Office of the Principal Scientific Adviser
to the Government of India

RICH
Research and Innovation
Circle of Hyderabad

COMPENDIUM ON
HEALTH

Acknowledgement

The Government of India established the Office of the Principal Scientific Adviser (O/o PSA) in November 1999. The O/o PSA aims to provide pragmatic and objective advice to the Prime Minister and the cabinet in matters of Science and Technology. The O/o PSA was placed under the Cabinet Secretariat in August, 2018. The O/o PSA serves as a high-level advisory body providing strategic guidance and scientific advice to the government on matters of science, technology, and innovation. The primary objective is to align scientific advancements with national development goals and address complex challenges across different sectors. The O/o PSA coordinates and facilitates scientific efforts across ministries and departments. It plays a pivotal role in formulating science and technology policies, fostering collaboration between academia, research institutions, and industry, and promoting innovation-driven solutions.

Prof. Ajay Kumar Sood

Principal Scientific Adviser to the Government of India

We extend our heartfelt gratitude to Prof. Ajay Kumar Sood, Principal Scientific Adviser to the Government of India, for his unwavering support provided to Science and Technology clusters (S&T clusters). His leadership as Chairperson of the PM-STIAC has been pivotal in advancing scientific innovation and fostering collaboration across industry, academia, and government. Prof. Sood's dedication and contributions to science and technology, recognised by numerous prestigious awards, continue to inspire and drive S&T clusters' mission and progress. His expertise and vision are invaluable in formulating impactful policies for advancing the R&D ecosystem in India. His dedication to addressing national challenges through scientific advancements has led to promoting sustainable development and substantial impact on the nation's scientific landscape.

We express our deepest appreciation to Dr. Parvinder Maini, Scientific Secretary at the Office of the Principal Scientific Adviser, for her exceptional support. Her invaluable efforts in expanding the R&D ecosystem, shaping crucial policies, and fostering collaboration among industry, academia, and government have been remarkable. Under her guidance, initiatives such as the Regional S&T clusters, One Health mission, and National Deep Tech Policy have flourished. Dr. Maini's extensive experience and unwavering dedication to advancing science and technology have significantly contributed to S&T clusters initiatives. Her continued work serves as a beacon of inspiration and progress within the scientific community and for S&T clusters.

Dr. Parvinder Maini

Scientific Secretary, Office of the Principal Scientific Adviser to the Government of India

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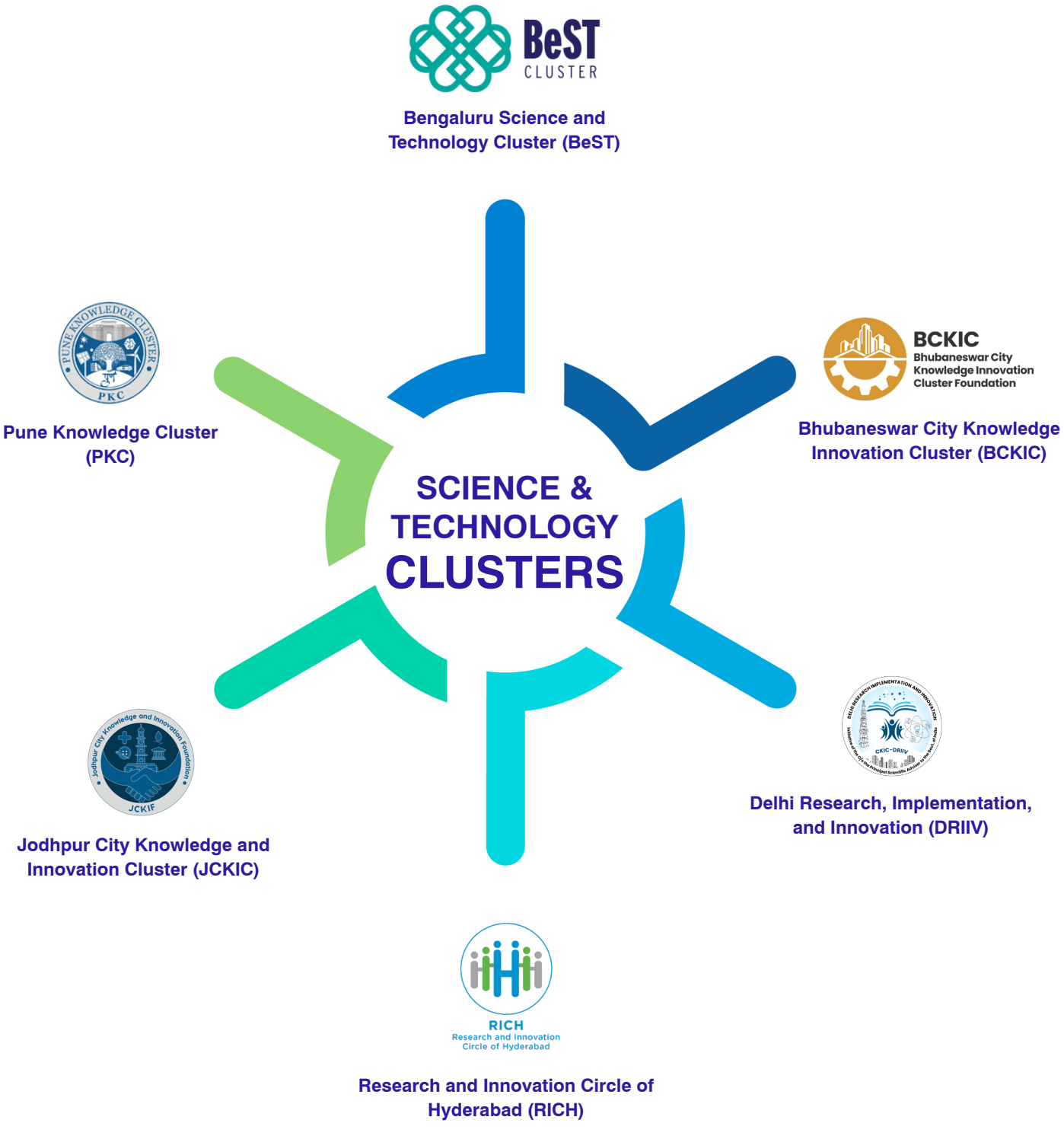
1. Introduction

The Union Budget observed that many of our cities have various research institutions, universities, and colleges supported by the Government of India. Hyderabad for example has about 40 such major institutions. It proposed setting up formal umbrella structures, Science and Technology Clusters (S&T clusters), so that these institutions can have better synergy, while also retaining their internal autonomy. Seven such S&T clusters have been initiated under the Office of PSA at Bengaluru, Bhubaneswar, Chandigarh, Delhi, Hyderabad, Jodhpur, and Pune. In the below figure, six clusters working on the Health theme are highlighted. These clusters are supported by the O/o PSA on the recommendation of the Prime Minister's Science, Technology and Innovation Advisory Council (PM-STIAC) to create an Atmanirbhar Bharat through Science and Technology.



Science and Technology clusters of India working on Health Theme

The initiatives of S&T clusters in India align to the objectives defined by the O/o PSA for S&T clusters which includes the following:

i) Building of a shared ecosystem in the region:

At the foundation of this framework lies the notion of fostering a collaborative environment. The S&T clusters created strong linkages between existing academic institutions, national & state research laboratories, and other stakeholders like relevant ministries, industry partners, start-ups, MSMEs, state governments, philanthropic foundations, and international organizations. Key aspects of this ecosystem include facilitating the exchange of research and innovation between institutions and industry in turn fostering industry-academia collaboration.

ii) Becoming a regional solution provider:

Moving up the pyramid, the focus shifted to S&T clusters serving as problem solvers for local entities, state governments, and industries, thus exerting a regional influence. To achieve this, partnerships with local business incubators, state Science & Technology councils, and innovation societies were essential. By addressing local challenges through rigorous research, development, and innovation, the S&T clusters became key players within respective regions.

iii) Becoming nationally and globally competitive:

At the pinnacle of the pyramid, each cluster focused on domains where they possess significant strengths, aiming to excel nationally and internationally in these areas. This entailed aligning with the objectives of the Government of India's national missions and actively participating in large-scale national and global scientific endeavors.

