UNIFIED COVID-19 DATA PLATFORM

उत्तर प्रदेश सरकार का एकजुट प्रयास
''पहले स्वास्थ्य'' तभी विकास।

GOVERNMENT OF UTTAR PRADESH

A Joint response by

Department of Health & Family Welfare
Department of Medical Education & Training

UNIFIED COVID-19 DATA PLATFORM

Foreword

The COVID-19 pandemic, unexpectedly placed our nation, like the rest of the world, in an unprecedented challenge. Uttar Pradesh effectively responded to the healthcare needs in the backdrop of continuously evolving understanding of the disease itself.

Uttar Pradesh, being the largest and most populous state in the country, had a herculean task at hand including huge influx of migrants, to quickly adopt protocols to identify, track, test and treat its citizens. In addition, the state had to rapidly cater to the scale up requirements, establishing required infrastructure for testing and post impact treatment, as required.

We are grateful for the leadership of the Hon'ble Chief Minister under whose guidance and support the state has been able to deliver a comprehensive response to the pandemic in an effective manner. Effective response required data based decision making and we were able to develop a forward looking, integrated, modular and intuitive COVID-19 Unified Data platform which became the single source of truth for the entire state of UP.

I would like to specially acknowledge the efforts of the Additional Chief Secretary, Department of Health and Family Welfare as well as the Department of Medical Education & Training and their teams, who have jointly worked towards rolling out a coordinated response to the COVID-19 pandemic.

We are hopeful that with the confidence gained by successfully rolling out this system which has been leveraged across the public and private sector, we will be able to carry forward these learnings to drive the agenda of the National Digital Health Mission across the entire state and are well poised to be a front runner on Digital Health in the country.

Shri Jai Pratap Singh
Minister,
Department of Medical Health & Family Welfare
Government of Uttar Pradesh

Foreword

The sudden unprecedented spread of the COVID-19 pandemic brought the entire world to a standstill leading to unprecedented steps like lockdowns. The need to leverage digital health systems that are workflow, life cycle and systems based were understood by Uttar Pradesh in the early part of the pandemic itself. ·

The development and implementation efforts of the UP COVID-19 Unified Data Platform, as the state's digital response to the pandemic, successfully demonstrates Uttar Pradesh's ability to envision, develop and adopt large-scale digital system, in an integrated way across departments, the public and private sector. The platform is an important contributor for effective management of the pandemic as it served as a single point of truth for all stake holders.

These efforts were undertaken under the guidance of the Honorable Chief Minister, Health Minister and Medical Education Minister, with technical support extended by the Bill and Melinda Gates Foundation and the UP TSU. The successful adoption of the platform has also been a clear demonstration of how partnerships and collaborative efforts can help us build comprehensive digital systems.

This holistic response gives impetus to the state's ongoing efforts to take steps towards developing longitudinal health records for its citizens. The state's response to COVID- 19 has also provided the required confidence across all key stakeholders and has earned the trust of people at large.

Amit Mohan Prasad
Additional Chief Secretary,
Department of Medical Health & Family Welfare
Government of Uttar Pradesh

Message

The COVID-19 pandemic has impacted all our lives. The size and scale of Uttar Pradesh, required us to ensure we plan not just for the state ‘s immediate response but think about a holistic approach to keep our citizens safe and healthy.

Given the nature of the disease, it was of paramount importance for us to be pro-active around identification of different approaches and mechanisms to engage with citizens, deliver the right information, undertake early identification and testing efforts and most importantly equip our state and on-ground teams with the right kind of training and capacity building, in order to effectively deliver health services and quickly adapt to new processes and platforms.

The state has effectively managed to develop, implement, and drive state-wide adoption, of the comprehensive COVID-19 data platform, which has been able to bring together all (public and private) stakeholders engaged in the state’s COVID-19 health response, to track, monitor, and provide information to facilitate strategic planning and optimal utilization of resources across field teams, labs, facilities and surveillance teams. Leveraging a digital platform as the single source of truth across the entire states, has helped streamline and bring complete transparency and accountability to the state ‘s response to the pandemic.

With the successful rollout of the COVID-19 platform, the state is also making efforts in alignment with the recommendations of the NDHB and the National Digital Health Mission to move towards digitizing beneficiary level health data at source across all our health programs.

Aparna Upadhyay
Mission Director,
National Health Mission
Uttar Pradesh

Message

The COVID-19 pandemic has pushed the thinking around leveraging 'Digital' as an enabler to drive better health services, worldwide and more so in the Indian context.

We are extremely grateful for the guidance of the Honourable Chief Minister's office, to leverage a comprehensive, end-to-end platform thinking approach while developing the Unified COVID-19 platform as a comprehensive state level response to the pandemic.

Drawing from the initial learnings of the COVID-19 digital response led by a few states in the country, the Departments of Health & Family Welfare and Medical Education & Training in Uttar Pradesh, were able to jointly and pro-actively work towards a holistic, medium to longer term design and solution, keeping in mind the size of the state and the expected case volumes and the associated 3T strategy - tracking, testing and treating.

We are continuing to work towards taking forward the success of this digital response, and applying it across health programs to drive an interoperable platform to digitize citizen level healthcare records.

The confidence based on the success of this digital platform, has also paved the way for the state of Uttar Pradesh to initiate mobilization of efforts, working towards the establishment of the building blocks identified by the National Digital Health Mission.

Dr. (Major) Devendra Singh Negi
DG, Medical Health,
Department of Medical Health & Family Welfare
Government of Uttar Pradesh

Message

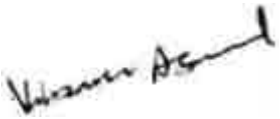
The scale and speed with which COVID-19 impacted, called for united efforts on all fronts across the state of Uttar Pradesh. For the State Surveillance team to be able to transparently drive tracking, testing and treatment efforts, there was a need to bring all stakeholders involved onto a common platform and use of digital technology was indispensable.

Our digital response involved an early identification of the right technological foundation to drive the on-ground surveillance efforts and design a comprehensive and continuously evolving platform, across the continuum of care. Thus, the Unified COVID-19 platform has been developed as an intuitive, modular and integrated work flow based system, which enabled case management across the complete life cycle of an individual right from case identification and registration, surveillance, testing, treatment at facility (including referrals, home isolation, self-quarantine).

A key driver around adoption has been the user centric design of the platform, keeping in mind the actual workflows and a data minimalistic approach, with the ability to easily access remote training and handholding support. Also, the quick response by State team to queries from field, ensured adoption of the platform. The platform continues to be the single source of truth, to report on COVID-19 across the 75 districts in the state as well as to share with the Center, with innovative actionable dashboards made accessible to state and district officials. Several citizen facing interfaces have also been developed to ease access to COVID-19 interventions.

I thank UPTSU for developing this portal in the early part of the pandemic itself, helping the State roll it out by rigorous training, handholding, and prompt response to field teams, as well also integrate with the national portals.

We hope to take the learnings of these efforts across our digital strategy for overall disease surveillance in the state.



Dr. Vikasendu Aggarwal
State Surveillance Officer,
Department of Medical Health & Family Welfare
Government of Uttar Pradesh

Preface

World over collaborative efforts are being made to respond to the unprecedented spread of the COVID-19 pandemic. Given the size and scale of the State of Uttar Pradesh, the challenge to streamline the response to the pandemic upfront were paramount.

Under the guidance and leadership of the Additional Chief Secretary, Department of Health & Family Welfare, the Government of Uttar Pradesh, has been able to leverage technology effectively to respond to the pandemic and provide a seamless system to facilitate real time management.

To ensure an effective and comprehensive response, to control the spread of COVID-19 in the state, the Government of Uttar Pradesh adopted the well-founded 'Track, Test and Treat,' or the 3T strategy. The joint and coordinated response by the Departments of Health & Family Welfare and the Department of Medical Education & Training as well as the synergies developed across their teams, resulted in the successful development, implementation, and the state-wide adoption, of this comprehensive Unified COVID-19 Data Platform developed by Uttar Pradesh - Technical Support Unit (UPTSU).

The Uttar Pradesh - Technical Support Unit, supported the Government's tireless efforts by playing the role of a strategic and technical partner as well as an implementation support agency to ensure a timely implementation of the platform.

The platform was jointly developed with a singular focus to ensure that the State has a single point of truth as far as COVID management was concerned. It ensured that work of the field staff is digitized and there are inter-linkages across the surveillance teams, laboratories and facilities to enable seamless exchange of information with the central platforms. This coordinated approach, resulted in the state being able to bring together all (public and private) stakeholders engaged in the state's COVID-19 health response. The platform continues to successfully adapt to the constantly evolving and changing scope and requirements, given the inherent challenges faced across both the waves.

The State Government's quick response to deliver on its medium to long term vision by developing an end-to-end case management digital system, as well as, drive state-wide implementation and adoption of technology has clearly demonstrated its ability to move away from siloed thinking. It has given the State the confidence to drive-in large-scale digital initiatives, with ease and finesse.

Dr. Vasanthakumar N.
Executive Director,
Uttar Pradesh Technical Support Unit

Acknowledgement

Few days into the first COVID-19 case being reported in India, the mammoth task ahead of the Government of Uttar Pradesh, was to plan and implement a comprehensive state-wide COVID-19 response. The goal was to ensure that every citizen of the State is tracked, tested and treated across the continuum of care – bringing together all COVID health facilities, laboratories, state, district and field staff onto a common platform. The successful design, development and timely rollout of the Unified COVID-19 platform was only possible due to the meaningful partnerships and invaluable contribution of a number of key stakeholders.

First and foremost, we express our sincere gratitude towards the Hon'ble Chief Minister and his office, for having envisioned a comprehensive and effective response mechanism to tackle the pandemic. We are extremely grateful for the joint leadership of the Additional Chief Secretaries of Department of Health and Family Welfare as well as Department of Medical Education and Training, for being the guiding force behind the adoption of a new user centric common platform, as the single source of truth across the 75 districts of UP.

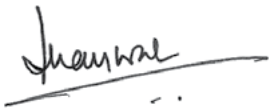
Our special thanks to the State & District officials and District Magistrates, for very quickly adapting to a new system and driving data backed decision making at the last mile.

The timely rollout of the platform could not have been possible without the relentless efforts of the field teams who went above and beyond their call of duty to get remotely trained on the platform and tirelessly supported efforts at the last mile.

Several partners have enabled us in our humble quest to support GoUP with the holistic COVID-19 digital response in the state, and we are grateful for their continued assistance.

Last but not the least, a personal note of thanks to the team at UP TSU, for their sincere and humungous efforts in supporting the Government, in what has been a daunting time for every citizen of the country.

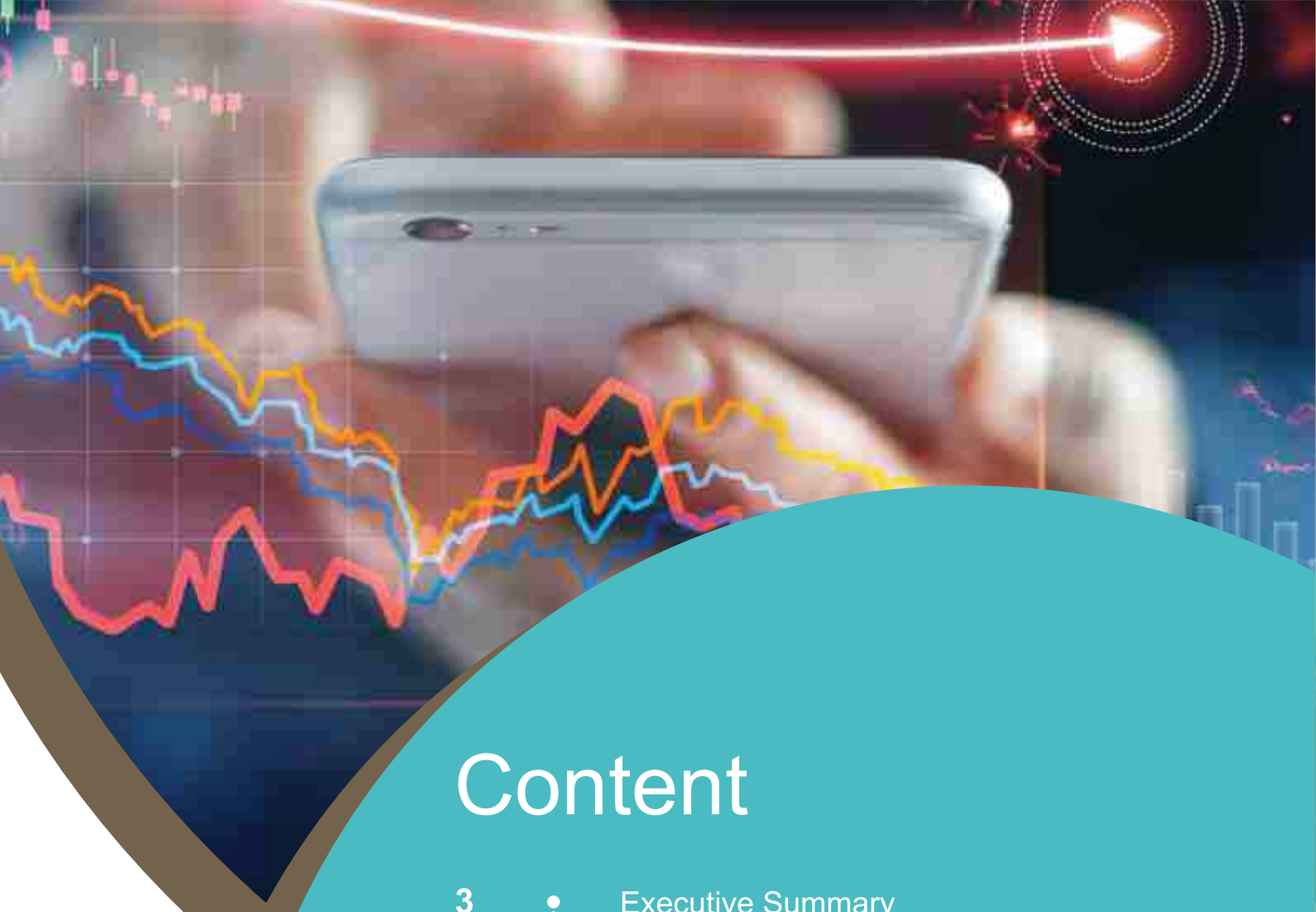
The Unified COVID-19 Data Platform has demonstrated the strength of a collaborative ecosystem of partners coming together and established the role digital can play as an enabler. This gives the State assurance towards adopting digital health systems in future endeavors.



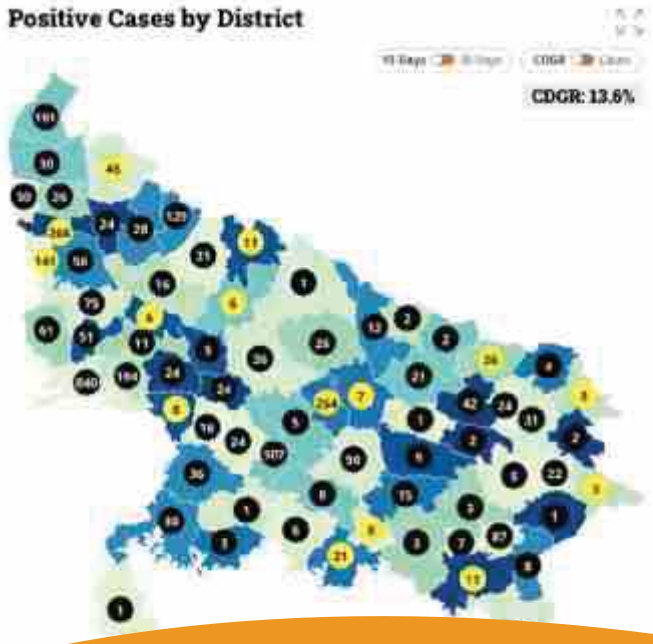
Sameer Kanwar
Director Digital Health,
Uttar Pradesh Technical Support Unit

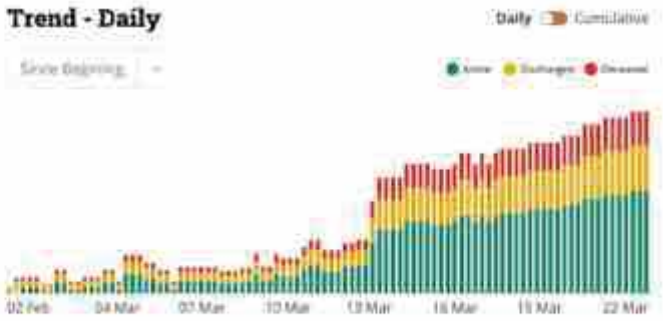
Abbreviations

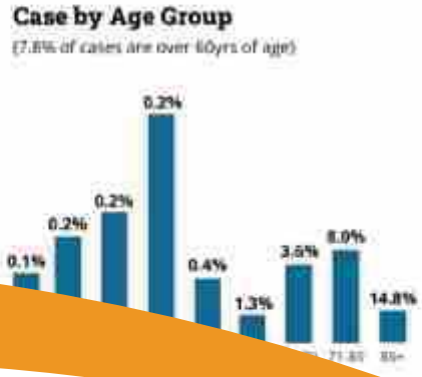
ANC	Antenatal Care
ANMs	Auxiliary Nurse Midwives
API	Application Programming Interface
BMGF	Bill & Melinda Gates Foundation
CMO	Chief Medical Officer
D2C	Direct to Consumer
DDM	District Data Manager
DEOs	Data Entry Operators
DFPS	District Family Planning Specialist
DM	District Magistrate
DMA	Disaster Management Authority
Dept. of Health	Department of Health and Family Welfare
Dept. of ME	Department of Medical Education and Training
DSO	District Surveillance Officer
EHR	Electronic Health Record
GoI	Government of India
GOs	Government Orders
GoUP	Government of Uttar Pradesh
ICMR	Indian Council of Medical Research
IDSP	Integrated Disease Surveillance Programme
IEC	Information Education and Communication
BCC	Behaviour Change Communication
MeitY	Ministry of Electronics and Information Technology
MHA	Ministry of Home Affairs
MoF	Ministry of Finance
MoHFW	Ministry of Health and Family Welfare
NDHB	National Digital Health Blueprint
NDMA	National Disaster Management Authority
PRI	Primary Rate Interface
RATI	Rapid Antibody Test of India
RMNCH+A	Reproductive, Maternal, Newborn, Child Health plus Adolescents
RRT	Rapid Response Team
SDMA	State Disaster Management Authority
SSO	State Statistical Officer
TPAs	Third Party Administrators
UI	User Interface
UP	Uttar Pradesh
UP TSU	Uttar Pradesh Technical Support Unit
WHO	World Health Organization



Content







Executive Summary

World-over, digital interventions and innovations are being used to solve both - simple and complex problems across sectors. Within healthcare, technology is being leveraged across the continuum of care – for planning a doctor's visit, surveillance, telemedicine, registering a patient's longitudinal records, providing diagnosis, dispensing medicines, treatment-related reminders, and even to support Mediclaim and TPAs.

