R. Wavare		Susmit Kosta, Senior Scientist, Head & Incharge, Molecular & Virology Research Diagosnotics Lab, (MVRDL), SAIMS, INDORE Clinical Research Coordinator, Mohak Bariatrics and Robotics Center, Indore, susmit.kosta@saimsonline.com, Phone:+91-731-423-1551, Mobile:+91-968-		
35	All India Institute of Medical Science (AIIMS)- Bhopal	Prof. Nitin M. Nagarkar	director@aiimsbhopal.edu.in, directoroffice@aiimsbhopal.edu.in	Dr. Debasis Biswas email: debasis.microbiology@aiimsbhopal.edu.in		
36	Government Medical College (GMC), Patiala			Dr. Rupinder Bakshi, Associate Prof, VRDLGMC Patiala, rupindergill1@yahoo.co.in: 9815320300		
37	Kempego wda Institute of Medical Sciences(KIMS),Bengaluru	Dr. M. K. Sudarshan		Dr. K.L. Ravikumar, Prof Emeritus-Microbiology, CRL, klravikumar@gmail.com, crlkimsb@gmail.com, Office#080-26712546/47, Mobile#09880229905	Dr. Geetha. N, Associate Prof., Central Res Lab, Geetha.ndri@gmail.com, 09448605734	Dr. Geetha. N, 09448605734
38	Kasturba Gandhi Hospital For Infectious Diseases, Mumbai			Dr. Jayanthi Shastri- 9820549156; jsshastri@gmail.com		Dr. Vidushi Chitalia- 9029307253; vd.chitalia26@gmail.com
39	SMS Medical College, Jaipur			Dr. (Ms.) Bharti Malhotra, MD, drbhartimalhotra@gmail.com, 09414042040		
40	Pasteur Institute, Shilling, Meghalaya			Dr. Eva. Shadap, eva.shadap@gmail.com, pasteurinstituteshg.bsl2@gmail.com, Mob#9436334500		
41	State Public Health Laboratory (SPHL),Chennai			Dr. S.Raju, ngslabsphl@gmail.com, dphpmlab@gmail.com 9444356151		
42	LNJP & MAMC, New Delhi			Dr.Seema Kapoor Director Professor, Division of Genetics,Genetic & Metabolic Lab, drseemakapoor@gmail.com Tel.No.: 01123239417 Mob: 9968604313		Sunil Kumar Polipli; sunilpkumar18@gmail.com, 9015860688
43	Maharshi Dayanand University (MDU), Rohtak, o			Prof. Anil Chhillar, Director Research, Maharshi Dayanand University Rohtak, anil.chhillar@mdurohtak.ac.in, 918168645344	Nar Singh Chauhan- nschauhan@mdu.rohtak.ac.in	Nar Singh Chauhan- nschauhan@mdu.rohtak.ac.in
44	MYSORE MEDICAL COLLEGE & RESEAR CH INSTITUT E, VRDL, Mysuru- 01, Karnataka			Dr. Amrutha Kumari B., amrutakb@yahoo.co.in, Mobile No: 9900571039		
45	MRU, Dept of Anatomy, Institute of Medical Sciences, Banaras Hindu University, BANARAS			Dr. Royana Singh, royanasingh@bhu.ac.in, Mob#09450545650,8004922000		Dr. Chetan Sahni BHU- MRU, Mobile no 8802528235
46	Shri Vinoba Bhave Civil Hospital & NAMO Medical Education & Research Institute, SILVASA			Dr. Narayan Kamath, nktallur@gmail.com, Mob#9967587087		
47	National Institute of Immunology, DELHI			Dr. Aneeshkumar AG aneesh@nii.ac.in Mob# 9971986746		
48	Siddhartha Medical College, VIJAYWADA			Dr. N. Subha Lakshmi nakkalasubahe@gmail.com Mob# 7842459716		
49	King George's Medical University, LUCKNOW			Prof. Amita Jain amita602002@yahoo.com Mob# 9415023928		
50	CSIR- National Environ mental Engineering Research Institute (CSIR- NEERI), Nagpur	Dr. Atul Narayan Vaidya, Tel: +91-712-2249999/66	vaidya@neeri.res.in, director@neeri.res.in	Dr. Krishna Khairnar, Scientist & Head, Environmental Virology Cell, k_khairnar@neeri.res.in, mob# 7588887569		
51	Defense Research & Develop ment Establish ment (DRDE), Gwalior	Dr. Manmohan Parida	mailto:paridamm@drde.drdo.in	Dr. Paban Kumar Dash, Scientist F & Head, Division of Virology, Mob#9425403326, Tel#0751- 2390290 Email#pabandash@drde.drdo.in		
52	State Level Virus Research & Diagnostic Laboratory, Bangalore Medical College & Research Institute (BMCRI), Bengaluru	Dr. Shantala G., Mob: 09448078081	Email: drshantalagb@gmail.com	(1) Dr. Ambica R. State Nodal Officer, VRDLs, Karnataka (9448688998; ambicar481@gmail.com) (2) Dr. Shantala G.B., Principal Investigator, State Level VRDL, BMCRI (9448078081; drshantalagb@gmail.com) (3) Dr. Sathyanarayan M.S., Co-Principal Investigator		
53	Dr. S. N. Medical College (SNMC), Jodhpur			Dr. Smita Kulshrestha, kulshresth asmita@yahoo.com, Mob.9414742662		
54	AIIMS, RAIPUR, CHATISGARH			Dr. Anudita Bhargava, Professor & Head, Department of Microbiology, Emai#anuditabhargava@gmail.com, dranudita@aiimsraipur.edu.in, Mob#8518881903	Dr.Sanjay Singh Nagi, Additional Profeesor, Department of Microbiology, Emai# negidr@yahoo.co.in, negidr@gmail.com, Mob: 8518881779	Dr. Pushpendra, Research Scietist: 9425724709
55	CARINGdx, Mahajan Imaging Pvt. Ltd.			Dr.Shelly Mahajan drshelly@caring- research.com 9873438909		
56	Strands life Sciences Pvt. Ltd., Bengaluru			Alpana Razdan, Alpana.razdan@genestrings.co.in, 9811368862		
57	Genotypic Technologies Pvt. Ltd			Dr. Manju Nath, manjunatha.bl@genotypic.co.in, 8040538232		