Objectives of Science and Technology clusters of India

By leveraging the existing strengths and enhancing the competitiveness, the clusters positioned themselves as Science & Technology enablers for various thematic domains in both national and global stages. One such domain that is captured in this compendium is Health. The importance of health in India is immense, and addressing health challenges through comprehensive policies, innovative solutions, and integrated approaches is essential for the country's sustainable growth and development.

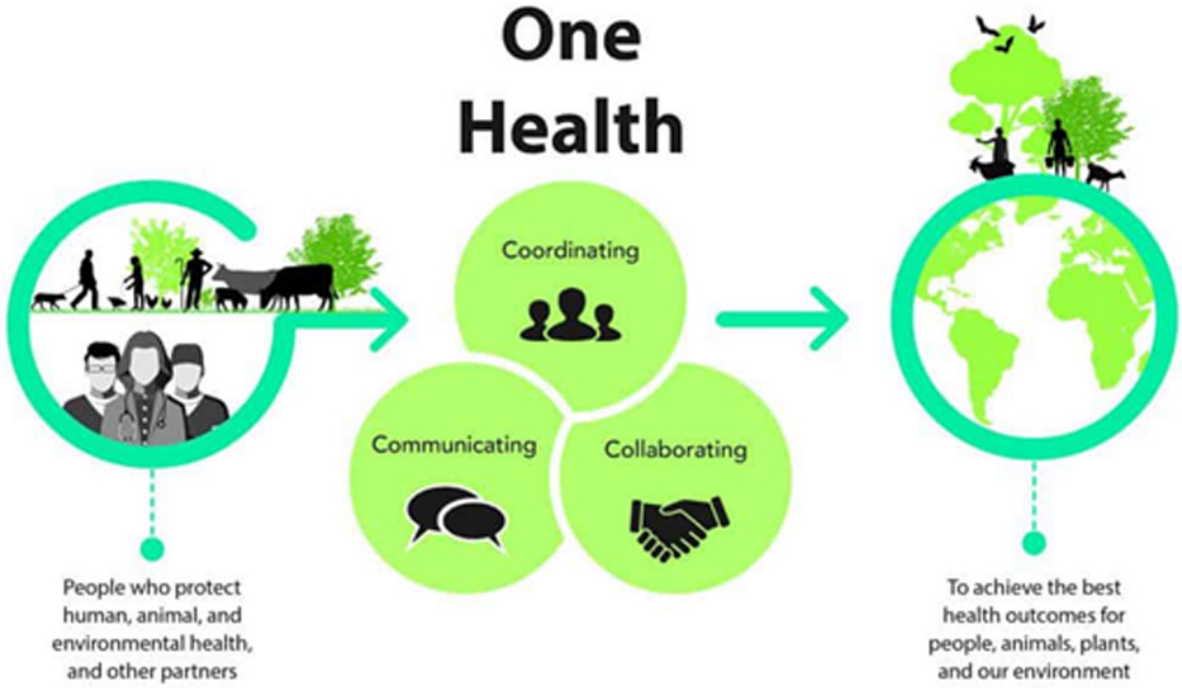
2. Executive Summary

In India, the importance of health transcends personal well-being and stands as a vital pillar for economic growth, social stability, and national progress. The COVID-19 pandemic starkly highlighted this reality, revealing the profound impact health has on every aspect of society. The health of the population influences educational achievement, workforce productivity, and overall societal resilience, making health a crucial area for sustained investment and innovation. A healthy population is the backbone of economic productivity.

India faces a formidable burden from both communicable and non-communicable diseases. Addressing these health challenges requires robust policies and innovative approaches. The National Health Mission (NHM) plays a pivotal role in this context, striving to provide accessible, affordable, and quality health services to the rural and urban populations. By significantly improving healthcare infrastructure and delivery, the NHM aims to bridge the healthcare gap across the country. The Ayushman Bharat Digital Health Mission (ABDM) represents a transformative step towards embracing digital health solutions. By creating a robust digital health ecosystem, ABDM aims to improve healthcare access and efficiency through electronic health records, telemedicine, and health information systems. This digital transformation is crucial for a country with vast geographical diversity and a large population, ensuring that healthcare services are more streamlined and accessible.

The ABDM Ecosystem

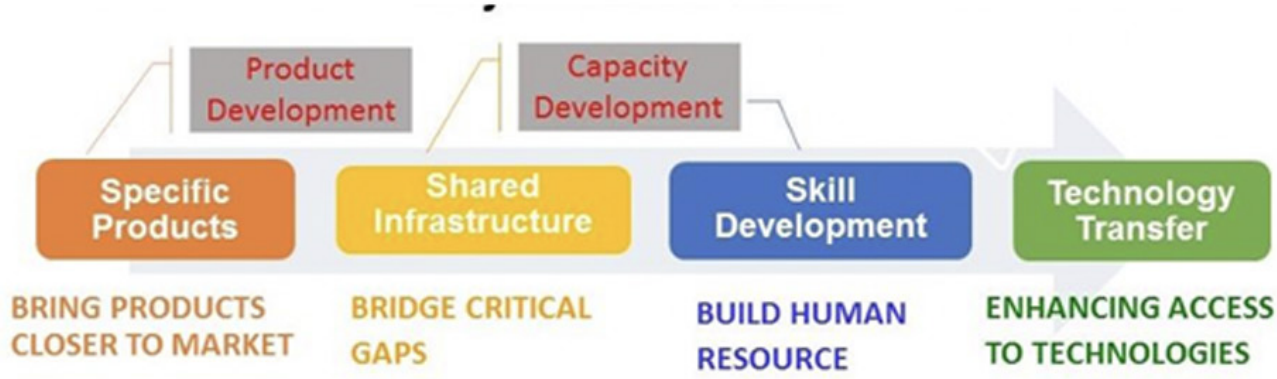
The COVID-19 pandemic has highlighted the necessity of environmental and zoonotic health issues that require integrated and collaborative approaches. The National One-Health Mission addresses the intersection of human, animal, and environmental health, tackling challenges such as zoonotic diseases and antimicrobial resistance. This holistic approach ensures a comprehensive strategy to health threats that transcend traditional boundaries, fostering a more resilient health system. A subset, vector-borne diseases remain a significant public health challenge in India. The National Vector Borne Disease Control Programme (NVBDCP) is dedicated to controlling diseases like malaria, dengue, and chikungunya. Through focused efforts on surveillance, prevention, and treatment, NVBDCP plays a crucial role in reducing the incidence and impact of these diseases, protecting the health of millions. Effective disease surveillance is vital for early detection and response to health threats. The Integrated Disease Surveillance Programme (IDSP) strengthens disease surveillance systems, enabling timely data collection and analysis. This program is critical for monitoring disease trends, detecting outbreaks early, and implementing control measures promptly, safeguarding public health.



The Foundation of One Health. Pic source: Centers for Disease Control and Prevention, USA

Additionally, preventive healthcare is essential for mitigating the rising burden of chronic diseases. There are many National programmes addressing each specific disease in mission mode. One such is the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke (NPCDCS) focuses on early detection, lifestyle modifications, and effective disease management. By emphasizing prevention and management, this program seeks to improve health outcomes and reduce the incidence of non-communicable diseases.

Health innovations are critical in addressing India's unique healthcare challenges. The National Biopharma Mission stands out as a key initiative, advancing biopharmaceutical 7research and development. This mission facilitates the production of affordable and effective medical devices and diagnostics within India, aligning with the broader Make in India campaign that promotes domestic manufacturing and self-reliance, including in the health secto



Objectives of National Biopharma Mission

The health initiatives of S&T clusters encompass a wide range of projects aimed at addressing various national health challenges. Under the COVID-19 and pandemic preparedness initiatives, the Hyderabad Reagents Consortium by the Research and Innovation Cluster of Hyderabad (RICH) and the Pune Knowledge Cluster (PKC)'s comprehensive COVID-19 study in Pune are notable. Additionally, the Delhi Research Implementation and Innovation (DRIIV) developed early warning systems with AI/ML for pandemic preparedness. One Health and Antimicrobial Resistance (AMR) initiatives include Bengaluru S&T Cluster's (BeST) One Health project, PKC's Metropolitan Surveillance Unit and AMR study, DRIIV's AMR tracking dashboard and Bhubaneswar City Knowledge Innovation Cluster's (BCKIC) advanced composites for antibacterial activities. In digital health, initiatives include RICH's clinical data digitalization, DRIIV's AI-enabled clinical decision-making, and BeST's digital health use-case. Disease and wellness interventions feature RICH's biobank creation and genome atlas for cancer, DRIIV's infectious disease screening model, and BCKIC's development of sanitary pads for women's hygiene. Deep-tech startup projects include RICH's Acceleration Initiative for Devices & Diagnostics, BCKIC's IHF Quest Grand Challenge, UK–India Healthtech Bootcamp, and startup technology deployment activities. Lastly, several impactful regional ecosystem strengthening activities by RICH, BCKIC and Jodhpur City Knowledge and Innovation Cluster (JCKIC).