With the advent of the Corona Virus Disease (COVID-19), a novel virus that has spread across 220 Countries and Territories around the world have reported a total of 177 Mn confirmed cases, with a death toll of over 3.8 Mn people, Governments, across the world, have made significant efforts to implement various strategies to curb the pandemic while managing the humanitarian crises at hand.

The first case in India was reported on 30 January 2020 in Kerala, with two additional cases reported in the country in February 2020 and subsequent cases sparsely reported across states beginning in early March 2020. Around the time, the World Health Organization made an announcement terming COVID-19 a pandemic, the Government of India (GoI) too started working towards identifying different measures to prevent the spread of this novel virus while building healthcare infrastructural and manpower capacity.

The Uttar Pradesh (UP)-State Leadership had to promptly take significant steps to address this unprecedented and constantly evolving health crises, while unequivocally extending unified support in these extraordinary circumstances in leveraging digital tools across the continuum of care.

The state developed, implemented, and **drove state-wide adoption**, of this **comprehensive** COVID-19 unified data platform, which has been able to bring together **all (public and private) stakeholders** engaged in the state's COVID-19 health response. The platform has enabled the state to track, monitor, and provide information to facilitate strategic planning and optimal utilization of resources. The **agility and layered architectural framework** with which this **integrated** platform has been developed **facilitates inter-linkage with modules developed**

for each key stakeholder i.e. surveillance module for *state/ district surveillance teams* and *field tracking teams (via Case Tracking App)*, facility module for 1000+ *facilities,* and lab module for 350+ *laboratories* covering 98% COVID specific private and public facilities and labs in UP, to update information, review case wise progress and take prompt action, as required. The **Decision-Making Dashboard** provides *Policy and decision makers,* with an integrated dashboard view for swift decision making as well as **advanced analytics on contact tracing data** for identifying spread patterns, super-spreaders, and clusters of high infection.

The Uttar Pradesh Technical Support Unit (UP TSU), effectively complemented the Government's efforts, as a technical support partner by extending strategic, technical as well as implementation support to ensure that a speedy and timely response could be rolled out.

The state decided proactively, to leverage technology effectively and then went on to execute this goal by developing a broad vison, engaging with partners and then delivering on it. The successful rollout of this platform across the entire state, as a single source of truth, within such a short time period, demonstrates that UP's ability to be a front runner on adoption of Digital Health initiatives. This has increased the Government's confidence around the adoption of digital initiatives to improve health service delivery at the last mile.

Some of the key learnings being incorporated into the digital health strategy going forward, includes ensuring data collection (at source) only at a line list level across all health programs in contrast with the current approach to collect aggregate data purely from a monitoring lens. Additionally, efforts are also being made, in alignment with the recommendations of the NDHB to move towards developing **Electronic Health Records and Personal Health Records**(beneficiary life-cycle focused) in the state of UP. The discussions so far between GoUP, UP TSU (as a part of the support being extended to GoUP) and NHA have been promising and will help accelerate implementation of UP's digital health strategy going forward, **aligned to the vision of the NDHM, and its implementation guidance going forward to states.**

Introduction

The Government of India (GoI), in order to prepare and drive a unified emergency response to curb the virus, holistically and comprehensively, given the inherent challenges associated with COVID-19 and its unprecedented global spread, assigned key roles to each of the Ministries and the associated agencies. The Ministry of Health and Family Welfare (MoHFW), Ministry of Home Affairs (MHA), National Disaster Management Authority (NDMA), Ministry of Electronics and Information Technology (MeitY), Indian Council of Medical Research (ICMR), Ministry of Finance (MoF), NITI Aayog among many others have been supporting the development efforts and/or issuing guidelines and directives, which continue to get updated based on the changes in the situation on the ground. Also, few digital interventions have been implemented at the National level as a part of the COVID-19 response, for example – Aarogya Setu, S3 Portal, ICMR Portal, Rapid Antibody Test of India (RATI), MyGoV Direct to Consumer engagement channels (Facebook, Whatsapp, Telegram etc.). A key challenge around effectively and actionably leveraging these platforms has been the non-availability of this data in a seamless manner at the field level.

With health being a state subject, many states had already initiated development/ implementation of digital tools, customized to their state-specific needs. Limited clarity around sharing data with states as well as the urgency to respond promptly has resulted in states continuing to rely on their local applications to drive timely and prompt action. Uttar Pradesh (UP) is one such state which developed mobile applications and information systems, moving towards developing an end-to-end integrated surveillance platform solution to respond to COVID-19.

Over 235 million people reside in the state of UP, with over 5 million migrant workers making their way into the state by end of May 2020. The COVID-19 pandemic was to disproportionately affect these individuals, putting them at risk of increased morbidity and mortality, underscoring the urgent need to improve provisioning of health care and maintain global health commitment. While the initial focus was on foreign travelers and ensuring they are screened, tested and quarantined to limit the spread – that was followed by the GoI imposed phases of lockdown, wherein focused efforts were made to create awareness, rigorously screen, isolate, test and treat. While numerous

facilities were designated as COVID only facilities, it was also extremely crucial in the context of UP for the two Departments i.e. Department of Health and Family Welfare (Dept. of Health) and Department of Medical Education and Training (Dept. of ME) to jointly own the various response initiatives being undertaken in the state. Unlike many other states, such as Bihar, where the State Disaster Management Authority has led the state's COVID response and was playing the role of the key decision-maker, in UP these two departments were driving the health response for the state which resulted in ease of coordination and a faster clinical response.

The Team led by the Additional Chief Secretary, Health spent considerable time discussing aspects and developing protocols around physical quarantine, home quarantine, process for handling of positive cases, customizing testing guidelines in the context of UP and more recently, home isolation and quarantine and more recently the vaccination status for new registrations getting captured. There are more than 22 Govt. Labs, 5 (NABL accredited) private labs on-boarded as per the guidelines) and 410 COVID facilities (L1, L2, L3, DH-I, L1-CCC, L2-Pvt). Of these, all laboratories and 42 L2 facilities are under the preview of Dept. of ME and all other facilities are under the preview of Dept. of Health.[1]

Keeping in mind the size and scale of the state, the rapid spread of the virus and the inter-departmental coordination requirements, the State Government worked towards effectively leveraging digital as a backbone to their joint response to the pandemic. Thus, the UP COVID-19 Unified Data Platform was developed, as the single source of truth for each citizen, facilitating end-to-end case management across the continuum of care for COVID-19, to aid mitigation efforts in the state of UP. The platform stabilized by May 2020 and has been leveraged across both the waves for effective management of the pandemic.

The objective of the report is to document the technology-led, end-to-end solution in response to the pandemic, and highlight key challenges along with best practices and way forward, from March 2020 - May 2021. In the report, Wave 1 and 2 are referred to the time periods where there was a surge in cases i.e. Wave 1 is July 2020 - October 2020 and Wave 2 is April 2021 - May 2021.

1. These numbers increased across the two waves based on the spread of the virus.

Evolution of the Unified Data Platform for COVID-19

The Government of Uttar Pradesh (GoUP) has had to address many challenges, unique to the complexities of the State. UP has a population of over 235 million (78% rural) and the state comprises of 106,000 villages and 75 districts. The state has a disproportionate proportion of global and India specific burden of disease and deaths. Given these existing realities, the State Departments of UP, with support from the Chief Minister's office, had to overnight work towards developing a holistic health response to the COVID-19 pandemic. This included:

- **Identification and mitigation** of existing Health infrastructure gaps
- **Evolving a health emergency** unified response strategy
- **Coordination requirements** across different departments like Dept. of Health and Dept. of ME
- **Changing role of health care facilities and healthcare providers** in the face of a pandemic
- **Development of systems to monitor, track and respond** in near real time during the constantly changing situation

COVID-19 posed a number of unforeseen challenges. For instance, the initial low testing rate, made it extremely crucial for health professionals and front-line workforce to physically verify whether people were suffering from symptoms. Soon after, as people were found to be asymptomatic yet positive, screening became even more challenging. In these ambiguous circumstances, with the growing panic in the minds of the citizens, as well as, the spread of misinformation around the virus (resulting in stigma and discrimination), it was even more challenging yet extremely critical for the Government to drive effective communication by ensuring timely flow of accurate and relevant information.

The senior officials within the Government, aware of the large demographic size and scale, was sanguine that in order to tackle this pandemic, digital technology would need to be leveraged effectively. The pre-lockdown phase provided an initial planning window. With lockdown being imposed, infection control and social distancing norms being practiced – the big challenge at hand was to shortlist the user requirements for new digital tools and to develop them (mobile apps/ web portals) as a part of the state's COVID-19 response strategy, as also to ensure, that the Government was able to remotely train and drive behavior change for adoption of these digital tools.

In the initial stages of the COVID-19 relief efforts, the Chief Minister's office, had to coordinate between the various departments and agencies in order to ensure an integrated response. The two Departments i.e. Dept. of Health as well as Dept. of ME, coordinated efforts to setup dedicated COVID facilities in the initial 2-3 weeks to prepare the surge in positive cases by increasing capacity across facilities.

Convergence of efforts across the state

As the positive cases in the state began to increase, it became extremely important for the Government to slowly work with the local partner ecosystem present.

UP TSU was one of the key partners supporting the Government's response to COVID-19. For the Executive Director at the UP TSU, it was not only important to clearly read the signs of the size and scale of the problem at hand early on, but to also effectively align the efforts across various stakeholders. This includes, the senior officials across Departments, the IDSP teams, and even within the UP TSU Team to collectively respond to the crisis while navigating different points of view as well as the continually evolving situation.

With time being of absolute essence, and with GoUP juggling with different priorities, it became integral for the UP TSU (hereafter referred to as TSU) to extend support wherever possible. These support efforts began with a request to the TSU team on 16 March 2020, by the official leading the efforts at the State Call Center to digitize the Call Center software, in order to profile callers, ensure timely follow-up, digitize the softcopies of the travelers' details, and set up more phone lines and operators to prepare for the expected surge in cases.

> *The readiness and willingness to help, as well as the past work I had undertaken with the TSU, made me comfortable enough to pro-actively reach out to gear up our Call Center which became the Control Room for the state…It felt extremely nice that our call center could set an example for other states within a short period of time, during the early stages of the spread itself. Talking to callers at different stages whether foreign travelers, migrant workers, relatives of a passenger - being at the Call Center, helped us understand the pulse on the ground. Due to our close interactions with Digital Health Team at TSU were able to share real-time feedback and needs. They would make sure to not only incorporate the feedback into the system but also ensured that it was user friendly for our periphery staff.*
>
> **— Ms. Pooja Pandey (IAS), Director HR, Department of Health and Family Welfare, UP**

Delivering on immediate needs

Over the course of the next 2 weeks in March 2020, the TSU, based on the initial asks from select Department officials and the Chief Minister's office, supported the Government with the following digital initiatives:

- **Set up of a full-fledged Call Center – Control Room**, with a COVID-19 protocol-based software
- **Supported teleconsultation services**, wherein four doctors were placed from within the State Department
- **Developed and launched a dedicated official web page** for the Government for sharing all COVID-19 information and updates from GoUP
- **Developed a Self-Quarantine App: The app was meant for self-reporting** and was shared with travelers over SMS since Google at this point was not allowing mobile applications on COVID to be hosted over play store. Subsequent conversations with the Google leadership in India, with the help of the Gates Foundation and a letter from the MD NHM, finally helped bring the app up on Google Play store
- **Developed and launched a website for IEC and training materials** for doctors, nurses, ANMs, and sharing relevant web links via SMS
- **Developed a simple case Tracking platform** for the SSO and their RRT's to track each case

We could develop this portal and make it successful across the state, with district teams finding it useful, because of clarity of thought at the state level and clear exchange of ideas between State Surveillance Unit and UP TSU. I saved an immense amount of time by using the platform to send out relevant reports from 4-5 hours daily, I was only required to spend 30 minutes per day. Going forward, I believe doctors must be trained into handling such situations in policy making so that more people can come forward to support.

— Dr. Vikasendu Agrawal, State Surveillance Officer, IDSP, Department of Health and Family Welfare, UP

Gathering momentum for what lies ahead

By the 25 March 2020, working in close coordination with the Government, the TSU had developed a reasonably sound understanding of the Surveillance team's needs and the workflows involved in the entire case lifecycle. They were able to, collectively develop a comprehensive vision of the proposed platform that would be required to drive end-to-end case management of COVID-19 cases in UP. Thus, in addition to the Surveillance module being rolled out, it was clear that linkages would need to be established with the requisite labs across the public and private sector as well as the Facilities to ensure three key objectives:

- **Ensure timely screening** and prompt clinical assistance
- Drive absolute **transparency and accountability** across the value chain
- Ensure there is a **single source of truth** available across the entire state for case tracking

As the need for a unified and comprehensive response increased, the need to work within the current challenges and pull-in experienced technology partners (even with the challenges around remote coordination and the constantly evolving state context), became paramount.

Thus, began the most important task, to demonstrate and show the value of what could be the potential digitally enabling tool to respond effectively and efficiently to the pandemic. A compelling narrative with effective use of data and visuals was developed. The TSU leadership in parallel, had several discussions with the ACS, Health, CM's office, Secretariat, SSO, and other senior officials to help build a case for an end-to-end Unified data platform for the state of UP to respond to COVID-19. A two-pronged approach was used to socialize the proposed concept with GoUP:

- **Data backed evidence to demonstrate current gaps:** The TSU analyzed and shared inconsistencies across the data being collected with the current processes vs. data being collected through proposed and developed digital tools
- **Data backed decision making ability:** The TSU leadership leveraged dashboards to demonstrate the value of using visual representations to assist the state leadership with prioritization of efforts via the effective representation of hotspots, patterns, focus areas across the state, district and field teams while helping with better resource planning and case management

The positive user response from the last mile, post the implementation of Surveillance module, and subsequently the Facility and Lab Modules, as well as, the increasing number of cases across the state, made an even more compelling case for the State Leadership across both departments, who began to find immense value in developing and implementing a *self-correcting end-to-end digital platform* for COVID-19 response in UP.

To achieve this mandate, each partner organization has had a very specific role to play to drive coordinated and timely efforts to develop the platform. The TSU Digital Health Team's core strength has been stakeholder coordination and identification of functional requirements and business solutions. In addition, their work has involved understanding the evolving functional needs, translating these requirements into workflows, finalizing workflows and timelines, and then sharing them with the technology partner.

Figure 1: UP COVID-19 Unified Data Platform

INTUITIVE **MODULAR** **INTEGRATED**

Single source of truth
for the state

Workflow based
end to end unified platform

Case management
across complete case life-cycle

Live data from public and private sectors

One time case entry
with integrated flow throughout the case life-cycle

Advanced analytics on **contact tracing data** for identifying spread patterns, super-spreaders and clusters of high infection

Below is a roadmap of how the initial Surveillance Platform evolved adoption in such a short span of time:

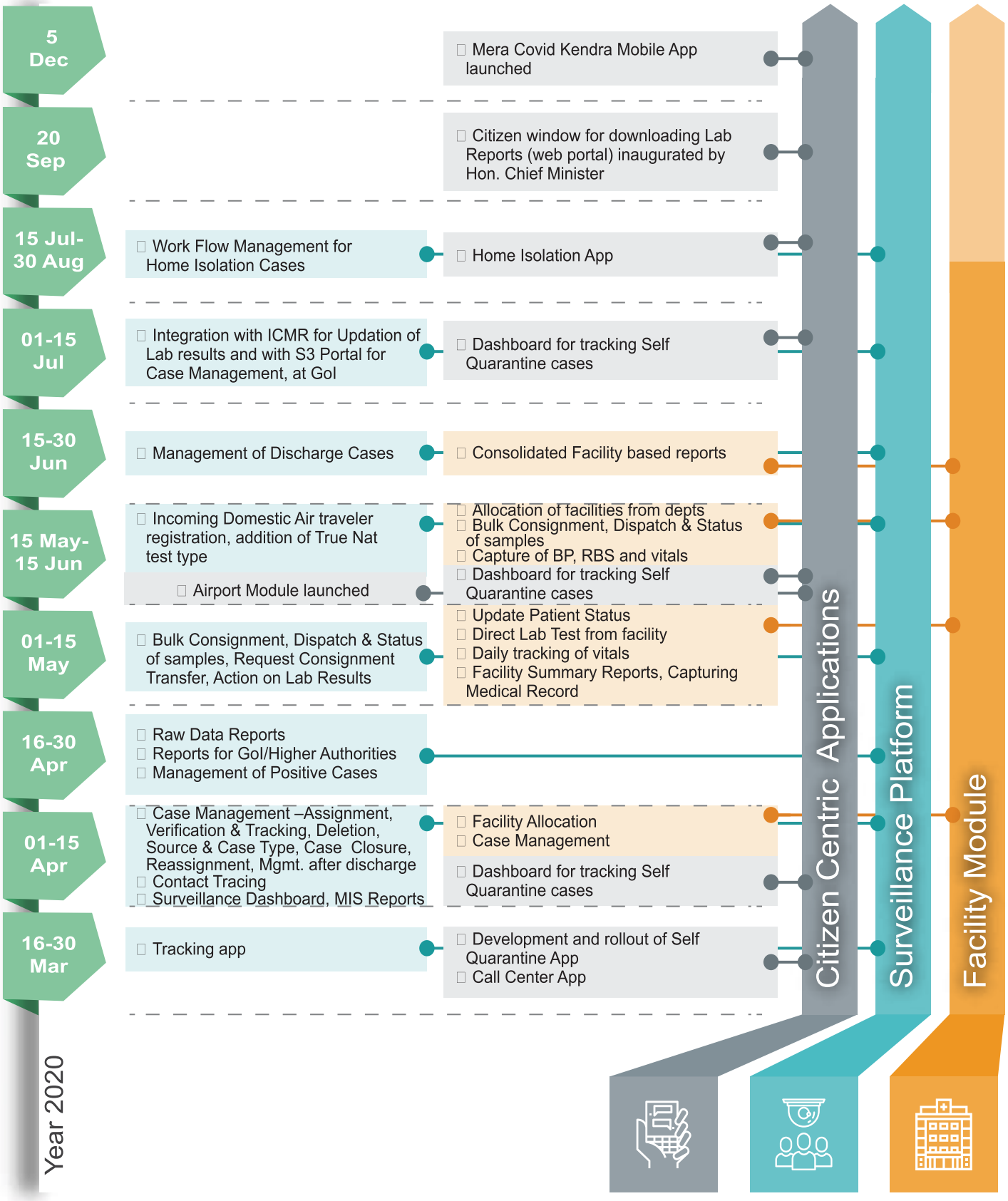
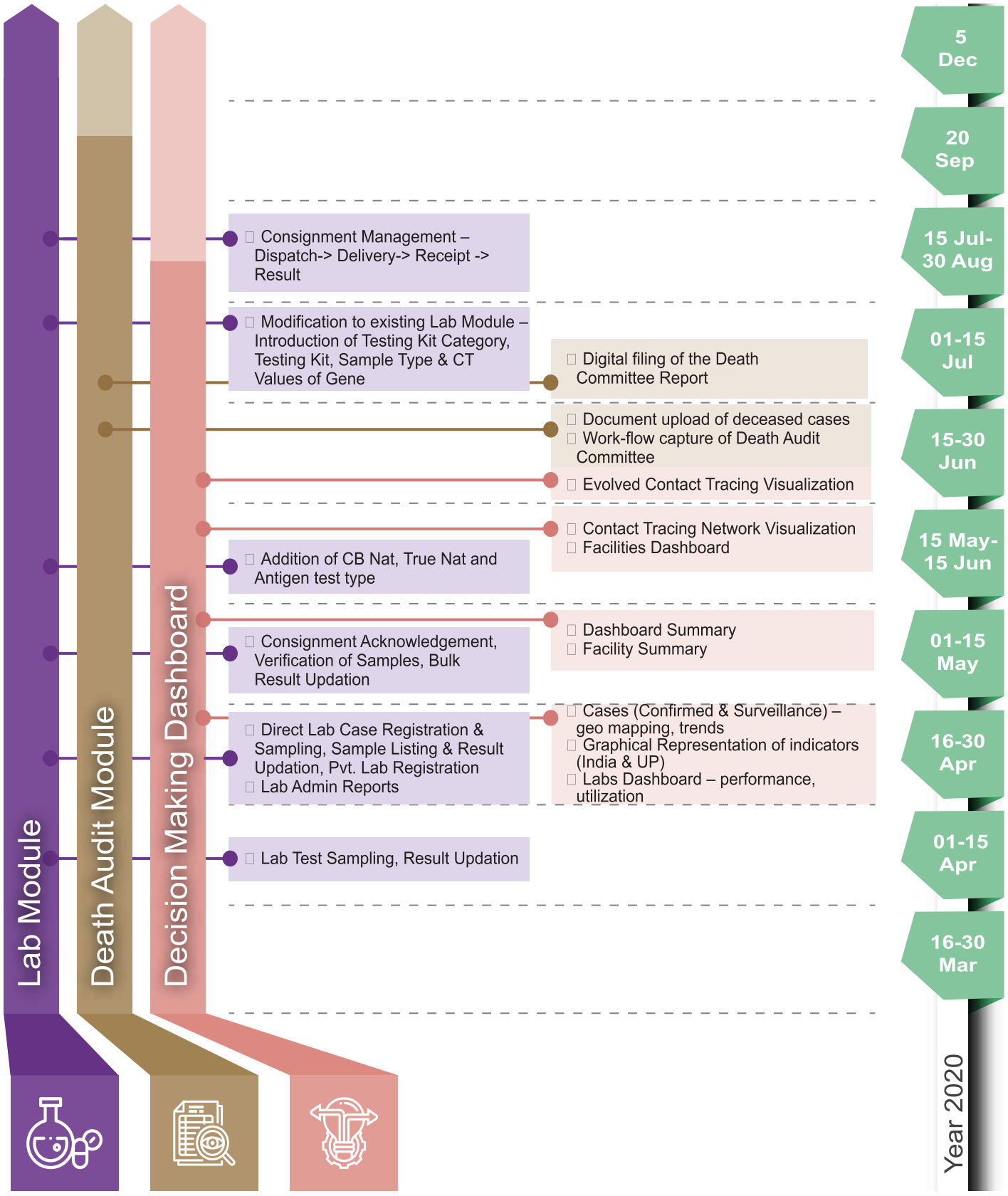


Figure 2: Evolution of the UP COVID-19 Unified Data Platform

into the end-to-end UP COVID-19 Unified Data Platform, with state-wide



Digital Initiatives as a response to COVID-19 in UP

To assist the Government to proactively curb the spread of the novel virus in the community and comprehensively manage and monitor the COVID-19 pandemic, the TSU extended technical and implementation support on several digital initiatives in the state. These initiatives have supported the administration in effective decision making at strategic, technical, and operational levels - based on surveillance, information management, resource management, to drive timely response planning in an emergency.

UP Unified COVID-19 Data Platform

In order to plan resources, track, monitor, and provide information to facilitate strategic planning and optimally utilize resources, a comprehensive, integrated platform for all stakeholders engaged in COVID-19 response, was developed. A multi-dimensional integrated response was developed to track and manage COVID-19 in the state which comprised of:

- **Designing** the COVID-19 treatment architecture
- **Enhancing** clinical competencies of health care professionals
- **Enabling** FLWs for community surveillance
- **Leveraging** data analytics & strategic guidance

Design Principles

The unified data platform evolved into an end-to-end solution in less than two months. The guiding principles that were kept in mind while strategizing, designing, and developing the platform include:

- Leverage the platform as a **Single source of truth** for the entire State – for T3 – **Track, Test and Treat**
- Drive effective **end-to-end Case management** across complete case life cycle
- Ensure **Modularity** across different user groups and services and the associated views, with UI and services not coupled to increase functionality at scale
- Develop an **intuitive** design based on the regular **workflow** of the user, to enable them with tool that helps save time given their daily workload
- Engage all **stakeholders digitally** – Officials, surveillance teams, facilities, Labs (public and private)

Figure 3: Key Design Principles

System Perspective - About the Platform

The unified data platform is a single source of truth across the entire state and facilitates end-to-end case management and real time view of the COVID-19 status across districts. It utilizes the following functional modules:

- **Data Inputs:** This platform enables data collected from the tracking platform; Call Center, surveillance teams, and self-quarantine app flow into the system, in near real-time
- **Components:** The Key Components of the platform include a Surveillance Module, Facility Module, and a Lab Module, built on a common backbone. In addition, with the protocols evolving over a period of time, death audit and Home Isolation Modules were added
- **Decision Making:** Information collected through all these different interfaces, entered by different users can be viewed to draw actionable insights via the Decision-Making dashboard, it is the center of gravity for all COVID-19 related planning and monitoring. Whether it is a summary of the cases overview, hotspots, contact tracing status, availability of trained HR or infrastructure, facility preparedness to handle COVID-19 cases – the Decision Making has been developed to equip all administrative and department officials to prioritize their efforts and enabled pro-active response planning

The **overall tracking and monitoring system** has the following key features (work-flow depicted in *Fig. 4):*

- **Single point of case registration** from State-District Helpline, GoI Database, State-specific data, Labs, Tracking Teams and contact tracing
- **Unique Case ID** assigned for case management across the system
- **Ability to drive bulk allocation** of cases to Tracking Teams
- **In-person verification** of newly registered cases, daily follow-up and contact tracing on the field
- **Ability to assign bulk cases for testing** through consignment-ID and bulk upload results at the lab - results updated real-time at Facility/District level
- **Flexibility provided to the district officer** to assign any facility
- **Post case allocation, one-time medical record updation by Nodal officer** at the facility. Daily updation of epidemiology data within the facility
- **Seamless inter-facility** referral facilitated
- **District officer assigned** with the responsibility of handling (e.g. case closure) **post-discharge management**
- **Outcome assigned to each case** at the end of cycle

Integrated Workflow – Step wise guide of the Digital Case Management process across the state

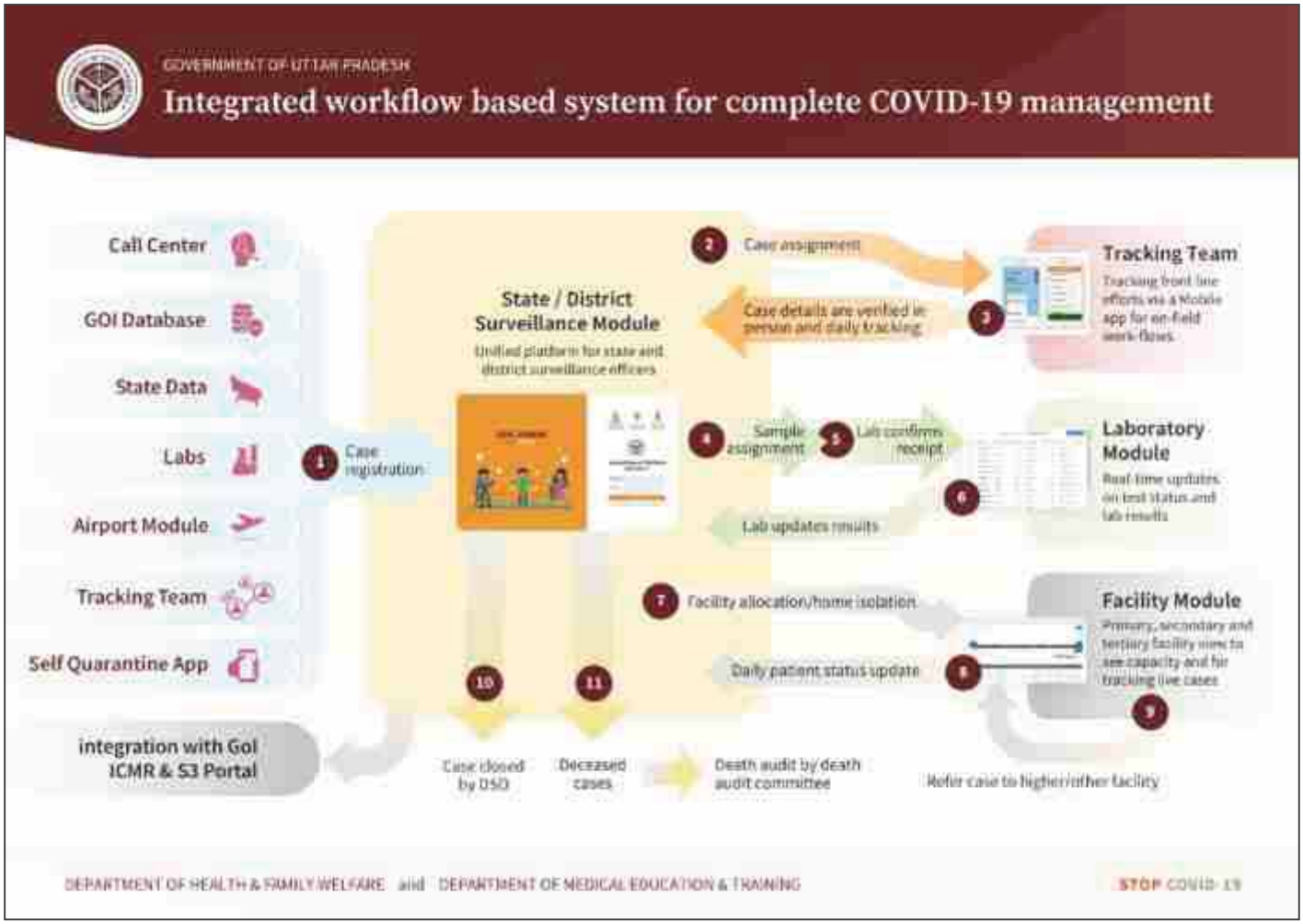


Figure 4: Workflow-based COVID-19 Data platform

From *a **Data Security, Privacy and Hosting*** perspective, the following principles were applied:

- **All privacy and data protection directives** issued by Government of India have been complied with
- **Platform has been hosted** on government approved **cloud** environment
- **Data is encrypted** in transit and at rest
- **Security groups and firewalls** are configured, with API authorizations put in place
- **Role based access to data** at various levels based on State policy. All Personally identifiable data is encrypted and only the assigned CASE ID is shared. The APIs exposed by the platform for integration do not carry personal identifiers

STEP 0

Reporting of Case data through multiple sources

An individual's data can be reported through multiple channels – these include data collected by the Call Center, GoI, State data, Labs data, Tracking teams as well as contact tracing. Data collected through each of these sources flows into the Surveillance platform as a single focal point and source of entry. Below is an overview of the digital initiative's setup at the COVID-19 Helpline Center as well as the Self Quarantine/ Home Isolation Application for citizens:

COVID-19 HELPLINE CALL CENTER - (1800-180-5145)

As a response to manage the COVID-19 queries and calls by the public, Dept. of Health set up a dedicated 24x7 call center (1800 180 5145) at Swasthya Bhawan, with support from the TSU in order to:

- **Categorize, prioritize** and profile callers as per the protocol defined in consultation with the Surveillance Unit
- **Maintain a record** of the necessary demographic details of the caller such as name, address to facilitate D2C engagement via SMS and to enable the department tracking teams to conduct follow-up visits
- Provide **general information to educate** and generate awareness among the citizens on **COVID-19 symptoms** and the necessary precautions e.g. handwashing, social distancing, etc.

The TSU Team supported the Government to setup the Call Center, manage and operationalize it by:

- **Leveraging a Primary Rate Interface (PRI)** based system with a total capacity of 60 phone lines. The Call Centre was setup within 3 days and the workstation capacity was enhanced to reach the intended level. Separate meeting rooms were also set up to facilitate any discussions and a Data visualization Wall was installed for live tracking of calls status, in what came to become the *Control and Command Center for the COVID-19 response for GoUP*
- **Developing a digital platform** to automate the existing manual process. The protocol algorithm was defined post detailed discussions with the SSO. The customized protocol helped automate prioritization of callers based on their travel history, symptoms, any contact history with COVID-19 suspected cases (Figure 5). This was an agile algorithm and continued to be customized in line with GoUP guidelines in the initial lockdown phases
- **The CM Helpline Call Centre extended support** to the COVID-19 Call Centre and developed a similar call handling protocol, through a customized software

	Protocol Definition and Priorities						
Foreign Travel	Yes	F_1	Symptoms	No	S_1	Contact with confirmed COVID-19 Case	Yes
	No	F_2		Any One	S_1		No
Age	<60	$A_{>60}$		Any Two	S_2		
	>=60	$A_{>60}$		Any Three	S_1		
Priority 1	F_1S_1	Foreign Travel and any Symptom					
	F_1S_2						
	F_1S_1						
Priority 2	F_1S_1	Only Foreign Travel					
	S_1	All Symptoms (Excluding F_1S_1)					
Priority 3	C_1S_1	Contact with Confirmed COVID-19 Case & one or two symptom					
	C_1S_2						
Priority 4	S_2A_{xx}	Age more than 60 and having two symptoms					

Figure 5: Protocol Definition and Prioritization in the initial Phase

The average per day call volume at the call center was between – 1,500 - 1,600 calls and a total of one lakh plus calls had been handled by June 2020.

COVID-19 SELF QUARANTINE/HOME ISOLATION APP

- To encourage **self-reporting and social responsibility a Self-Quarantine app** was developed by the state for real-time tracking of home quarantined citizens. The application captured travel history, symptoms, and test results of self-quarantined person to be updated by the user. In addition, the user's GPS location was captured and the Geo-fenced range was fixed at 50 meters with an advisory SMS automatically sent in case of a violation. The application was very effective in the initial stages and the total number of registrations on the application was 28,753 by end of May 2020.
- With the evolving protocols, this application was upgraded to **track Home Isolation cases** with effect from July 2020, starting from Unlock 2.0. The application allows the district staff to monitor the positive home isolated cases on a daily basis through self-reporting. A total of fifty thousand positive cases have made use of the application by end September 2020

Figure 6: Home Isolation Application

AIRPORT MODULE

When the air travel agencies resumed operations, an airport module was developed based on the protocols issued by GoUP for passengers arriving at the various airports across UP. All passengers arriving across these airports namely - Agra, Ghaziabad, Gorakhpur, Kanpur, Lucknow, New Delhi, Prayagraj and Varanasi, were required to:

- **Register themselves on the UP-Government portal:** https://reg.upcovid.in/ and were asked to verify their mobile number via an OTP based verification process. Post registration, the passenger was requested to register themselves and their family members details (in case relevant)
- **While exiting, Airport Security** were required to check the SMS/ Generated PDF based on the registration on the portal
- **In case of any difficulty** while operating the registration portal, passengers were also informed about the Helpline no. available 18001805145
- **Based on the travel plans,** quarantine protocol were laid down by the state for the visitors

Government Of Uttar Pradesh
Traveller Registration Confirmation

Registration Date/Time	Registration Number	Bar Code
06 Jan 2021 21:10	UPAR1096	

Traveller Details

Sr. No.	User Type	Name	Age	Gender
1	Primary User	Mr. XYZ	23 years	Male
2	Family Member	Mr. ERTY	34 years	Female

From Where Traveller is Coming

Foreign Travel	Yes
Country	Not Applicable
State	Not Applicable
District	Not Applicable

Where Traveller is going

Country	INDIA
State	UTTAR PRADESH
District	LUCKNOW
Address	XYZ Colony, XYZ Lane, Near Rock Plaza, Lucknow
Pin Code	223333

Return from Current Location : Yes
Return Date : 07/01/2021
Travel Mode : Air
PNR : XQW1234

Figure 7: Traveller Registration Confirmation

STEP 1

Surveillance Platform: Case Registration by SSO, DSO, Lab or Field Team

- **Once the case data is received via the multiple data sources**, a case can be registered by the State Surveillance officer (SSO), District Surveillance officer (DSO), the Laboratory or the Field team
- **Data captured includes demographic details** (Name, Age, Gender), survey History – Symptoms and testing data
- **Wef. from March 2021, the vaccination details** are being captured as a part of the registration process
- **All Cases Carry a unique Case ID** which is used across the work-flow
- **Only One-time** data entry of cases

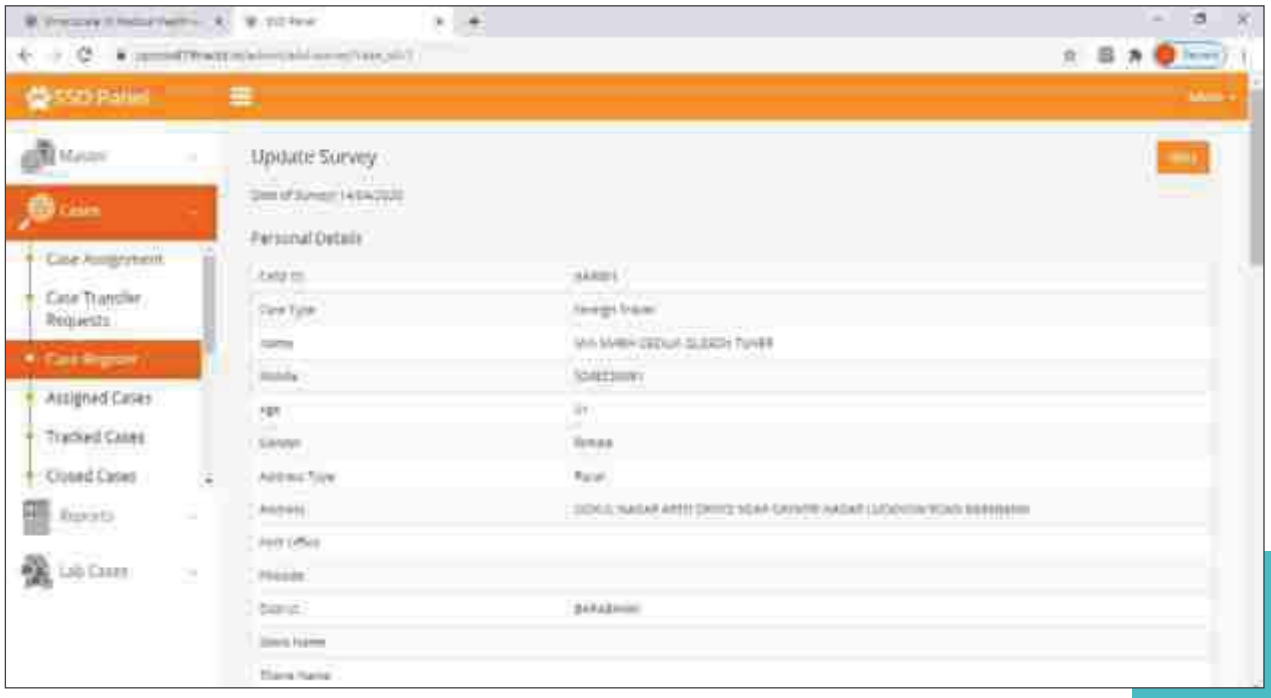


Figure 8: Case Registration on the Surveillance platform

Registering a case for the first time: In the surveillance platform, “CASE ID” is used as a unique ID, and transactions across the entire platform are tracked based on the case ID. Each case has a ‘Source’ Field and ‘Case type’ field for easy categorization of cases. Below are a few examples around how the Case ID is defined:

	Source	Case ID Format	Example (For Agra District)	Remark
1	GOI Data, CM Helpline, Health Call Center, Tablighi Jamat, ASHA Surveillance, Any other from HQ, Others	District Code + 8 (Length Size) numeric digits	District Code = AGR 8 Digits = 02020201 Case ID = AGR02020201	The cases received from these sources are uploaded by State Surveillance Officer after data cleaning. Case ID generated accordingly as stated.
2	Labs, Facilities, Field Data Entry	District Code + N + 8 (Length Size) numeric digits	District Code = AGR New Entry = N 8 Digits = 02020201 Case ID = AGRN02020201	The web interface is given to end-users of Surveillance, Lab, and Facilities for entering the cases of these sources. Case ID generated accordingly as stated.