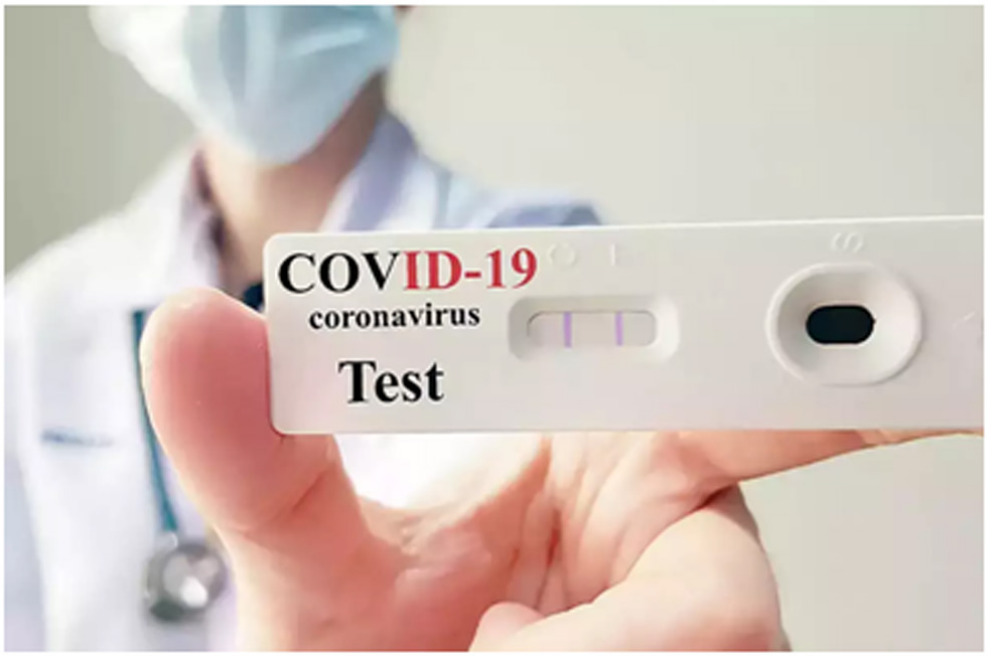
In conclusion, the importance of health in India cannot be overstated and addressing health challenges through comprehensive policies, innovative solutions, and integrated approaches is essential for India's sustainable growth and development. Initiatives like the National Biopharma Mission, Make in India, NHM, ABDM, NPCDCS, National One-Health Mission, and others exemplify the country's commitment to improving health outcomes. Embracing technological advancements, enhancing healthcare accessibility and fostering preventive health measures are the few key steps towards ensuring a healthier future for all citizens.

3. Details of Health Initiatives

3.1 COVID-19 Initiatives & Pandemic Preparedness Initiatives

During the COVID-19 pandemic, S&T clusters implemented a range of initiatives aimed at mitigating the virus's impact and safeguarding public health. These measures encompassed public awareness campaigns, bolstering healthcare infrastructure, and enhancing testing and vaccination efforts. The pandemic highlighted the need for robust healthcare systems and swift, coordinated responses. Moving forward, S&T clusters' focus is on strengthening pandemic preparedness through improved surveillance, better resource allocation, and international collaboration. By leveraging lessons learned, the S&T clusters aim to collaborate to build resilient systems capable of addressing future health crises efficiently and effectively, ensuring the well-being of the Indian population.

3.1.1 Hyderabad Reagents Consortium by Research and Innovation Circle of Hyderabad (RICH)



COVID-19 RT-PCR Test Kits

When "Test-Test-Test" became a universal mantra early in the course of the COVID-19 pandemic, highlighting the critical need for extensive and efficient COVID-19 testing, the urgency of ramping up production of commercially available COVID-19 testing kits, alongside the development of superior, rapid, point-of-care testing kits, became immediately apparent. As the pandemic progressed, a potential bottleneck was identified: the shortage of diagnostic kits, primarily due to the lack of high-quality reagents necessary for their production. Several factors contributed to this issue, including a sudden surge in global demand, risks associated with the price and supply of imported products, and the quality, capability, and capacity limitations of local manufacturers. These challenges underscored the need for indigenous manufacturing of kit reagents and components as a crucial part of the diagnostic manufacturing value chain.

In response, the O/o PSA spearheaded the creation of public-private partnership models aimed at building national capacity for diagnostics. This initiative was implemented through Science and Technology city clusters in Bengaluru, Hyderabad and Pune. RICH worked with the national consortium to support indigenous testing kits, reagents and components available from Indian MSMEs and start-ups.

The consortium was supported by esteemed academic partners such as the CSIR-CCMB (Centre for Cellular and Molecular Biology). The project received funding from the Foundation for Innovative New Diagnostics (FIND) India and Bill and Melinda Gates Foundation (BMGF), which financed the pilot phase.

Aiming high, the pilot phase of this program realized a remarkable achievement by meeting 100% of the local demand for affordable testing kits. High-quality reagents and components are now met by our very own indigenous manufacturers. This milestone isn't just about numbers; it's a testament to the nation's resilience and capability in the face of adversity. Moreover, the consortium has forged a powerful group of Micro, Small, and Medium Enterprises (MSMEs), to name a few, Huwell Lifesciences, Bioserve, Bioartism, Sapala, Promea and others, who united their strengths to serve not just our nation but the world at large. Thus, we stand poised to meet the burgeoning national and global demand, showcasing the immense potential of collaboration and collective action.