STEP 2

Surveillance Platform: Case is assigned for In-person Verification by the DSO to the Tracking Team

- **The DSO initiates** case level monitoring by assigning the case verification to the Tracking Team
- **Bulk assignment** of Cases to Tracking teams

Figure 9: Case Assignment on the Surveillance platform

STEP 3

Tracking Application

The Tracking team reviews and verifies the case details through the Case Tracking Application

The Tracking team is responsible for field level verification, updation of survey form and contact tracing efforts for positive cases. As part of the Surveillance Platform, a web and mobile application were developed to keep a track of suspected/likely COVID-19 cases as well as those who have been tested positive for the virus. Through the app, health functionaries in the field shared real-time information, making it easier for the authorities to Track, Test and Treat (T3). Thus, resulting in ease of information flow from state to district and field, and back to the state.

Figure 10: Mobile Application for field tracking

The key functionalities of the app include:

- **Seamless information sharing and assignment of cases** from state to district and field staff
- **Real-time tracking** of active cases till closed
- **Real-time Information sharing on verification of assigned cases,** by field team though tracking app
- **Provision to enter data** of suspected cases at a district or FLW level
- **Actively carry out contact tracing** of positive cases
- **Carry out fitment check** for Home Isolation Cases

Figure 11: Web Dashboard for field tracking

During the initial phase of development, the focus was to enable information flow of the data received at the state level to the field staff, assign it for verification, seek confirmation, update details and track the suspected cases till the cases are closed. Over time, the modules were developed, with a workflow-based approach, to share information from the field about suspect cases, contact tracing and Home Isolation fitment check.

STEP 4

Surveillance Platform: DSO assigns the Test type and Lab

- **The DSO assigns the test-type** and lab (Public/ Private) to the case with the sample collection date recorded
- **The DSO can assign** samples based on bulk consignments with Consignment ID
- **PDF is generated with consignment & sample IDs** for dispatch and the DSO/ district dispatches consignments

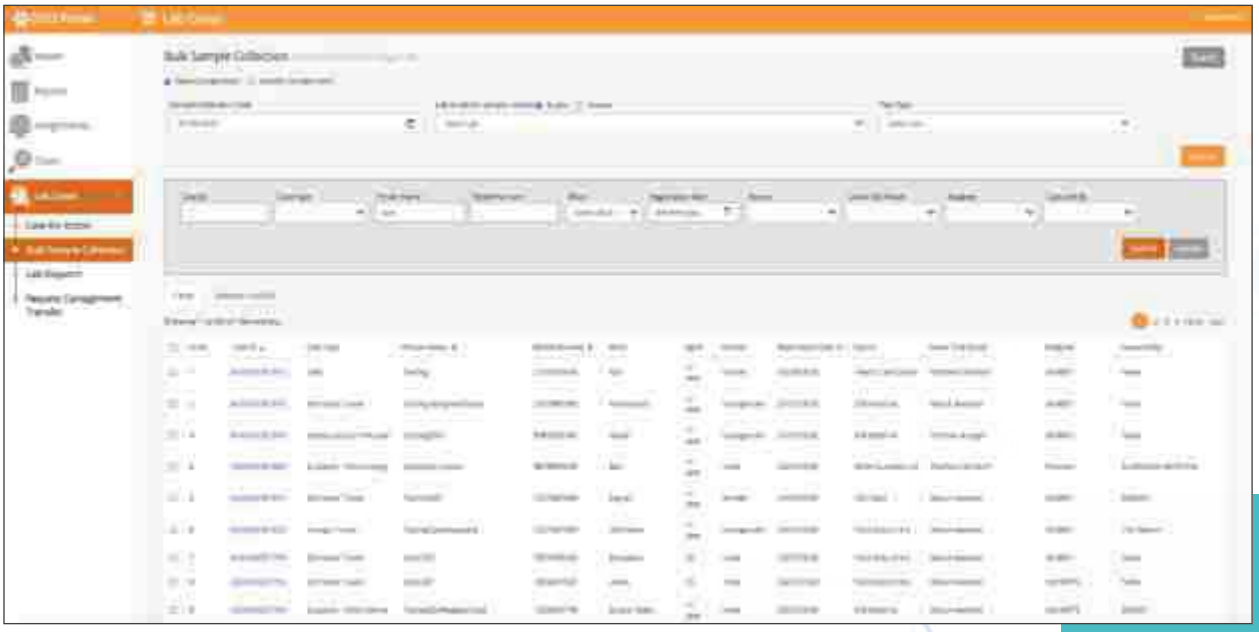


Figure 12: DSO assigns Lab Test and type for each case

STEP 5

Lab Module: Lab confirms sample delivery and receipt

- **Samples can be assigned** by districts, facilities or departments within a facility
- **The assigned lab will confirm consignment delivery** followed by sample receipt on the portal
- **District gets acknowledgement** of consignment delivery and Samples received at Lab

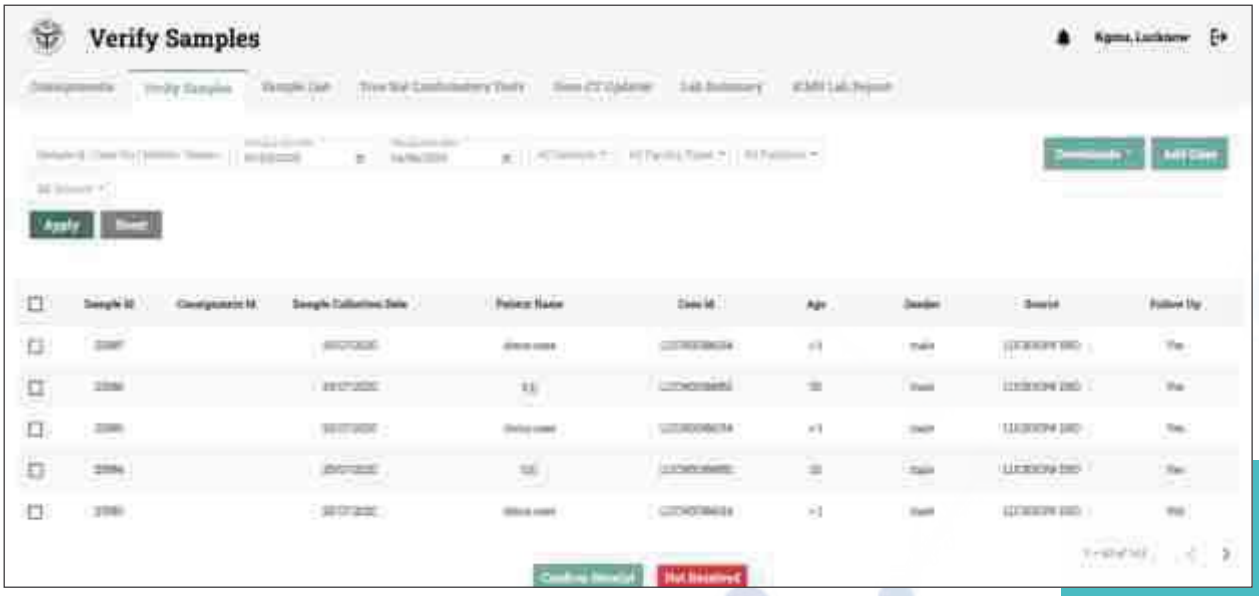


Figure 13: Labs update sample receipt on the Lab Module

STEP 6

Lab Module : Lab confirms and updates results

- **The Lab will select the case** and update sample details and test result, if the sample is found satisfactory
- **The Lab updates results** – options to bulk update and bulk upload of results through excel
- **Results reflected in real time** at Facility/ District level

Figure 14: Labs confirms and updates results on Lab Module

STEP 7

Surveillance Platform: In case of positive case identified, the DSO allocates a facility or Home Isolation to the case

- **The DSO initiates facility allocation/ Home Isolation** for the positive case, with allocation date captured, by selecting the facility type i.e. L1, L2, L3, L1-CCC, DH-I, the facility name and allocation date
- **Facility allocation** also depends on the criticality of the case
- **Positive Cases** are also assigned to tracking Team(s) for contact tracing
- **Home Isolation** application used for active tracking of home isolated cases

Figure 15: Facility allocation by DSO

STEP 8

Facility Module: Facility user updates Case details daily

- **Once the case is allocated** to a facility, the case automatically reflects in the facility module
- **When the case is allocated** to the facility for the first time - the facility fills the one-time Medical Record – includes comorbidity, as well as education level, BPL etc.
- **Daily Patient Update:**
  - **Inpatient** (on-ventilator, on oxygen), recovered, referred, deceased
  - **Asymptomatic/Symptomatic** (fever, cough, breathlessness & sore throat)

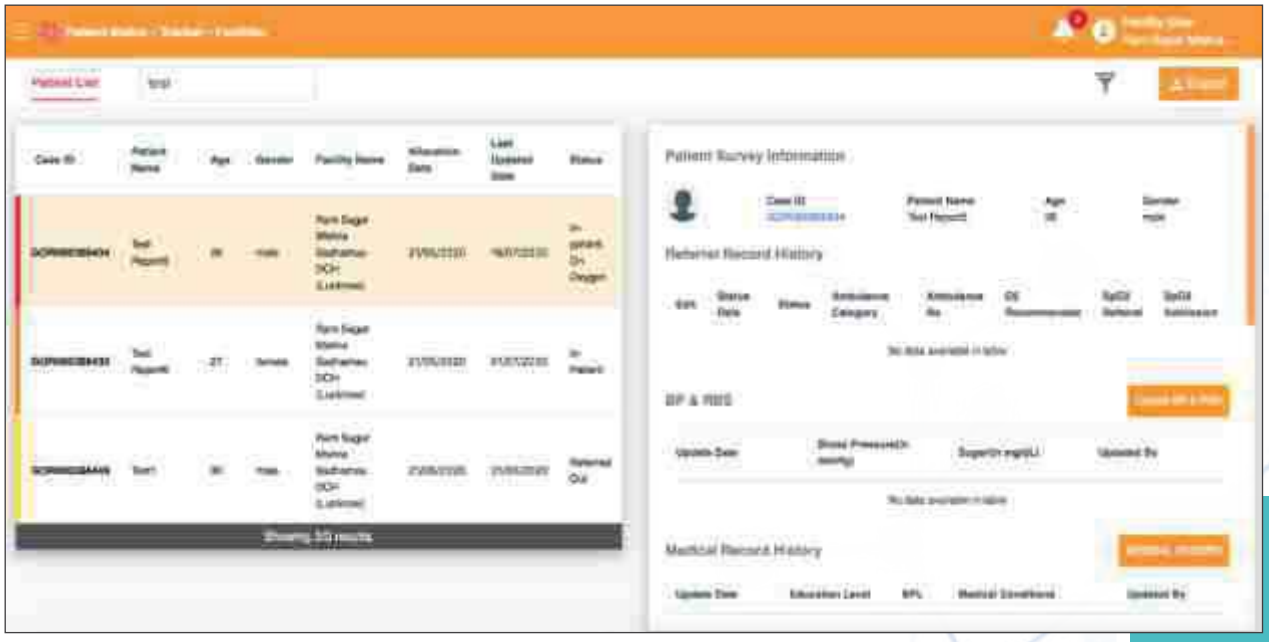


Figure 16: Facility Module to update case wise details

STEP 9

Facility Module: Referral to other Facility

- **The facility can refer the patient** to another facility depending upon the health conditions

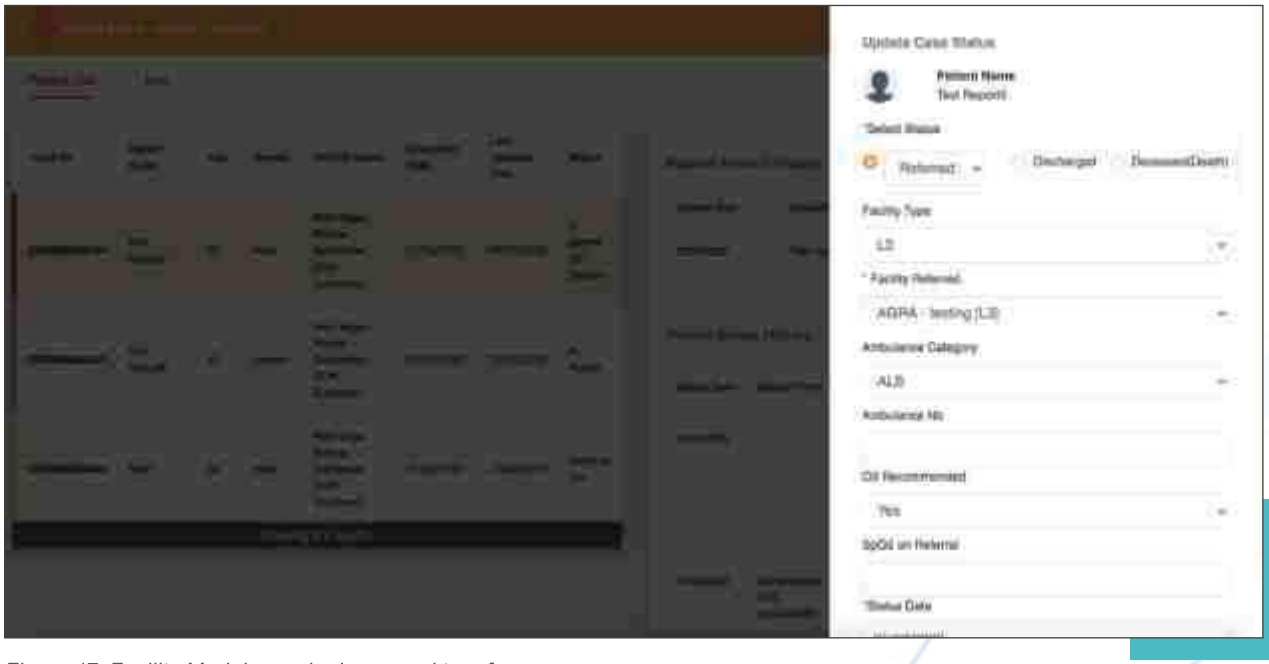


Figure 17: Facility Module can be leveraged to refer cases

STEP 10

Surveillance Platform: Case closure by DSO

- **On Discharge the DSO** may suggest quarantine for select cases, as per protocol and continue tracking
- **The DSO closes a case**, with reason for closure as well as the closure date

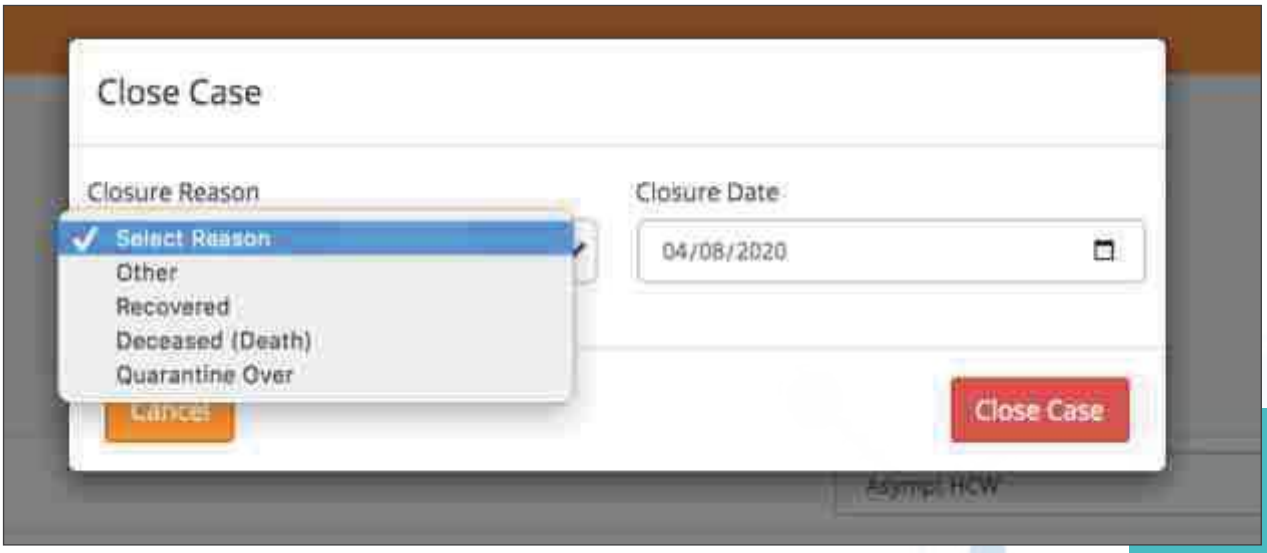


Figure 18: Case Closure on the Surveillance Platform

STEP 11

Death Audit Module: Handling of Death Cases

In case of reporting of death at a district/facility the entire case file can be uploaded on the portal. The details are then made available to the Death Audit Committees assigned to each district through a separate login. The entire process of death audit is closed online, including the final report.