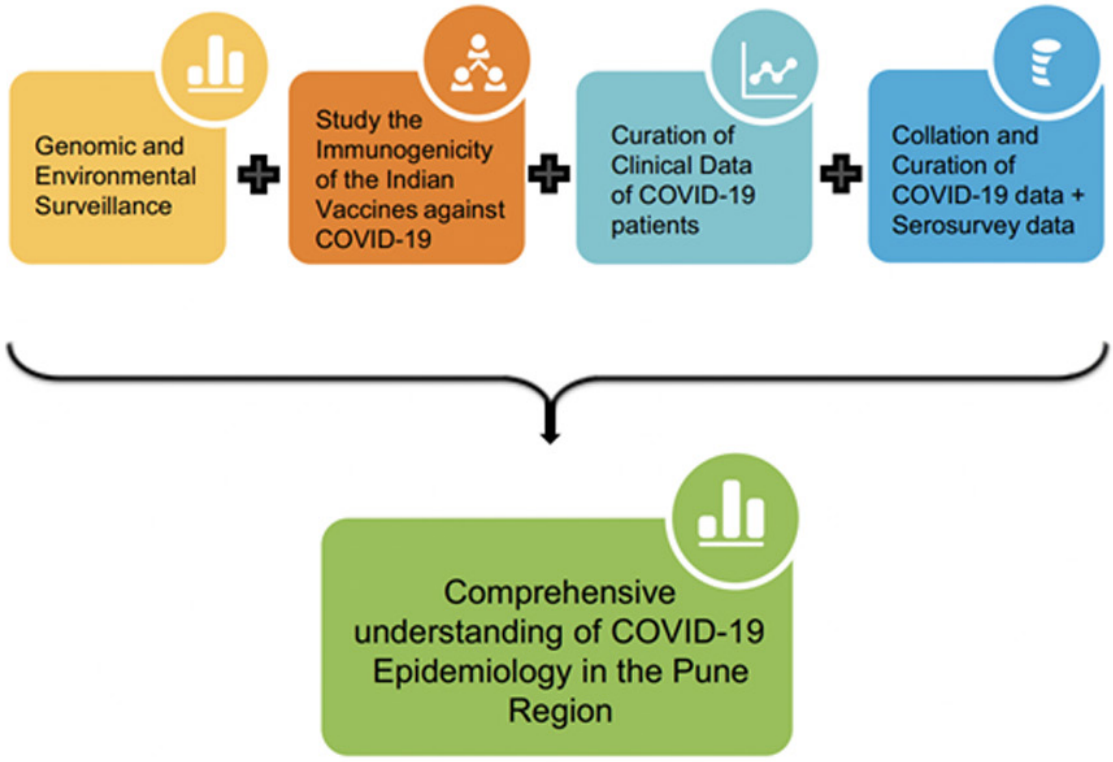
3.1.2 Rejig.Hyd Startups by RICH

A glimpse of impact provided through Rejig. HydStartups Initiative by RICH

Covid-19 pandemic has brought about unprecedented situations worldwide and disrupted what we have known as "normal". Many shops and businesses were affected due to the crisis and some had to close down. Startups, particularly, were struggling due to the economic slowdown caused by the COVID-19 pandemic. Extending a helping hand to these startups, particularly in these times a virtual micro-accelerator program called Rejig.HydStartups initiative was launched. Rejig.HydStartups was an initiative by the innovation ecosystem enablers and incubators of Telangana State, bringing select startups the much required curated support, mentoring, and access to industry and investors during the tough pandemic. About 30 incubators and startup enablers, including RICH, The Indus Entrepreneurs (TiE Hyderabad), Telangana State Innovation Cell (TSIC), T-Hub, CIE-IIIT-H, IKP and several others were part of the initiative. The programme received over 300 startup applications, of which 125 startups were selected to be part of the mentoring programme. This initiative provided help to the startups for a period of 3-weeks to rejig their strategy, refine their pitch and prepare them for investor access and corporate connect demo days. The programme culminated in a startup pitch for equity funding, collateral-free debt funding or corporate market access.

3.1.3 Understanding COVID-19 comprehensively at the Pune city level by Pune Knowledge Cluster (PKC)

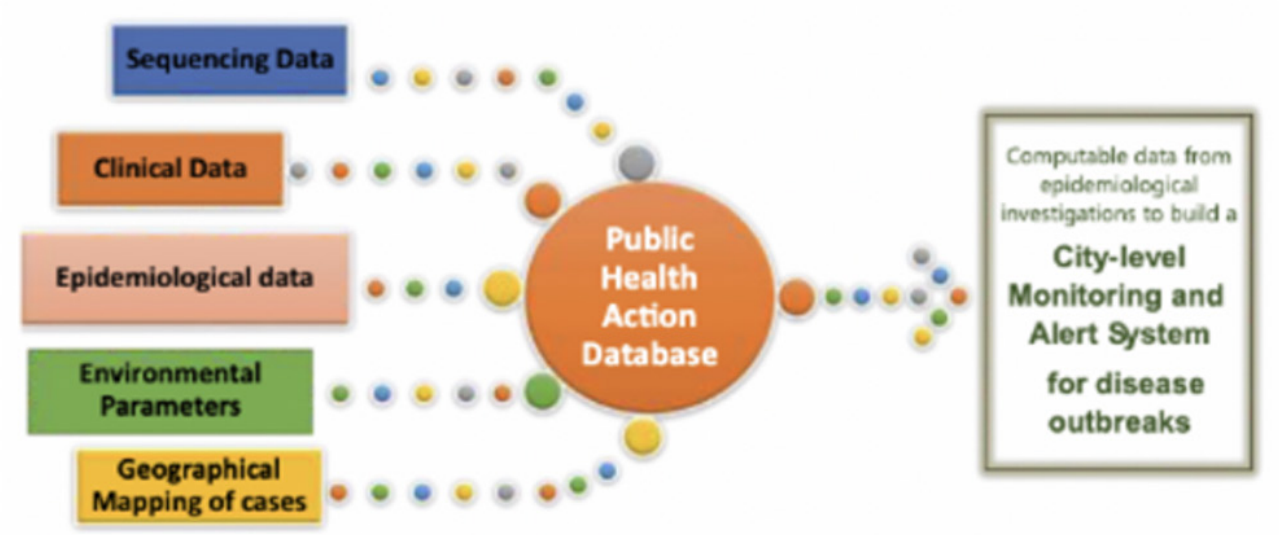
Pune was one of the worst hit cities in India during the COVID-19 pandemic. Being the need of the hour, the Pune Knowledge Cluster played an integral role in supporting the public health system and government strategies aimed at disease containment and management. PKC's COVID-19 efforts focused on comprehensively understanding the epidemiology of the SARs-CoV-2 virus and working toward strategies to mitigate and reduce the disease burden in the Pune region.



PKC's strategy for understanding COVID - 19 comprehensively at the city level

PKC managed five multi-stakeholder COVID-19 projects in the Pune city in collaboration with partner organizations including research institutes, hospitals, pathology labs and government bodies that involved generating data critical for public health decisions such as sero-surveys, clinical, immunological, and environmental surveillance and creating an epidemiological database with comprehensive health information for Pune city and access to real-time data. The individual projects are detailed below:

I. COVID-19 Data Analysis and Forecasting for Pune city

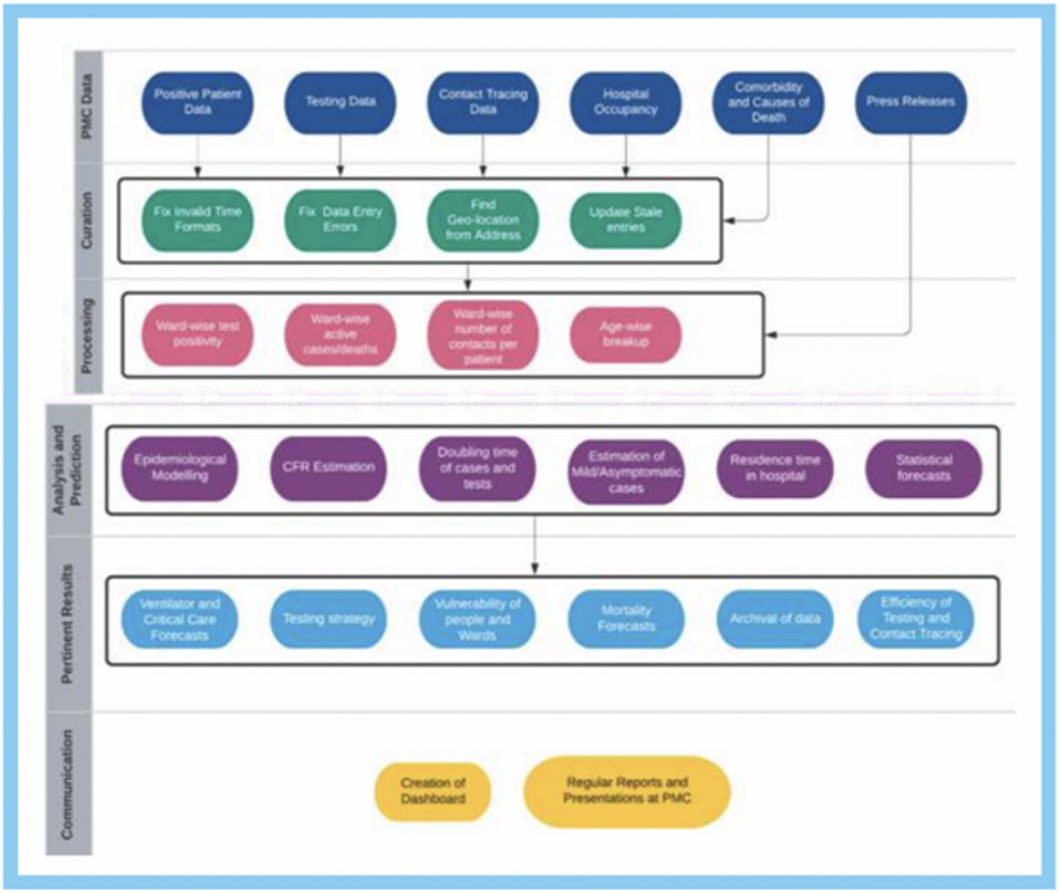


COVID-19 Public Health Action Database for Pune Envisioned by PKC

During the early stages of the pandemic, the Indian Government and the Indian Council of Medical Research (ICMR) collaborated to establish guidelines for the centralized collection of crucial demographic and clinical data, encompassing metrics such as total case count, mortality rates, hospital occupancy, and protocols for clinical management. In Pune city, managed by the Pune Municipal Corporation (PMC), a commendable effort was made to adhere to these government-mandated norms for data compilation from clinics and hospitals. Recognizing the significance of data-driven policies, PMC and PKC (Pune Knowledge Cluster) forged a collaborative agreement in April 2020. This alliance aimed to develop and execute localized strategies based on meticulous analysis of COVID-19 patient data.

PKC's pivotal role in this collaboration was multi-faceted. Firstly, PKC ensured the accuracy and completeness of collected information through rigorous data curation. Then, utilized sophisticated techniques to model the trajectory of the pandemic curve, aiding in proactive planning and response. Then, delved into granular data at the level of Prabhags (sub-regions) to identify localized trends and needs. Additionally, PKC spearheaded a comprehensive project to evaluate the prevalence of positive serology among the population, crucial for understanding the extent of spread and immunity. Lastly, they facilitated the procurement and allocation of essential resources, optimizing their distribution based on data-driven insights. This collaboration exemplifies a proactive approach to pandemic management, leveraging data as a cornerstone for informed decision-making and effective resource utilization.

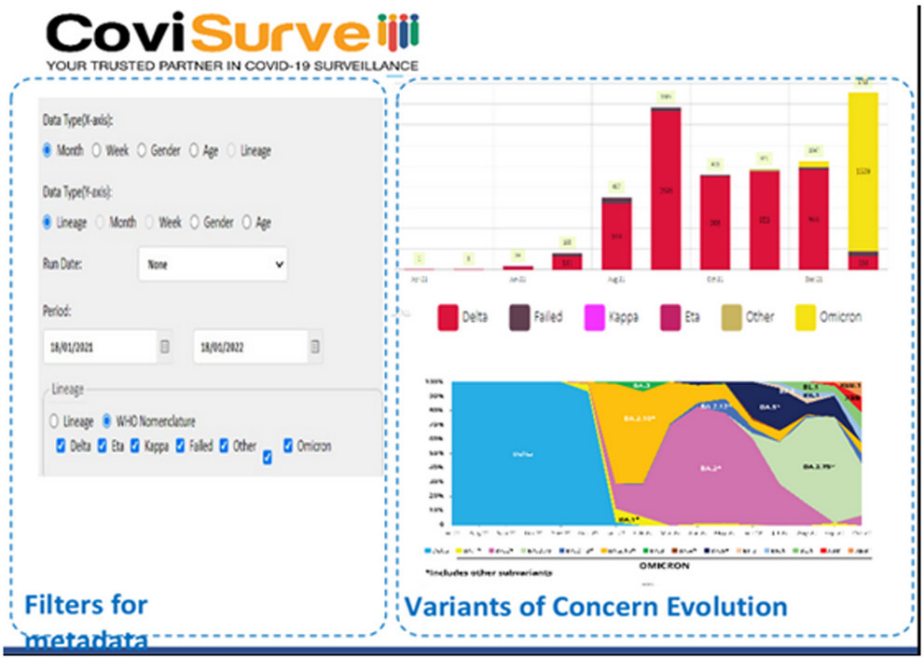
PKC's endeavors in Pune amidst the COVID-19 pandemic have yielded substantial impact across various fronts. A pivotal accomplishment was the development of a publicly accessible dashboard, providing forecasts of COVID-19 incidence at both city and sub-regional levels. Through rigorous epidemiological analysis, PKC assessed the effectiveness of lockdown measures, shedding light on their impact on case rates. Guided by expert forecasting, timely procurement of essential resources like test kits and ventilators, along with the establishment of additional testing facilities and dedicated care centers, was made possible. Moreover, PKC's meticulous data analysis pinpointed COVID-19 hotspot pockets, enabling targeted containment efforts in densely populated areas. These initiatives collectively underscore the critical role of data-driven strategies in mitigating the spread of COVID-19 and safeguarding public health in Pune.



COVID-19 activities undertaken by PKC in collaboration with Pune Municipal Corporation

II. COVID-19 Sero-Survey

A significant portion of SARS-CoV-2 infections go unnoticed due to their asymptomatic nature, highlighting the importance of serological testing to gauge the true prevalence of the virus within a community. In an effort to understand the extent of the pandemic's spread in Pune, sero-prevalence studies were conducted in five high-incidence Prabhags from July 20th to August 5th, 2020



Dashboard of COVID-19 Surveillance

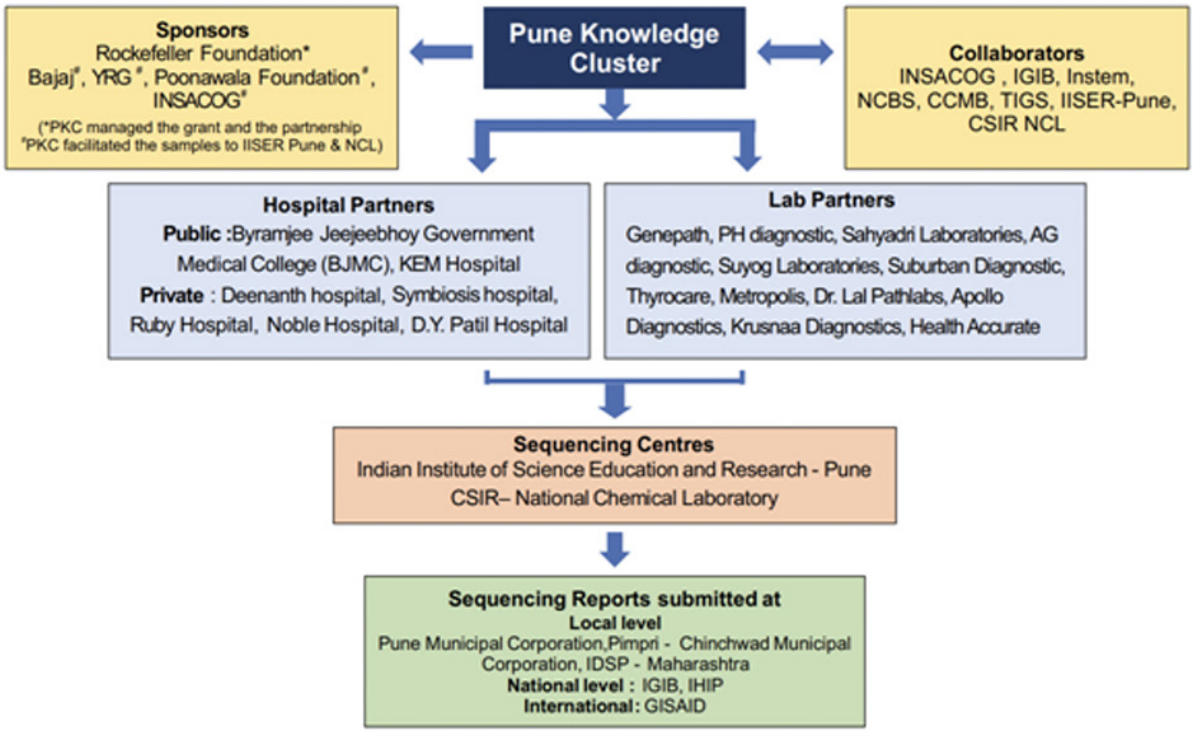
The study was sponsored by the Persistent Foundation, Pune, involved the recruitment of 1664 individuals across the selected Prabhags. PKC played a pivotal role in orchestrating a consortium to execute the project, facilitating fundraising, securing permissions from the Pune Municipal Corporation (PMC), and disseminating data. Collaborating partners included the Indian Institutes of Science Education and Research (IISER), Pune; Savitribai Phule Pune University; Pune Municipal Corporation; Christian Medical College, Vellore; and the Translational Health Science and Technology Institute (THSTI), Faridabad.

The impact of this sero-surveillance endeavor was profound. Analysis revealed a substantial spread of infection within the sampled Prabhags, with a reported seroprevalence of 51.5% (CI: 49.1-53.9%). These findings served as a clarion call to local officials, alerting them to the looming strain on the public healthcare system in the affected areas. Consequently, the city administration took proactive measures to bolster testing and surveillance efforts in these Prabhags, aiming to curb further transmission and mitigate the burden on healthcare infrastructure.