Figure 19: Death Audit Module

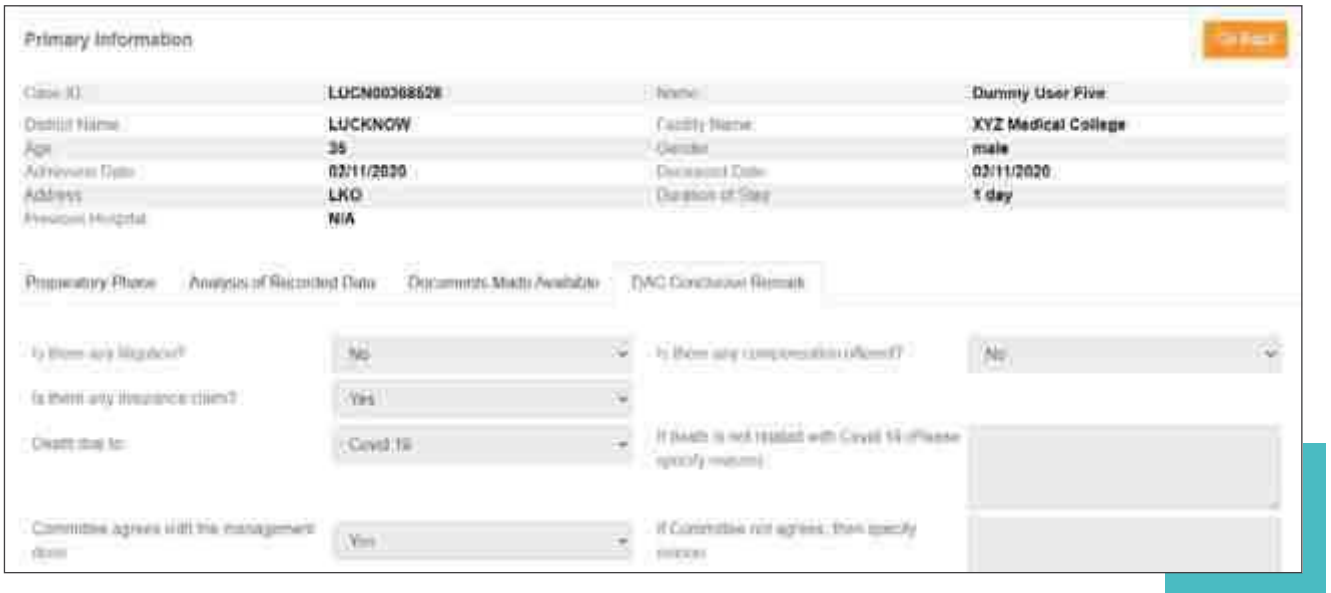


Figure 20: Death Audit Module

Decision Making Dashboard

The Dashboard leverages visualization for **advanced analytics on contact tracing** in UP facilitating dynamic modeling to predict patterns and outliers, heat maps for risk detection to drive focused efforts and COVID-19 Carrier Surveillance for real-time monitoring. An additional deep-dive analysis is being planned using age, gender, case type details etc.

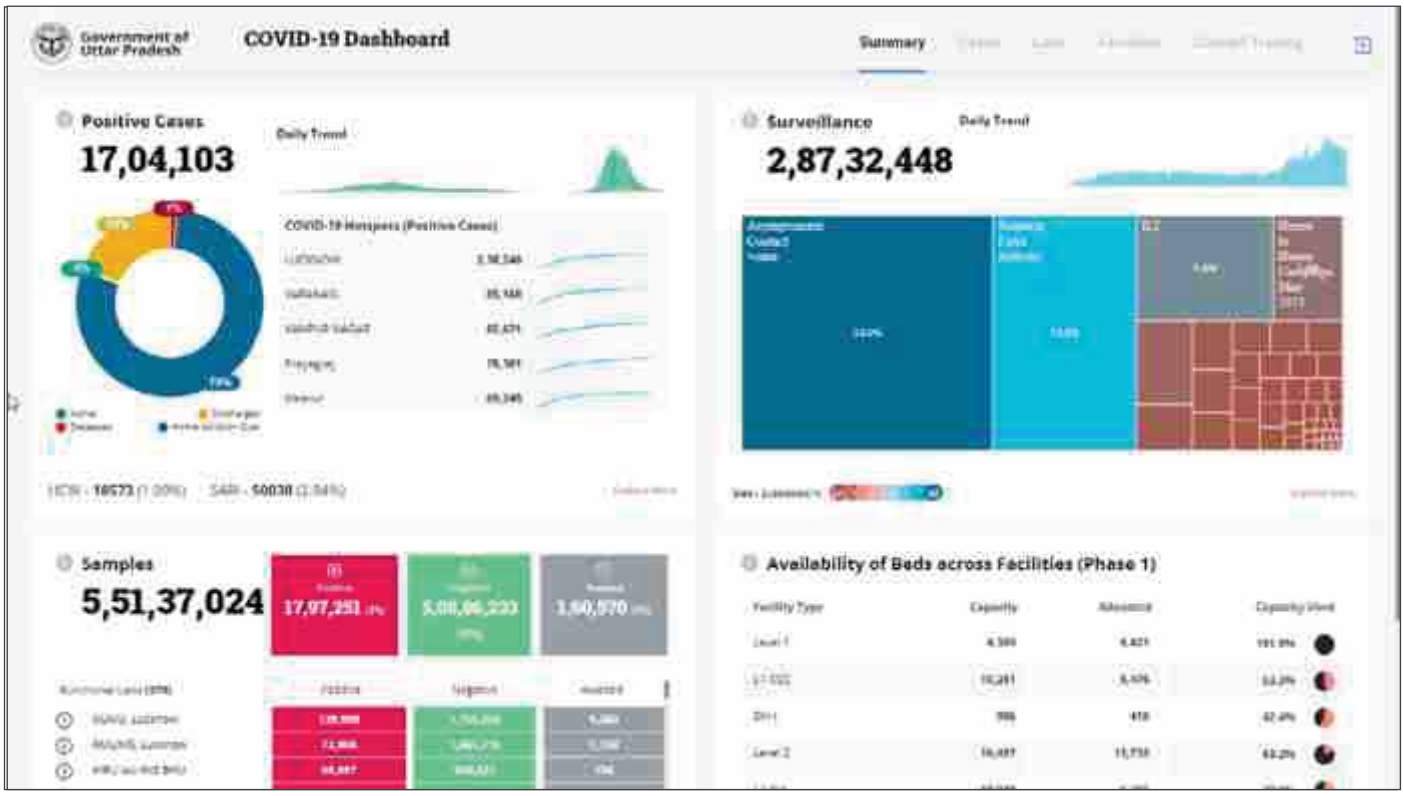


Figure 21: Decision Making Dashboard

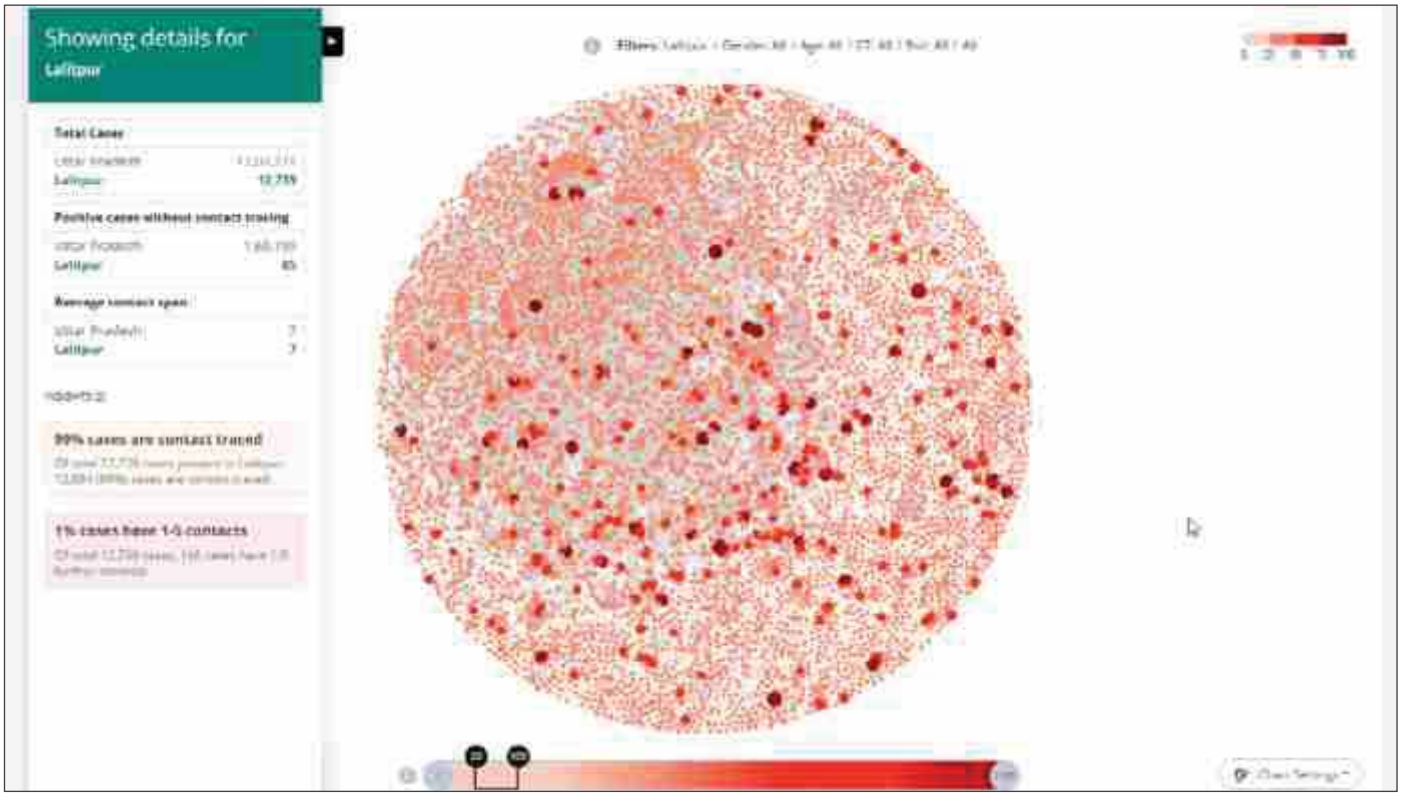


Figure 22: Decision Making Dashboard

COVID-19 SELF QUARANTINE/HOME ISOLATION APP

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- With the evolving protocols, this application was upgraded to **track Home Isolation cases** with effect from July 2020, starting from Unlock 2.0. The application allows the district staff to monitor the positive home isolated cases on a daily basis through self-reporting. A total of fifty thousand positive cases have made use of the application by end September 2020

Figure 23: Home Isolation Application

MERA COVID KENDRA APP

Mera Covid Kendra was inaugurated and went live for citizen on 5 December 2020. The app enables easy access to citizens to COVID test/collection centers – upto a radius of 5 Km from their location. Essential details are shared via a map view or a list view which include Center Name, Timings, Tests Performed, getting directions from their location to test/collection center etc. The user can also search for Test/collection centers (1240 Centers listed on the App at present) based on any district, city Pin Code, Location, Address etc.

Figure 24: Mera Covid Kendra App

Public access to Lab results via a single online platform:

In addition, from a citizen's perspective, the are four types of COVID-19 tests i.e. RTPCR, CB-NAAT, ANTIGEN and True-nat. In order to perform any of these tests, citizens are required to visit a CHC/ PHC/ Health Camps/ Public Labs/ Private labs to share the required sample. As soon their sample get tested, individuals need to visit the center again for collecting their reports.

To give easy access to the public for accessing their CoVID-19 results as soon as they are made available, GoUP has developed a common window for COVID-19 lab test results, as the single online platform for citizens to login (using the OTP generated based on their mobile phone number) to quickly access and view their results from anywhere through internet enabled devices. The platform was inaugurated on 20 September 2020 by the Honorable Chief Minister and over 2,57,18,698 (2.57 Crore) reports have been downloaded so far.

- **The user will need to open** the URL:http://dgmhup.gov.in on the Web/ Mobile Browser and access the COVID Lab Report/Result link, and enter the mobile number which was used for registration
- **The user verifies their information** by clicking on "Send OTP" button to generate an OTP which will need to be updated on the portal
- **After submitting the OTP,** the user can view/download test results as required across all their case reports
- **The report is QR enabled**, hence is valid for travel purposes.

Figure 25: Citizen interface for online access to lab results

The Stakeholder Perspective

The platform is designed to assist all the stakeholders. Accordingly, various features/modules have been aligned keeping the workflow and the case life cycle in mind. The linkage of modules and digital initiatives rolled out in the state, with stakeholders can be found below:

Key Stakeholders	Key Features/Modules	Digital initiative leveraged
 **Policy and Decision-Makers**	• Single source of truth for all data and analytics needs across stakeholder groups • Integrated dashboard for swift decision making	***Decision-Making Dashboard***
 **State/ District Surveillance Teams**	• Singular point of case registration with end-to-end case management and post-discharge case follow-up • Integration of multiple data sources (lab, facility, field, citizens, call center)	***Surveillance Platform, Lab Module, Facility Module***
 **Lab Team**	• System generated real-time receipt and status updates for samples and consignments • Ability to bulk upload results at the lab - updated real-time at District/ Facility/ Field team level	***Surveillance Platform, Lab Module, Facility Module***
 **Facility Team**	• Medical and epidemiology record maintained against the unique case ID across the case life cycle • Seamless inter-facility referral • Integrated with real-time updates to/from State/ District and Lab teams	***Surveillance Platform, Lab Module, Facility Module***
 **Field Team**	• In-person verification and daily follow-up of each registered case • Contact tracing on the field • Collaboration with all field teams, facility, lab, and state/ district teams	***Case Tracking Application, Surveillance Platform***
 **State Residents**	• Direct beneficiary engagement through advisory messages for registered users • Geo-fencing, movement alert • Self-assessment, tracking and helpline support • Self-registration of passengers travelling to UP via air • Easy access to COVID-19 lab test results via an online single platform for the public across facility and test types • Access and search COVID test/collection centers details - Center Name, Timings, Tests Performed, directions	***Self-Quarantine App/ Home Isolation App, Call Center*** ***Airport Module*** ***UP COVID Lab Result for Public*** ***Mera COVID Kendra App***

Capacity building and digital training

The Government of India launched the online training platform, IGOT – a self-learning platform for COVID-19 for training of the health workforce. Since the platform was rolled out prior to its official launch date to support the COVID-19 training efforts, there were some initial concerns with the platform w.r.t accessibility, speed and also the inherent purpose of the platform which was more of a self-learning approach becoming a more long-term process, while the current requirements demanded a quick learning platform to support on ground efforts.

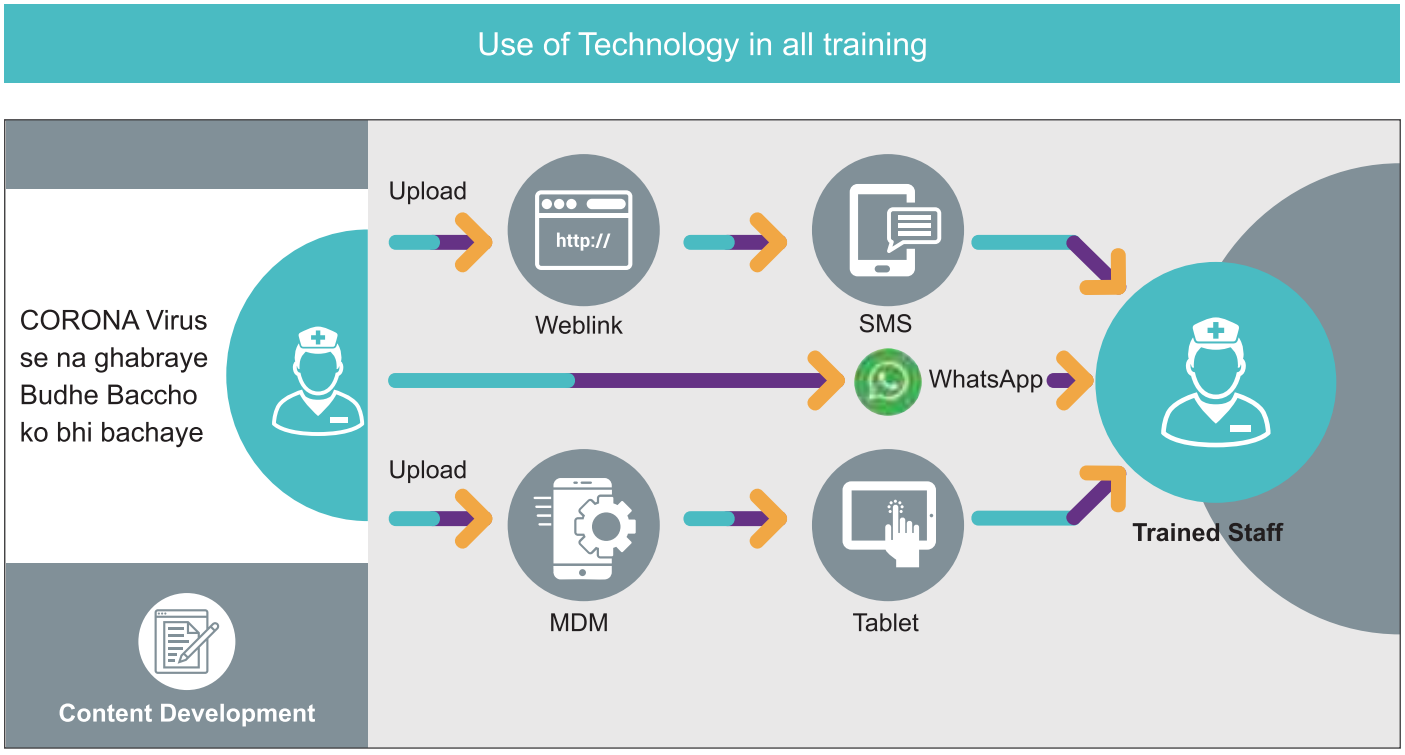
Figure 26: COVID-19 Website for training and IEC/BCC

Thus, to fill these gaps, mid-March 2020 onwards the Dept. of Health and TSU initiated trainings for the healthcare workforce in batches. Additionally, TSU also supported the development of the COVID-19 Website to train and share information with healthcare providers and field teams. This website was developed with a three-fold objective:

- **Sharing customized and easy to read training content** for Doctors and Staff Nurses based on updated guidelines e.g. orientation on facility preparation to handle COVID-19 cases
- **Dissemination of relevant IEC/BCC Material** via district officials, facility staff, field teams e.g. information to avoid exposure to coronavirus
- **Monitoring training** is undertaken by leveraging eHRMS code to track whether each staff member has accessed the training material

The ANMs were pro-actively informed and updated about new content material available on the website via SMS reminders and updates. In addition to leveraging Zoom as a platform to train the state, district, RRT, facility, and lab teams on the end-to-end surveillance module short, easy to view videos were developed and disseminated for each module. This helped officials and health providers across the state to become more confident to use the platform.