Through collaborative research efforts and proactive response strategies, the serological surveillance study provided crucial insights into the dynamics of SARS-CoV-2 transmission in Pune, underscoring the importance of targeted interventions to contain the spread of the virus within communities.

III. COVID-19 Disease Surveillance (Genomic and Environmental)

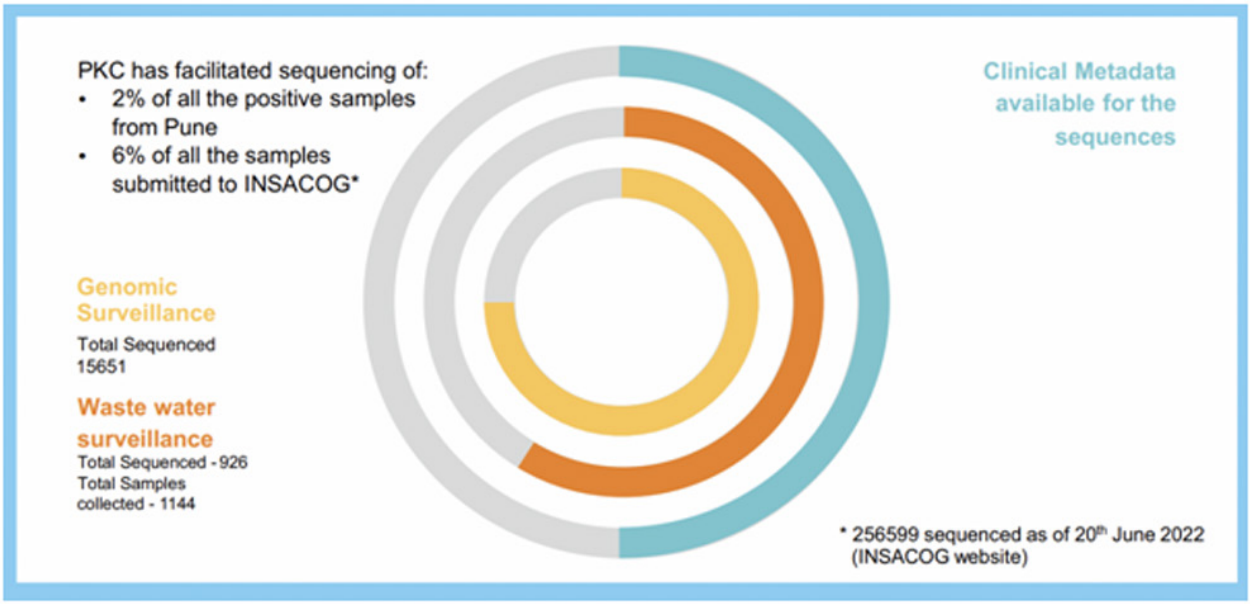
During the pandemic, a national-level consortium called The Indian SARS-CoV-2 Genomics Consortium (INSACOG) was created jointly by The Union Health Ministry, The Department of Biotechnology (DBT), The Council for Scientific & Industrial Research (CSIR) and The Indian Council of Medical Research (ICMR). The consortium consists of premier academic institutes, research institutes, philanthropic groups and industry organizations came together to conduct nationwide genomic sequencing and bioinformatics - based research.



Information and sample flow for Environmental surveillance & Clinical Sample Variant surveillance

PKC as part of this consortium helped synergize a multi-stakeholder collaboration in Pune to upscale genomic surveillance by ramping up sequencing efforts and bioinformatics. Genomic sampling strategy was based on epidemiological data and clinical meta-data. PKC facilitated prospective, clinical, and retrospective sequencing of samples with a focus on vaccine breakthroughs and reinfection cases. Experts correlated the epidemiological dynamics and clinical outcomes of patients and aided in the implementation of appropriate public health and medical countermeasures. Environmental Surveillance focused on the collection and analysis of sewage and wastewater samples from various parts of the city to complement human surveillance and enable early detection of disease, considering that a large proportion of infected people are asymptomatic.

This is the first study in India to demonstrate the utility of sequencing in wastewater-based epidemiology to identify mutations associated with SARS-CoV-2 virus fragments from wastewater as an early warning indicator system. The emergence of new SARS-CoV-2 outbreaks on a community level can be monitored through wastewater surveillance. Combined with clinical testing, sentinel surveillance and epidemiological data, wastewater surveillance for SARS-CoV-2 can help track and identify the virus at an early stage and also estimate its geographical spread and intensity of transmission.

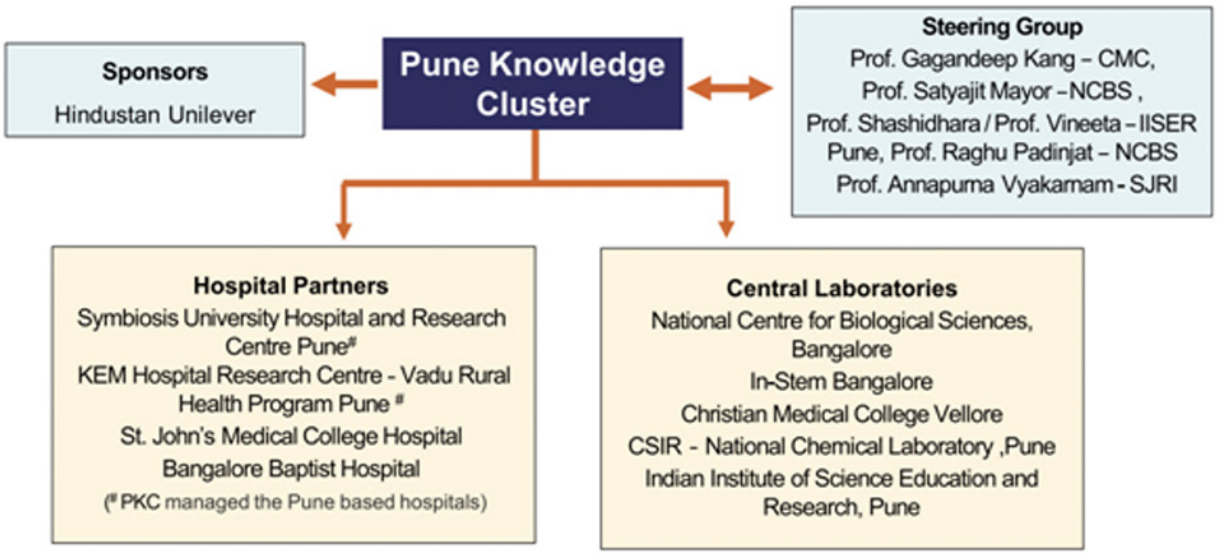


COVID-19 Surveillance (Genomic & Environmental) facilitated by PKC

The Rockefeller Foundation sponsored this pivotal project where PKC played a key role in spearheading crucial aspects from stakeholder identification, selection to sample acquisition and standardization of sample collection procedures. PKC's meticulous approach ensured the integrity and quality of the data, further bolstered by the establishment and maintenance of a comprehensive data depository. Integral to the project's success was PKC's adept handling of fund and people management, ensuring seamless operations. Weekly reports submitted to PMC provided regular updates, while data dissemination to the Pune Platform for COVID-19 Response (PPCR) and other key stakeholders empowered informed decision-making at the city level. Notably, PKC facilitated the sequencing of 2% of all positive samples from Pune, contributing significantly to India's COVID-19 sequencing efforts. Furthermore, the efforts led to 6% of all data submitted to the Indian SARS-CoV-2 Genomics Consortia (INSACOG), underscoring PKC's pivotal role in advancing genomic surveillance and public health response strategies. This project also led to 4 scientific publications.

IV. COVID-19 Long-Term Immunogenicity Study

The kinetics and longevity of immune responses generated by COVID-19 vaccines in the Indian population are not completely understood. To bridge this knowledge gap, a research study for multi- dimensional understanding of immune responses to SARS-CoV-2 was conducted in two cities including Pune. The primary objective of the study was to understand differences in magnitude and longevity of humoral and cellular immune responses generated after vaccination with Indian vaccines for COVID-19 in individuals with or without evidence of prior SARS-CoV-2 infection based on sero-positivity.

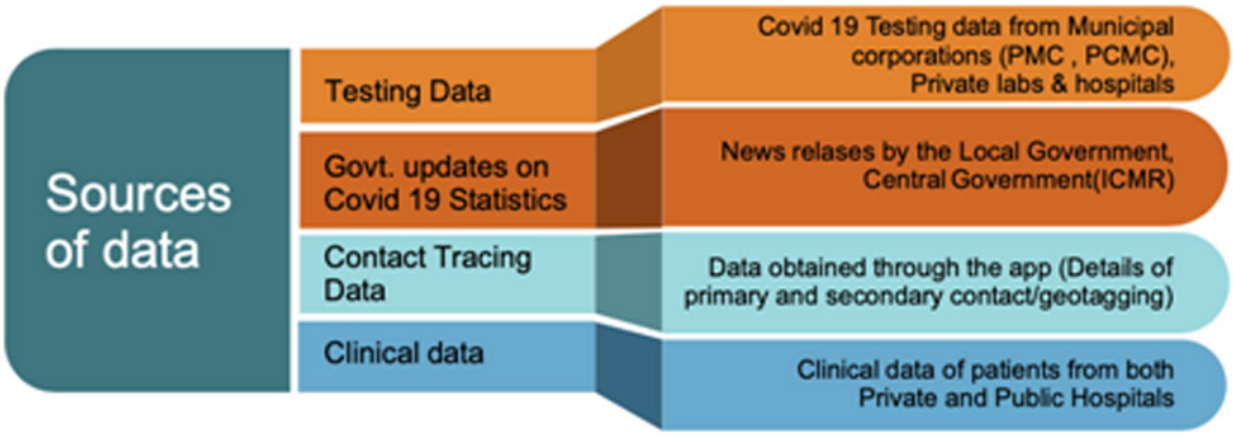


Organizations Involved in the COVID-19 Long-Term Immunogenicity Study

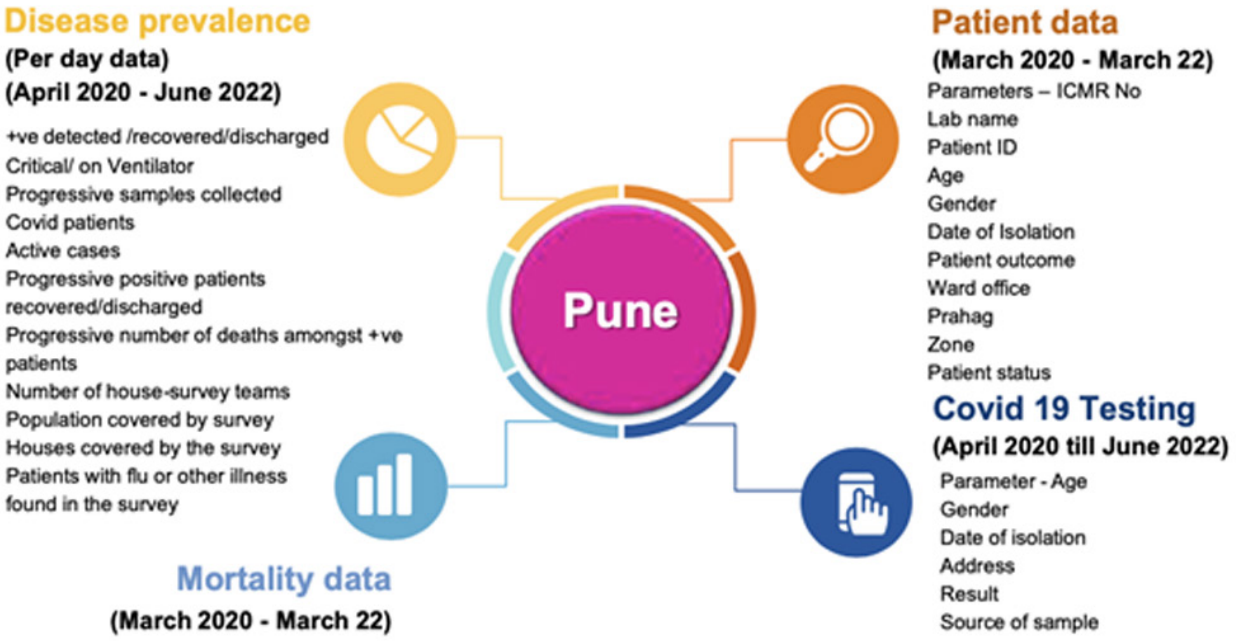
In collaboration with Hindustan Unilever Ltd. as sponsor, PKC played a pivotal role in the successful execution of this project. PKC's contributions encompassed multifaceted tasks, including the identification and selection of stakeholders, development of Electronic Case Report Forms (eCRFs), and crafting Standard Operating Procedures (SOPs) for sample collection and clinical investigations. With a focus on efficient fund and people management, PKC facilitated seamless operations throughout the 9-month study period. Acting as a crucial link between trial sites, laboratories, and stakeholders, PKC ensured smooth coordination and communication channels. The impact of this endeavor is profound, with over 300 individuals participating in the study, generating valuable insights into the role of innate immunity, microbiome, and micronutrient biomarkers on the immune response to COVID-19 vaccines within the Indian subpopulation. Currently, manuscripts are under preparation to document these insights. As of now, Phase 1 of the project stands completed, marking a significant milestone in the journey towards combating the COVID-19 pandemic.

V. COVID-19 Epidemiological and Clinical Database for Pune

PKC has used a data driven approach to understanding and implementing measures for COVID-19. Over the past 2 years, PKC in collaboration with hospitals, research organizations and civic bodies in Pune has collected and curated data for COVID-19 at various levels. This includes data for disease prevalence, hospitalized patients, testing and mortality. PKC also worked to build comprehensive open source databases consisting of epidemiological, clinical and genomic data for COVID-19 which can be used by researchers and civic authorities to build city level models for understanding disease impact and progression.



Sources of COVID-19 Data Collected by PKC



Types of COVID-19 Datasets Collected by PKC

PKC collaborated with esteemed institutions and medical facilities such as Byramjee Jeejeebhoy Medical College, AG Diagnostics, Sahyadri Hospital, Symbiosis University Hospital and Research Centre in Pune, and Noble Hospitals and Research Centre and technology providers in the healthcare industry, including EPIC-Health Information Management and Strand Life Science for this project.

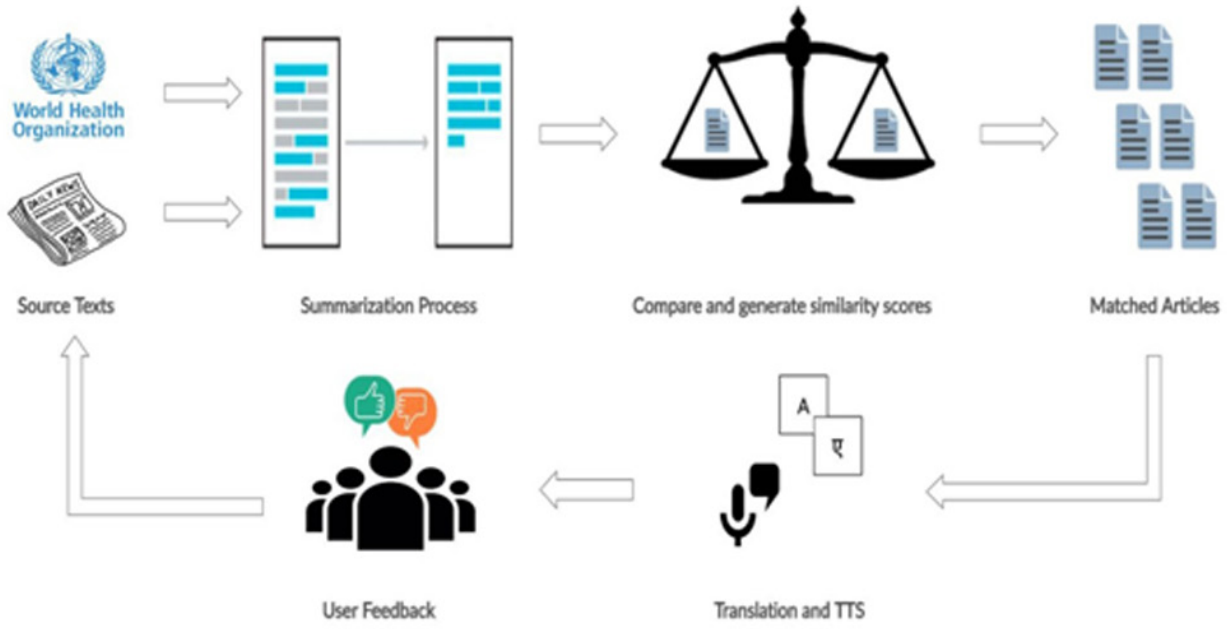
PKC has enabled the collection of clinical data for 11000+ patients and digitization of this clinical data is in progress to build a comprehensive database that can be used for analysis.