Below is a brief glimpse of how the in-person trainings evolved into remote trainings by using a combination of different digital tools and platforms for community and facility level trainings across the state:



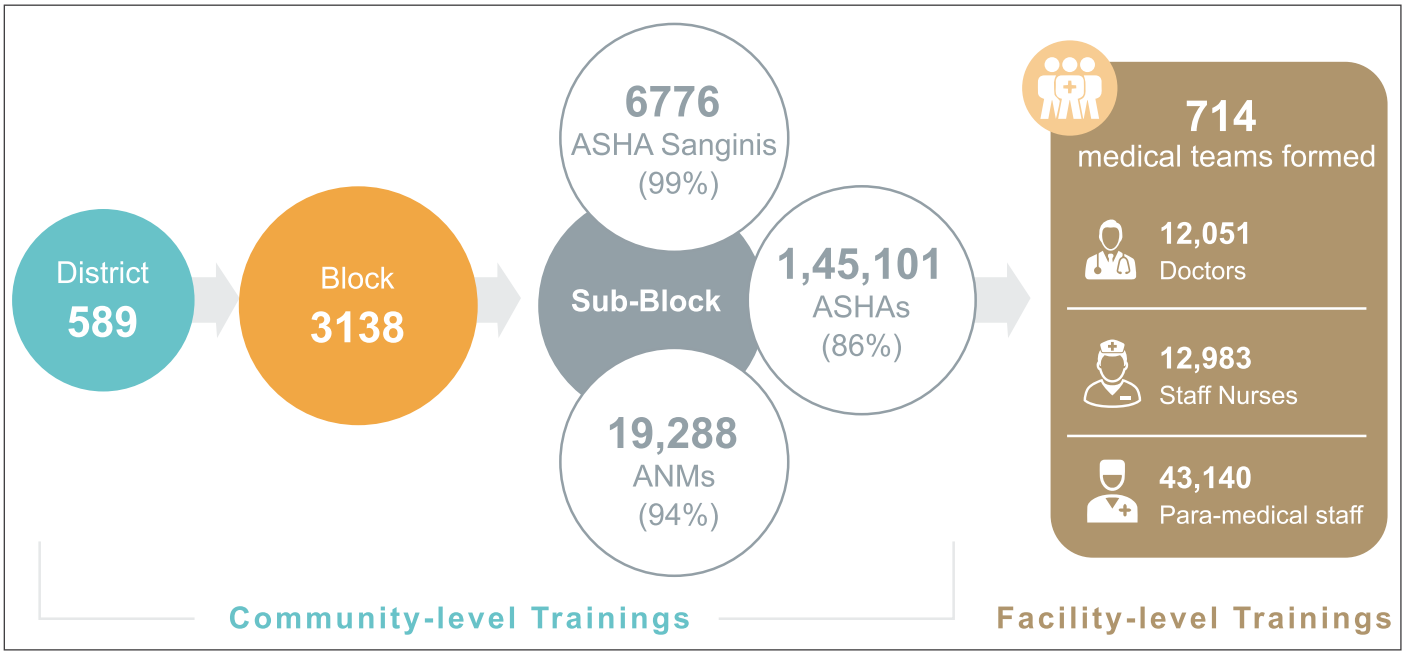


Figure 27: Leveraging technology for capacity building efforts

Impact of the Unified COVID-19 Data Platform

The efforts of the Technical Support Unit (UP-TSU) while supporting GoUP in managing the COVID-19 epidemic state, touched upon multiple dimensions of the state's COVID-19 response.

Right from supporting the administration to develop digital tools to collect data at source to contributing to enhance FLWs and HCWs capacities by effectively leveraging technology to manage surveillance and treatment efforts through comprehensive - integrated digital surveillance platform - COVID-19 Unified Data Platform and finally ensuring actionable visualization via the UP COVID-19 Dashboard providing strategic guidance on key parameters. The digital tools developed and rolled out have been able to ensure complete end-to-end transparency across the case management and administrative requirements.

The ability to view and analyze case trends as well as the result and impact of the various initiatives undertaken by the Government in real time, has been the most important and timely contribution of the State-wide rollout of the COVID-19 digital platform.

The State has been able to effectively….

Digitally **track** more than **4.15 Crore Cases across continuum of care (for COVID-19)**

Carried out **5.4 Crore Tests**

Managed more than **16.7 lakh Positive cases**

…using the Unified COVID-19 Digital Platform

As of 15 June 2021

As of 31 August 2020, the state of UP, which comprises 16% of the country's population, contributed to 6% and 7% of the nationally confirmed and active cases of COVID-19 respectively. Its mortality rate stood at 1.5%, below the national rate of 1.7%. The platform was able to clearly help understand how the growth in cases until now has been slower than certain other parts of the country – the doubling time for the virus in the state is 28 days, which is shorter than the national average of 35 days.

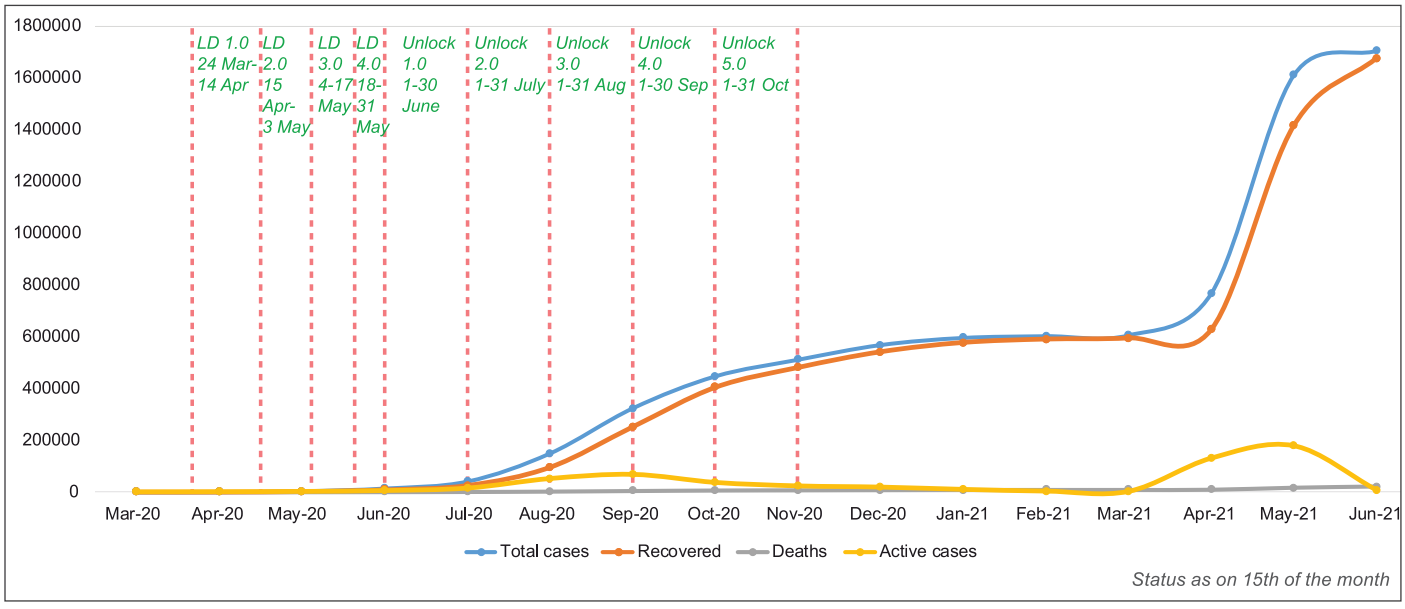
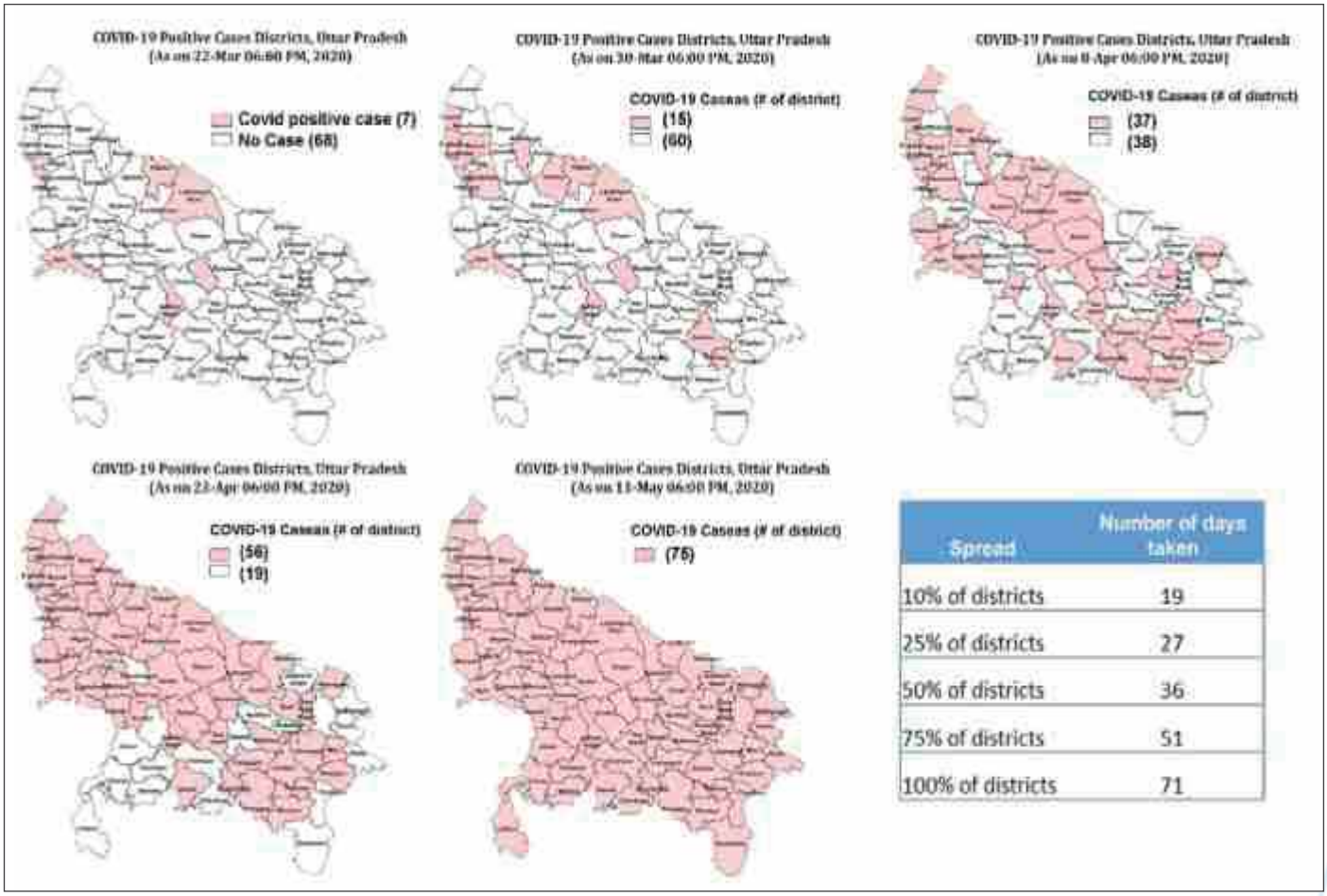


Figure 28: Epidemic curve for COVID-19 - Total cases, recoveries, deaths and active cases

In addition, the platform was able to help understand the impact as well as bring efficiency across various steps in case management and ensuring linkage to care.

Case Load and Spread - Trend Analysis

Ability to map and analyze the trend of the **case load** within a block and district, transitioning initially from major urban pockets due to the surge of people returning from overseas e.g. districts such as Gautam Buddha Nagar and Ghaziabad which lie adjacent to Delhi, followed by the capital of UP i.e. Lucknow to Western UP and then Eastern UP, before it spread across the entire state



Spread	Number of days taken
10% of districts	19
25% of districts	27
50% of districts	36
75% of districts	51
100% of districts	71

Figure 29: COVID-19 case trend across UP

Ability to **compare the epidemic curve** across districts in UP, across states and with countries roughly similar in size and population

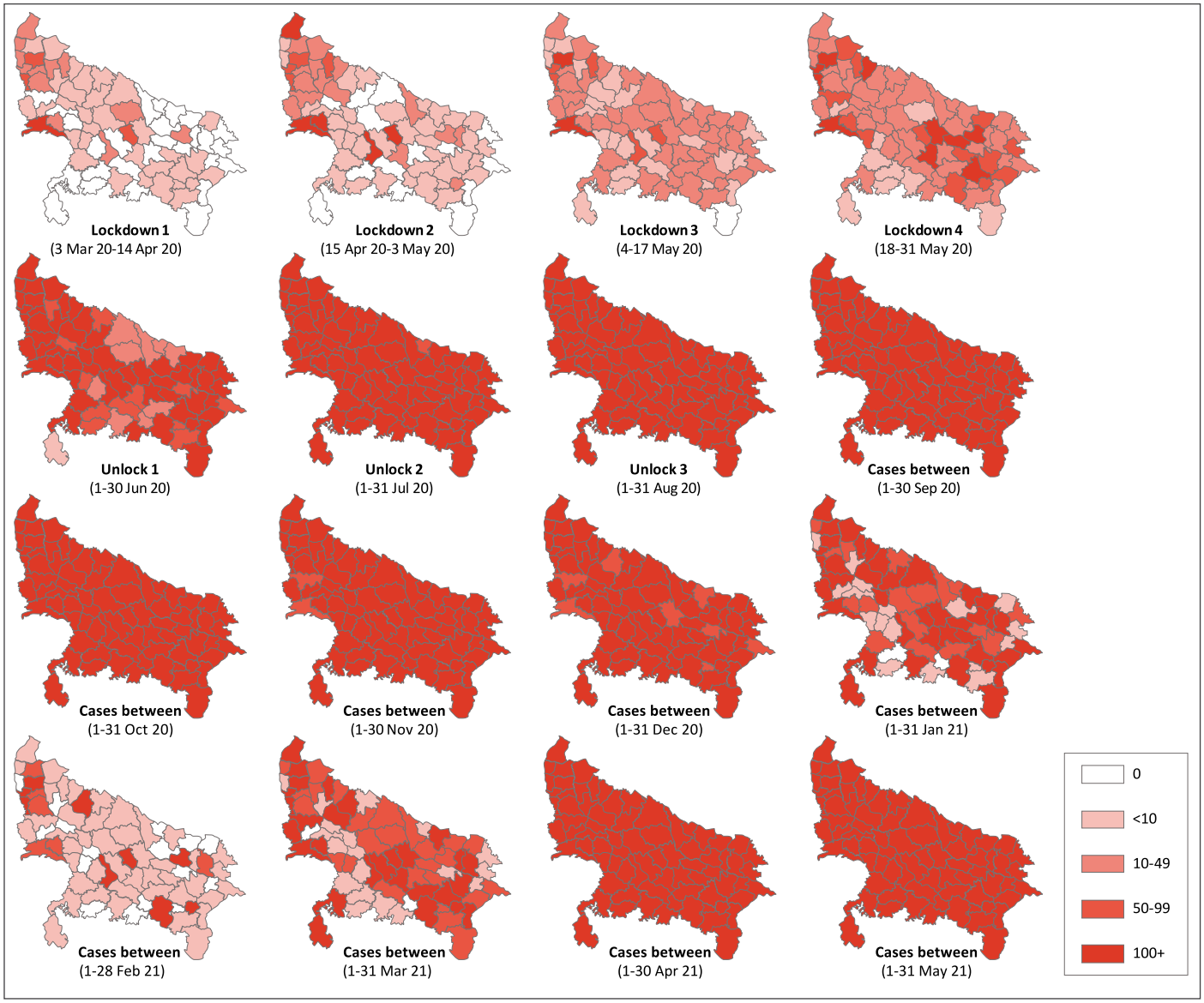


Figure 30: Changing epidemiological pattern during COVID-19

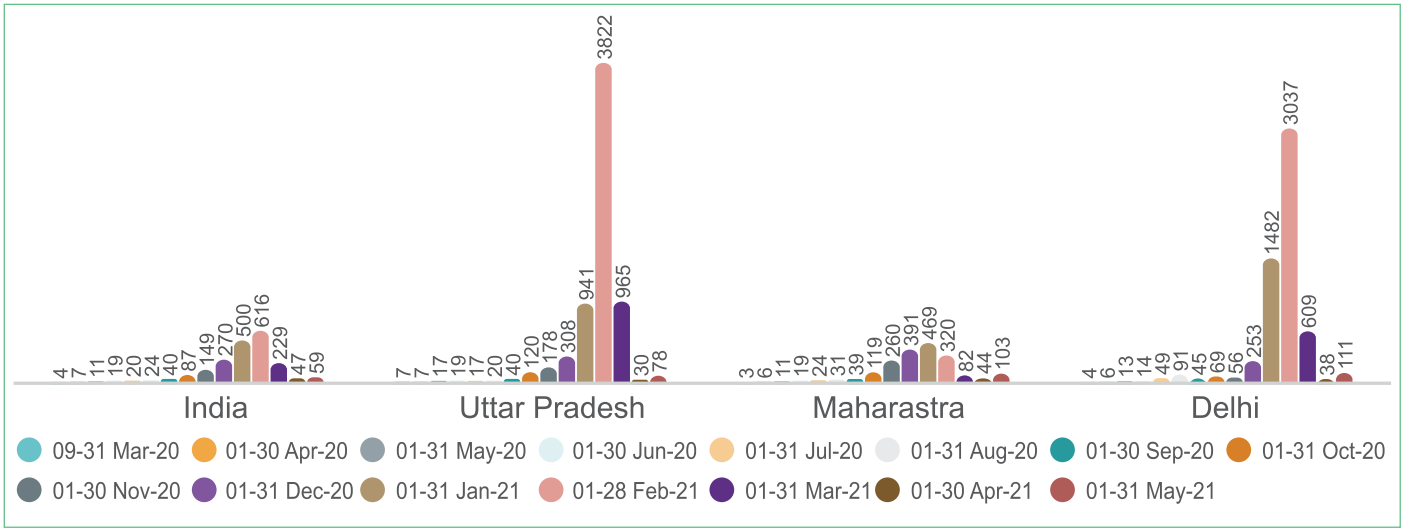


Figure 31: Trend in doubling time of COVID-19 among major states of India

Ensure Implementation of T3 Strategy

Ability to support the **T3 strategy** advocated by the ICMR, by enabling real time data updates and analysis across the three areas 'Track, Test and Treat'

Track

Active surveillance

Tracking itinerant populations and number of cases **active and closed**

- The platform over time was able to identify each **case across 17 different case types e.g.** ANC, ILI, SARI, Symptomatic HWC, Pre-Surgical, Foreign Travel, Dialysis Client, Domestic Travel etc.
- Age and gender wise and geography wise analysis

Contact Tracing - assigning field teams to track and test proactively

Passive surveillance - syndromic surveillance

Projection of the total case count in UP to facilitate medium to short term **resource and policy planning**

Test

Understand the **shifting testing landscape** across districts in the state

Sample tracking from collection, consignment delivery, received to verification and result with clear indication of turnaround time and delays if any

Track the **rate of increase in per capita testing levels** in line with the case trend across the state

Quickly adapt the **testing algorithms in line** with policies and track various tests being undertaken i.e. RT - PCR, TrueNat and Antigen testing by analyzing the proportion of each test conducted, test wise results (positive, negative and inconclusive), reducing the turnaround time, linking to immediate care etc.

Treat

Track **Confirmed cases and their linkage to facilities or Home Isolation**

Quickly adapt and accordingly **update Treatment protocol** to ensure the **entire state follows the same line of treatment** and data is recorded accordingly

Timely hospitalization - **Risk stratified strategy of hospitalization**

Facility

Status of facility admissions among total identified COVID-19 cases and actual daily count

- **In-patient**
- **Discharged**
- **Deceased**
  - Death review and pattern
  - Apart from analyzing the geographical variation in mortality levels, a comprehensive breakdown of the number and proportion of deaths by the age, gender, symptomatic, co-morbidity, different population groups and beneficiary types.

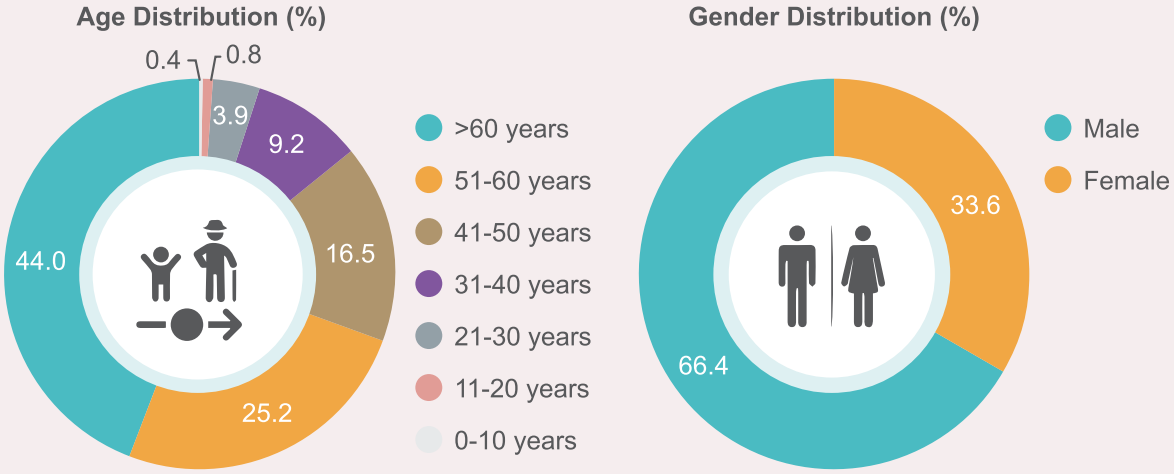


Figure 32: Profile of deceased cases

- Case Fatality Rate (CFR) i.e. the ratio between confirmed deaths and confirmed cases helped compute weekly as well as monthly moving average for CFR in UP including analysis based on case type i.e. ILI, SARI, clinical condition (ANC, surgery etc.), HCW etc.; age, sex

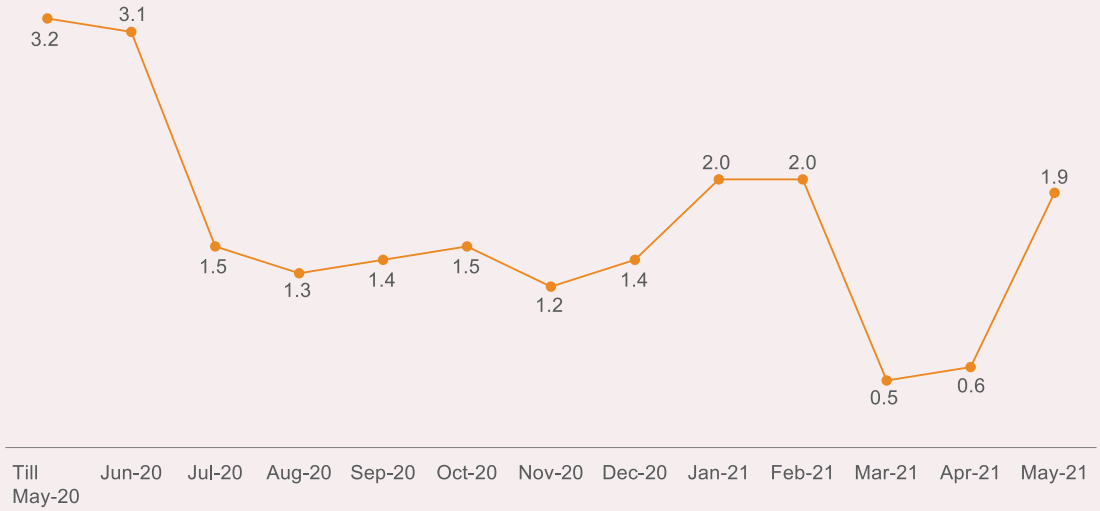


Figure 33: Monthly moving average of CFR, UP

- **Home-isolations**
  - Total proportion of cases allowed for home-isolation
  - Total cases currently active and recovered

Infrastructure Management and Gap Analysis – Facilities, Labs and Testing Landscape

The availability of real time data ensured that the State was proactively able to manage the infrastructure requirements, with effective change in strategy and protocols – from increasing the number of facilities and availability of beds, to earmarking paid facilities and timely implementation of Home Isolation protocols. From a Resource Availability and Utilization perspective, the total available Bed count increased from 2520 to 152,095 from April 2020 to mid-July 2020 and the availability of Ventilators increased from 20 to 1151 from April 2020 to mid-July 2020, with real time updation of the utilization rate.

The testing Landscape was managed through setting up of labs at district level, quantum increase in testing levels using different test types like RTPCR, CBNAAT, True Nat and Antigen, from 760 as of 3 April 2020 to 44484 as of 18 July 2020 and 1.5 lakhs by August 2020. The testing numbers increased exponentially with the second wave.

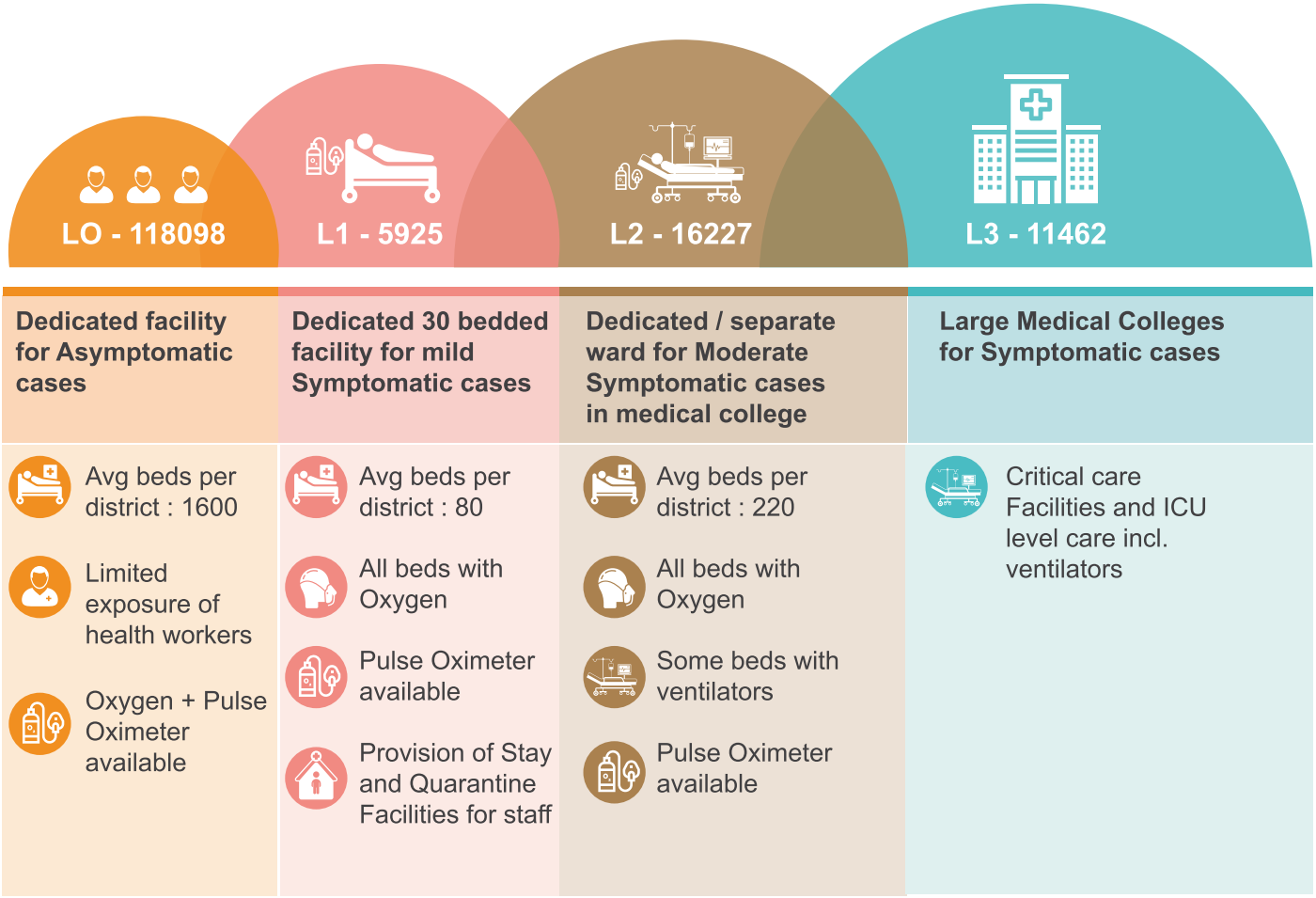


Figure 34: Increased capacity across facilities

Accountability and Reporting

The integration to seamlessly share testing, as well as, patient data with ICMR and MoHFW (S3 portal integration) ensured transparency and accountability at all levels. The API based integration has ensured that the labs and health staff do not have to make dual entry in the State. The latest data is available within twenty-four hours at the national level. More than 5,04,80,567 (5.04 Crores) lab results have been updated since 23 July 2020 (date of integration) till 16 June 2021 on the ICMR portal, with an average one lakh fifty-three thousand results being updated on a daily basis.

Key Learnings – What went well

Due to the size, scale and demographic profile, driving last mile health service delivery, has historically been a challenge for the state of UP. The GoUP has faced significant challenges while improving performance across health indicators and while driving implementation and adoption of health information systems at scale. As per the annual Health Index rankings released by NITI Aayog across 23 parameters, UP has been ranked last (among larger states) in two consecutive years (2018 and 2019).

The comprehensive COVID-19 response by the state has completely challenged the status quo. The Government has not only successfully developed an end-to-end platform as the single source of truth to respond to this emergency and scaled it across the entire state, but the rare ability of this platform to integrate different moving pieces and health care staff across the value chain, is an unprecedented achievement for the state. This collective response to leverage technology effectively and the state's ability to pro-actively plan a broad vision, engage with partners across the public and private sector and then deliver on it, has clearly demonstrated that even a large state such as UP, can be a front runner on adoption of digital tools at scale when it comes to healthcare management.

Below are some of the key reasons why the state has been successful in leveraging an end-to-end, unified data platform response, to the COVID-19 pandemic:

State level ownership and adoption

Strong and coordinated support from State Leadership

The sheer conviction of the state leadership/senior officials i.e. Chief Minister's office, Dept. of Health and Dept. of ME, to confront the pandemic upfront and leverage partner support as required, went a long way in achieving the desired adoption of the platform. Also, unlike many other states where the Disaster Management Authority (DMA) was also responsible for the health-related response to

COVID-19, in UP joint-ownership was assigned to the State Dept. of Health and Dept. of ME, helping streamline efforts even clinically to ensure timely execution of the common strategy developed. The Dept. of Health as well as the Dept. of ME had different data platforms being used by the respective facilities, with few labs not using digital systems at all. Speficially for the laboratories and facilities under the purview of Dept. of ME, getting earmarked for COVID-19 support efforts resulted in a quantum shift in existing processes and change in the data collection platforms. The Additional Chief Secretary from both departments, worked in an extremely collaborative manner by not only fully endorsing the common platform developed, but even releasing GOs and conducting VCs to drive adoption and usage to ensure there are no other digital tools/silo'ed systems used for COVID-19 data reporting and case management across the state.

> *"The journey has been made smooth – it was a very bumpy ride, to begin with, so much time to balance actual lab work and manual data reporting, but UP Portal made it smooth. Thank you for technical support at any time of the day for me and my entire staff – it helped to know that support, which is patiently provided, is just one call away"*
>
> ***— Professor (Dr.) Jyotsna Agarwal, COVID-19 Laboratory Incharge, Head of Microbiology Department at RMLIMS, Lucknow, UP***

Leveraging and finding value in technology for efficient time management in crisis

In the initial days of the pandemic, understandably a lot of the time of the UP-State Leadership was spent in managing operational requirements. Rollout of the COVID-19 platform in an easy to use, modularized manner, helped establish a comprehensive reporting process across the continuum of care for COVID-19, with the unified platform becoming the single source of information across the state. The ability to review real-time updates in a consolidated manner, helped the State to prioritize key issues, instead of focusing efforts on operational activities and helped them support key efforts more effectively. The data backed analytics via the Decision Making dashboards helped create actionable insightful views on the dashboard to support prioritization efforts and was found to be of immense value by state officials.

Additionally, at a district level with separate login IDs created for District Magistrates (DM) the efforts became much more inclusive, and it was observed that DMs were even supporting, reviewing, and collaboratively working with the District Surveillance Teams when it came to effective case management and completion of contact tracing efforts.

> *This portal helped me discharge a case at midnight. The Lab got a Negative test result for 9 cases and uploaded that information on the portal. We were able to arrange an ambulance (GPS tracked) and ensure the case could be discharged without wasting another day – physically as well as digitally from a reporting perspective. My District Magistrate called me the other day, to find out why contact tracing information had not been filled for 2 cases yet! I did not know separate login IDs had been created for the DMs as well – I felt embarrassed but at the same time was glad that till we are working on this together and supporting each other, in such a transparent manner, we will all be good. Now I also look at that Contact Tracing dashboard to keep a check on my team and my efforts, before the DM figures a gap.*
>
> **— Dr. Yash Agarwal, Nodal COVID-19, Kaushambi, Department of Health and Family Welfare, UP**

TSU Support: Listen carefully, deliver efficiently…and contribute effectively over time

Identify the quick wins while keeping a clear focus on the broader vision

By respecting the immediate needs of the Government, demonstrating commitment to find solutions to those requirements and ensuring timely delivery of these interventions, the TSU went on to slowly become a reliable partner to the State Government during the emergency. The initial quick wins helped the TSU team to build traction at a time where there was high sensitivity around data sharing. The TSU instead of imposing its thinking on the Government, was able to support the Government with their priorities while keeping a broader vision in mind.

It was important to empathize with the firefight mode that the Government was in initially, while also continuing to push and effectively position the long-term needs.

Identifying champions and adopting an inclusive approach, across departments and state teams

Early identification of key stakeholders across the state, was essential to enable a timely understanding of the different needs of each stakeholder, identifying their priorities and mapping the key challenges that may exist for different stakeholder groups. This helped prioritize socialization efforts strategically and navigate the path better, to not only ensure that the broader vision of this platform was successfully developed but also organically gather, wider acceptance and adoption across different Government stakeholders and on-field staff at this unprecedented scale for a state like UP.

The positive response and acceptance from the various stakeholders (Lab, Surveillance, Facility teams) worked well and further reduced the initial resistance. Over time, some of these stakeholders who may have had initial apprehensions went on to become champions and even took some extremely bold and unprecedented steps.

For instance, specifically with labs, while there was initial resistance and concern around using a new platform, not only did the State Coordinator for the Lab Network for COVID-19, support adoption of the platform but went a step ahead and issued an order to only allow real time reporting and no back date reporting of lab result. This has been an unprecedented step in the direction of going paperless from a lab perspective.

Time and Stakeholder Management - during an emergency, to do the 'groundwork' before proposing/ developing a state-wide tech solution

Since historically, the TSU team has had a strong focus on RMNCH+A programs, as the technical support partner it effectively managed time upfront by doing the 'groundwork' and understanding the workflow and user requirements for a Surveillance platform, before proposing/ developing a state-wide tech solution.

In addition, the Government and TSU team's agility, combination of different skillsets, responsiveness, 'let's do everything we can' attitude, collaborativeness, flexibility and open-mindedness were some of the key reasons why they were able to, 'convert' 'Champions' along the way. Across the team – a common theme found, was the commitment to:

- *Get things done* – get the requirement, break it down, expedite TAT and deliver the cleanest UI and UX with only the most basic functionalities
- *Keep the end-user in mind* – do not change the process, use their commonly used terminology
- *Demonstrate value to every user type in the easiest possible way* e.g. minimal data fields, automated reports, workflow-based design

The team was able to collaboratively, create insightful views on the dashboard to support prioritization efforts focused more on real time analysis of immediate needs (e.g. cases, testing, hotspots, contact tracing) as well as resource optimization (e.g. track availabilty - doctor, bed etc.).

> *Initially we thought it will not work and everybody will not want to use – we were hesitant and we are working on our system so well for 10 years. But when we started using and were able to integrate it across we finally saw value and transparency was created, which saved our time.*
>
> **— Dr. Amita Jain, KGMU, Department of Medical Education and Training, UP**

Leveraging the right partners, agile methods and communication

The TSU leveraged local vendors for the initial development efforts very effectively. As the understanding of the potential scope of the platform developed and with the lockdown being imposed (resulting in concerns on availability of the required HR including specialists), the TSU was extremely cautious of the limitations of continuing to work with a local technology partner. With the increasing scope of the platform, the TSU team made a proactive decision to shuffle technology (tech) partners, transitioning from the local vendor to seasoned technology partners. The decision to bring experienced technology partners onboard without delay and splitting responsibilities across partner organizations, helped the TSU to successfully develop the envisioned agile digital solution. The key criteria kept in mind while finalizing a partner were – ability to deliver on time, flexibility, professional expertise and competency and innate credibility based on past experience across projects. The Bill & Melinda Gates Foundation was able to extend timely assistance in this regard, by successfully seeking partner support from the digital partner eco-system.

This ecosystem of partners, with very different sensibilities and strengths was able to successfully adapt and work together across the back-end and front-end teams on a war footing. Additionally the ability of the local leadership across organizations to converge efforts, helped set the tone across teams – internally and externally to build a strong partnership.

Trust, freehand and unwavering support from the donor partner

Like most other partners, The Bill and Melinda Gates Foundation, had initially not envisioned that the state will develop an end-to-end data surveillance platform, especially given the high sensitivities around COVID-19 data and the minimal requests for support from GoUP. But once there was a better understanding around the scope and potential scale of the challenges at hand, the Foundation extended complete support to the TSU so that that they could 'do whatever it takes to support the state government to get through this pandemic'.

The donor agency's flexibility, confidence, and eventually ability to bring together various technology partners, laid the strong foundation to implement plans to bring into life the proposed vision for the state. This helped the teams involved in the COVID-19 support work, to balance the efforts regarding immediate needs versus taking a step back and continuously thinking about the big picture requirements.

Think big, act small, scale fast and implement all that is envisioned

Theories of change that rely on multiple modules may struggle if only some of these modules are scaled. The fundamental guiding principles adopted during development of this platform included a modularized approach around development; obtaining quick acceptance on the first cut and using the interim time as a proxy for user testing; ensuring a single source of data entry from the beginning; work-flow based design with content localization and colloquialization to make the work of every user easier; strongly adopting the principle of data minimization; extending role based access, and focusing on the 'low hanging fruit' while evaluating trade-offs.

Ensuring a human touch to drive digital adoption and ensure accurate reporting

The success of this platform and its increased adoption can be attributed to the value that was found by the users, making it a more bottom up, organic adoption, rather than a mandatory requirement imposed by the government.

Building capacity by adopting new modes of training

Whether it was conducting trainings in small groups or the advent of remote training via different mediums – the platform developed would have not achieved the scale it has, had effective training not been undertaken and new approaches to train not used. This includes:

- *Challenging the status quo around the frequency and need for physical training:* Replacing day-long in-person

trainings to train staff on new technology or leveraging a Training of Trainer model - all these methods were replaced by short Zoom training sessions. This might still be a challenge from a skill set training perspective, but was extremely helpful for knowledge sharing and disseminating information around continuously changing guidelines as well as live demonstrations around the use of the platform.

- *Learning at one's own pace and comfort*: Short videos (1-2 minutes) were created by breaking the work flows into sub categories and tasks for the field teams. This ensured quick adoption and uptake. WhatsApp was used for dessimination of these videos, thus enabling learning on the move.
- *Refresher training:* Leveraging easy to use and view short videos posted on youtube or circiulated via social media platforms, to refresh one's memory by actually referring to training material as a visual aid, while at work or even at home

Hand holding, troubleshooting and extending need-based support

The ability to troubleshoot as per the user's convenience went a long way in adoption of the platform. The responsive nature of support and the patience with which queries were handled helped the staff feel supported and motivated. Different mechanisms were setup to support troubleshooting efforts, these include:

- Dept. of Health
  - Three teams at the Directorate comprising of Joint Directors and Medical Directors interacted with the team at the district level for clinical and platform-related queries
  - Second level functionaries from various health programs at the Department became a sounding board for Data Entry Managers at the district and facility level
- UP TSU
  - The Core Digital Health Team extended support to senior officials as required
  - District Family Planning Specialist (DFPS) TSU functionaries – provided handholding support for data entry and updation
  - A team of 6 dedicated staff members, were made in charge of 3 divisions each (since the Surveillance platform was launched in March 2020) with their contact details circulated shared across districts during Zoom calls as well as WhatsApp
  - Four team staff members were assigned each for the Lab Module, Facility Module, Surveillance Platform and monitoring the dedicated COVID-19 platform email ID- upcovid2020@gmail.com as the nodal points of contact in case various staff members supporting teams on the field or the field teams directly wanted to reach out for module-specific questions. Whatsapp groups were also formed with different state/district officials

Timely Government Orders to build confidence and empower District teams

During an emergency response, reporting becomes a double-edged sword in people's minds, and it becomes crucial to promptly address that. While significant efforts were made to develop a simple, user-friendly platform as well as training the officials working on the periphery to realize that there was merit in being transparent the case updates, the state officials also promoted the use of the platform. The PS, Dept. of Health made considerable effort to encourage reporting by releasing Government Orders and iterating the need to be transparent around updating the status of COVID-19 cases, during VCs. The message became clear, 'Reporting is good' – 'if

> *Portal plays a very important role in prevention against COVID-19 given that it is the only portal used across the entire state, with different users being given access. Its user-friendly display and categorization of data fields with a selection menu wherever possible make it easy to operate all functions and helps with prioritization. Since data is line listed it allows helping with disease surveillance for expected seasonal diseases as well"*
>
> **— Sanjay Kumar, District Data Manager, IDSP Unit, Bareilly, UP**

you report now, yes there will be pressure to do contact tracing and the focus might move to your district', but you will be supported in every step and reporting now is better than handling an unmanageable surge in cases later on.

Ownership around Data Quality at district level

The platform has certain built-in validation checks (automated basic data quality checks) in place, which were extremely important since data is being sourced in multiple different formats by different user types. It was ensured that the district level staff took ownership for the data reported. This was due to the sensitivity of the data reported, as well as, the platform's ability to activate the next step for a different user, based on the data entered. The 'data entry' to 'data visibility' cycle being near real time ensured data quality at source.

Everybody wants a dashboard … but what about the data?

As the pandemic spread starting mid-March 2020 a number of digital dashboards mushroomed with elaborate visualizations including, extent of spread, hotspots, with gender and age-based analysis etc., these dashboards were based on aggregated datasets with manual feeding of data. GoUP release that such an approach would not be a long-lasting solution and there was a requirement to build dashboards with intrinsic datasets. Accordingly, a bottom-up approach was adopted for development of the Dashboard, rather than a top down approach. Though the design and concept for the dashboard were worked earlier on, the development and integration was initiated much later, once the State was satisfied that it had regular real time intrinsic flow of data from the Surveillance platform.

> *It was extremely tiring to segregate every result type manually - negative, indeterminate, and positive and then sharing timely information around these while also managing samples coming in. For instance, I think we save a 9-hour lag, for instance, earlier if I got the test results for a batch at noon we would upload the final at the end of the day at 9 pm ..but now because of batch processing we can enter test results at 12:10 pm itself. Since it is the same platform for everyone, now we do not have to enter all details related to the patient, we can keep the focus on our job. Maybe ICMR can also think about making the process simpler by only making us record basic patient details, this is giving us the confidence to perform our work and transparently update data.*
>
> ***— Dr. Vikram Senior Resident Incharge, Updation RMLIMS*, UP**

Key Recommendations - What were some of the core challenges

Short term view on the platform architecture selected

Since the initial development efforts were undertaken by a local tech vendor, as the scope of the platform increased the team realized that the initial choice of the vendor may not be commensurate with the platform scope that was eventually developed e.g. technical choice of leveraging the particular development platform resulted in additional effort at a later stage, lack of use of data standards to drive semantic interoperability etc. Due to the inherent selection of the data architecture for the platform, the limited time to adapt/make significant changes and lack of awareness around Data standards e.g. MDDS, EHR, FHIR, SNOMED CT, LOINC, DICOM - the tech team was unable to (a) adopt these data standards and (b) could not pro-actively leverage modularized data architecture models such as microservice architecture. Few best practices that could be adopted before initiating development include reviewing the technical architecture, framework and data standards that the vendor uses while selecting local vendors, developing a pre-requisite checklist for any development efforts undertaken going forward, identifying few technical experts (in-house/on-call) to provide guidance around the work being outsourced to the technical vendor.

Challenges on the field – platform, process and people

Some of the platform-specific concerns include the platform not being mobile responsive and system performance issues faced on the ground. Few process-specific concerns include confusion around the process to rectify data reporting mistakes on the platforms, few districts assigning referral cases to facilities, post getting lab results without registering them at the district level as well as duplication of data reporting efforts for labs due to the lack of integration with ICMR. Some of the core people-specific concerns include the need for recognition of the district officials to drive motivation levels, concerns around job security for DEOs and unprecedented work-life situations due to the lockdown as well as the nature of the disease.

Challenges faced across partner organizations

The TSU team was supported by Gramener and Beehyv from a technological and data visualization perspective. Since three partner organizations were involved in the requirement gathering and development efforts, some of the challenges faced include - lack of physical interaction, varied comfort levels across different communication methods, limited time for documentation and limited understanding of each teams' competencies and internal challenges. These inefficiencies resulted from a combination of challenges – some of which can be attributed to working in demanding and high-pressure situations, especially in remote partnership models; some due to the expectation mismatch around skillsets across teams, while others, of course, are beyond one's control.

Capacity Building within the Department

There is a need to undertake specialized leadership training for program roles similar to the SSO and DSO in order to equip the Government officials, to lead any program intervention end-to-end at the state/ district level. This will help the officials to make informed decisions under pressure and create a sense of ownership and accountability, enabling them to to make real time decisions and drive its implementation. Specifically at the state level, there is a need to have a dedicated Digital team, which leads, manages and supports development of systems and platforms across health programs. In the absence of such an instutituationalized structure within the Government, much of the digital efforts (requirements gathering and developed) were led by the TSU itself. The proposed IT Cell and State Digital Health Mission will be a step in the right direction.

Lack of effective Direct to Consumer engagement (D2C)

Majority of that content developed for GoUP and partners was not effectively customized and deployed via D2C platforms such as Whatsapp, Telegram, Facebook etc. This could have helped drive engagement with the local citizens as well as healthcare staff, in an easy to use manner, facilitating one-way and even two-way communication. This could be something that could be prioritized to unify D2C efforts across healthcare programs going forward.

Challenges in Center-State integration of platforms

The state team along with the TSU made significant efforts to share data with the GoI's – ICMR platform, S3 Portal over a few months to avoid duplication of efforts within the state. While there were certain technical issues (e.g. use of ICMR Surveillance ID), consistent push for the State ensured that the Unified COVID Platform was integrated with ICMR as well as S3 Portal for seamless sharing of data by July 2020.

No formalized process during data collection to obtain Consent of the beneficiary

Though the Pandemic Act gives the flexibility of not seeking *Patient consent* while collecting data. However, it would be a good standard practise to build in the consent form as part of the application while seeking details.

Way Forward

The Digital platform has given GoUP the confidence to adopt digital systems across the continuum of care.

Develping a roadmap for the state of UP with respect to the existing platform and its use for COVID-19 and for surveillance in the short-medium term is of extreme importance for the state. The modularized architecture of the platform ensured that the exponential increase in data capture and functionalities thereof, were seamlessly handled during the second wave.

Platform-specific enhancements

Functional Changes

The platform has evolved over a period of time based on the changing protocols and the ground situation. For instance, a separate Airport module was developed to track travelers entering the state; similarly, with home isolation protocols coming into vogue in mid-July 2020, the work flow of the application had to be modified for the same; with the setting up of the State Death Audit Committee, a Death Audit module has been developed. The platform has responded to these protocol changes with agility and would continue to do so as the situation evolves over the next few months.

Data architecture re-design

There are plans to leverage data standards as recommended in the NDHB, within the system to drive semantic interoperability, as well as review the data architecture of the existing platform to support plug and play architecture and configurability. The idea also is to review the source code and complete documentation. There is also a need to create separate backend for labs and facilities so that labs, facilities and surveillance can be scaled independently. This would help building a generic, modularized surveillance platform in the context of UP for undertaking intense surveillance efforts for any other disease outbreaks. This process has already been initiated at the time of writing this report.

Additional Data Analytics to be undertaken

While the current focus has been on ensuring real-time data reporting and drawing actionable insights to drive governance, there is immense scope to conduct more rigorous data analytics. This may include:

- Case Analysis w.r.t Age, Gender, Comorbidity, Severity, Symptoms, Population Density
- Contact/Case Relation Analysis w.r.t contacts testing positive/negative
- Intervention Analysis (w.r.t Case properties) such as medicines given, self-quarantine
- Supply and Demand Analysis across Health workers, Facilities, Equipment, Test Kits
- Indirect Transmission Trends Identification across area/time and other case parameters
- Analysis w.r.t other states in the country/countries to see growth and other parameters to introduce intervention methods
- ML Models using historic and other data to choose intervention methods, to predict stats, be better prepared, clinical/epidemiology-based data analysis

Center-State integration efforts

The state team along with the TSU faced a challenge, in sharing data seamlessly with the GoI – ICMR platform, S3 Portal to avoid duplication of efforts within the state. The integration was possible only in July 2020. The onus lies with GoI to take this opportunity and follow the principle of Federated Architecture as recommended in the National Digital Health Blueprint (NDHB) wherein data is anonymyzed at source and only relevant aggregate information is shared at the central level. This is actually an opportunity for the Central and State Government to start testing and implementing these principles with a few select states, before it is rolled out across the country.

> *I feel that the way the portal was launched in this hour of disaster COVID-19, it is highly commendable, it helped the state government and the districts for monitoring. It is a good initiative to make the departments paperless. From time to time, many diseases occur, monitoring of the same should be done in this way..*
>
> **— Suraj Kumar Yadav, Data Entry Operator, IDSP Unit, Varanasi, UP**

Ensuring continued data reporting going forward

With the expected evolution of the platform, going forward there may also be a change in the roles, processes and team structures of the users/ teams leveraging the surveillance platform. While so far, the state machinery's focus was on COVID-19, this single-track focus will change for each official and be split between supporting COVID-19 efforts as well as other programmatic efforts. The state will need to enforce strict utilization of this platform for COVID-19 and other surveillance efforts with certain checks and balances put in place e.g. regularized reviews, continue to use the platform for data collection and report generation, regular audits, etc. to keep the momentum.

Transitioning the system to the Department

Once the situation stabilizes, the Government along with the TSU team will need to work towards transitioning the system to the concerned Departments. A plan of action will need to be developed and a few of the factors that could be considered include data hosting, identifying a team for additional development, maintenance as well as oversight on data quality.

> *COVID 19 Data portal is a very good step by the Dept. of Health and very useful for the district regarding surveillance and monitoring of cases. We hope that it will update from time to time as required.*
>
> **— Dr. Sarfaraj Ansari,**
> **Epidemiologist, Auraiya, UP**

Evolution of the Platform from COVID-19 to a UP State Surveillance Platform for Vector Borne Deseases

For any surveillance effort in the state, largely seamless data flow across these three modules – outreach based surveillance groups, lab, facility will be required. The agility with which the platform has been developed facilitates inter-linkage across keys stakeholders including administrative staff, facilities, and laboratories (private and public). In case GoUP decides to transition this platform as a surveillance system for the state going forward, there will be a need to incorporate some technical design and development changes to be able to ensure seamless change/configure the protocol with minor modification to workflow and no significant changes to the code base. These changes are already underway, with technical changes being made to the platform to incorporate microservice architecture. This will be followed by leveraging necessary data standards to drive semantic interoperability.

Since the NDHB also mentions the component of Surveillance in its building blocks and architecture design, this platform can fit in extremely well for the Surveillance component within the NDHB design. The state may also make the source code of this platform publically available *for other states/center* to use, as per their requirements.

Health system strengthening: Carrying forward the momentum across other healthcare programs

The GoUP has successfully demonstrated its ability to leverage technology effectively. The Dept. of Health and Dept. of ME, with the guidance of the Chief Minister's office, has effectively managed to develop, implement, and drive state-wide adoption, of this integrated COVID-19 platform. The platform also continues to successfully adapt to the constantly evolving and changing scope and requirements, given the inherent challenges specific to the state.

This has helped break the age-old myth that (a) UP and (b) scalability and sustainability of digital innovations cannot go together, further increasing the faith across the various departments to adopt technology as an enabler to deliver healthcare service delivery at the last mile. The Government is now actively thinking about leveraging these learnings across programs to achieve the envisaged objectives of the National Digital Health Mission.

The successful implementation of this platform at scale has increased GoUP's confidence around the adoption of digital initiatives to improve health service delivery at the last mile. For the UP Government and leadership, in order to move towards developing Electronic Health Records, it would be key to have a separate Government budget allocation for these efforts. From a health system strengthening perspective, some of the key takeaways from the recent experience with the COVID-19 platform include:

Line listing of data at source

There is a growing consensus within the Dept. of Health to collect unit-level data at source instead of driving digitization of aggregate data

Beneficiary centric design

There has been an increased understanding around the importance of leveraging the principle of data minimalism, keeping a beneficiary lens in mind while capturing data fields to ensure complete EHR for each beneficiary can be maintained using a unique ID instead of focusing on data collection purely from a monitoring point of view

Importance of using data standards across systems

Immense value has been found by the state as well as end-users in developing work-flow based, modularized systems. There has also been increased understanding around the importance of leveraging data standards to drive semantic interoperability to ensure a seamless exchange of data across systems

Strengthening existing health systems

Various Government officials have increasingly realized the need to strengthen HR, Supply Chain and data systems across the state and will be working towards increasing the adoption of these systems across the state

EHR

Various Government officials have become open to streamlining processes to identify how the patient data collected across programs, links back to electronic health record of the individual and/or becomes the first unique electronic source for health information collected for that patient. Thus, there is a strong motivation to establish and scale up ICT-based individualized health records in the state

Training

There is a need to continue to sustainably leverage remote training platforms and effective troubleshooting mechanisms. In addition other innovative training approaches may be reviewed to build capacity among the staff across digital systems to solve for problems such as sharing collateral which the staff can take home

Registries

There is a need to develop and maintain facility, health worker, etc. registries for the state while continuing to coordinate efforts with the center in line with the recommendations of the NDHM

Telemedicine

The state found immense value in placing doctors within the state – level Call Center and has recognized the value of leveraging telemedicine for providing remote consultation services across different diseases while ensuring linkage to last-mile healthcare facilities

These are some of the key levers which can help the state leapfrog and move towards developing Electronic Health Records and Personal Health Records (beneficiary life cycle focused) for patients in the state of UP.

Stakeholder Consultations

Government of Uttar Pradesh:

Pooja Pandey (IAS) – Director, Administration, Department of Health and Family Welfare, UP

Dr. Amita Jain – Head MicroBiology Lab KGMU, Department of Medical Education and Training, UP

Dr. Vikasendu – State Surveillance Officer (SSO), Department of Health and Family Welfare, UP

Dr. Mohit Singh - Department of Health and Family Welfare, UP

Professor (Dr.) Jyotsna Agarwal – COVID-19 Laboratory Incharge, Head of Microbiology Department at RMLIMS, Lucknow, UP

Dr. Yash Agarwal – Nodal COVID-19, Kaushambi, Department of Health and Family Welfare, UP

Dr. Vikram – Senior Resident Incharge, Data Updation RMLIMS, UP

Sanjay Kumar – District Data Manager, IDSP Unit, Bareilly, Department of Health and Family Welfare, UP

Suraj Kumar Yadav – Data Entry Operator, IDSP Unit, Varanasi, Department of Health and Family Welfare, UP

Dr. Sarfaraj Ansari – Epidemiologist, Auraiya, Department of Health and Family Welfare, UP

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Dr. Vikas Yadav	:	Senior Program Officer
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BeeHyv

(Technical Partner for the Unified CoVID Platform)

Suresh Gopalakrishnan	:	Founder & CEO
Haritha Reddy	:	Chief Knowledge Officer
Sai Rahul	:	Program Manager
Anuranjan Kumar	:	Technical Lead

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(Implemented by University of Manitoba and India Health Action Trust)

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Gramener
Insights as Stories

(Technical Partner for Decision Making Dashboard)

Anand	:	Program Manager
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