3.1.4 Pandemic Preparedness: Early Warning Systems with AI/ ML by Delhi Research Implementation and Innovation (DRIIV)

During the pandemic, DRIIV has implemented two projects based on collective 18multi-sectoral response with systems thinking and coordinated local execution. They demonstrated the need for an effective digital backdrop that connects stakeholder organizations and ensures a rapid response towards mitigation of pandemics / epidemics in a concerted manner.

I. WASH KARO engine: ML-based application for raising WASH awareness in the times pandemic

The COVID-19 pandemic has revealed the power of internet disinformation in influencin global health. The deluge of information traveled faster than the epidemic itself and was a threat to the health of millions across the globe. Health apps needed to leverage machine learning for delivering the right information while constantly learning misinformation trends and deliver these effectively in vernacular languages in order to combat the infodemic at the grassroot levels in the general public.



NLP Pipeline used in building the WashKaro App

DRIIV in collaboration with IIIT Delhi created WashKaro which was incorporated in Delhi Corona App, Govt. of NCT, Delhi, a multi-pronged intervention for mitigating misinformation through conversational AI, machine translation and natural language processing (NLP). WashKaro provides the right information matched against WHO guidelines through AI, and delivers it in the right format in local languages. Additionally, they have come up with several strategies in a short interval of time to raise awareness among the people regarding the Coronavirus and have furnished tools that can help them maintain a safe distance from the disease.

II. Early warning systems for pandemic outbreaks by Integrated Federated Healthcare Platform

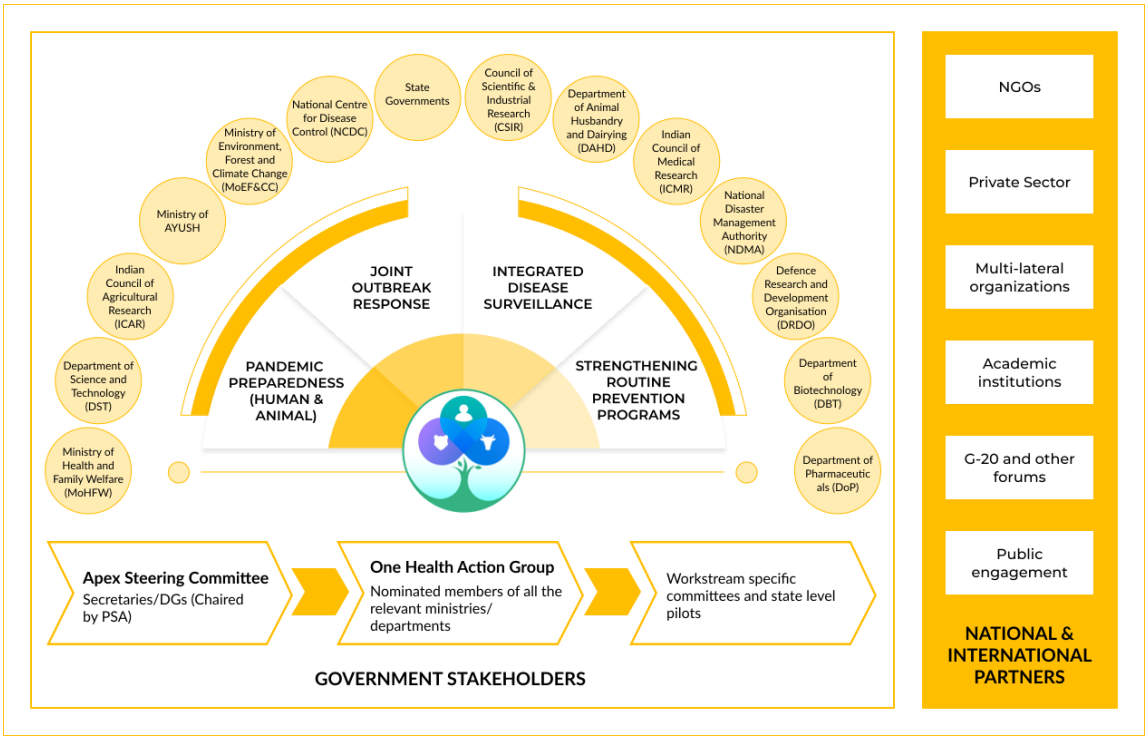
DRIIV in partnership with Integrated Federated Healthcare Platform built a comprehensive COVID-19 AI stack comprising of 3 dashboards i.e. Strainflow, Evidenceflow and VacSIM. These models were taken up by ICMR.

Strainflow dashboard focussed on AI Based Genomic Surveillance model for surge prediction with 2 month lead-time which accurately forecasted case surges in all three waves in India.

EvidenceFlow enables evidence mining using Artificial Intelligence by capturing and predicting emerging COVID 19 research trends for actionable insights. The dashboard is an open-source interactive web application built upon COVID-19 specific literature vetted by the WHO for tracking literature trends using alluvial diagrams, projection of influential entities, and network analysis across different months. The dashboard assists the user to understand the current and upcoming trends in the literature.

A COVID-19 vaccine was the best bet for mitigating the pandemic. However, vaccines were a limited resource. An optimal allocation strategy was necessary especially in countries with access inequities and temporal separation of hot-spots for effectively halting the disease spread. To solve this problem a novel pipeline VacSIM that dovetails Deep Reinforcement Learning models into a Contextual Bandits approach was developed for optimizing the distribution of COVID-19 vaccine.

3.2 One Health & Antimicrobial Resistance (AMR) Initiatives



The National One Health Mission undertaken by O/o PSA

The National One Health Mission undertaken by O/o PSA aims to coordinate across sectors for achieving overall pandemic preparedness and integrated disease control against priority diseases of both human and animal sectors, with early warning systems built on integrated surveillance system and response readiness for endemic as well as emerging epidemic or pandemic threat. Additionally, the mission envisions to address critical pillars of preparedness in the form of targeted R&D to develop important tools, such as vaccines, diagnostics and therapeutics, readiness in terms of clinical care, streamline data and information linkages and access across sectors as well as close community participation to keep Nation's readiness to respond. Aligning to the One Health Mission, S&T clusters have undertaken initiatives with an aim to create an integrated one health system, uniting practitioners and scientists to monitor pathogens in the dynamic urban environment.

Additionally, antimicrobial resistance (AMR) presents a growing global and national health threat, undermining the effectiveness of antibiotics and other antimicrobial agents essential for treating infections. This resistance leads to longer illnesses, increased mortality, and higher medical costs. As bacteria, viruses, fungi, and parasites adapt and survive exposure to these drugs, the urgency to address AMR intensifies. S&T clusters have initiated projects that are crucial to monitor, prevent, and mitigate the impact of AMR, ensuring the continued efficacy of treatments and safeguarding public health. These projects bring in collective action and comprehensive strategies that are imperative to combat this escalating challenge and protect future generations from untreatable infections.

3.2.1 One Health by Bengaluru Science and Technology Cluster (BeST)

BeST is building a network of practitioners and scientists who will engage with and inform policy makers, city planners, health authorities, NGOs, municipal bodies and citizens to minimize infectious and zoonotic disease risks to people and mitigate the challenges that novel outbreaks may bring.

Namma Bengaluru - One Health

The short-term impact is to generate data for designing effective vector control strategies, develop predictive and pre-emptive models for zoonotic and vector-borne diseases, conduct environmental surveillance of Bengaluru's lakes and promote awareness of the interactions between biodiversity, climate change and disease among citizens. Citizen scientists will be actively involved in data collection and monitoring efforts. The broader impact envisaged includes establishing a One-Health framework for Bengaluru, fostering interdisciplinary research to address local issues, encouraging multisectoral collaboration for enhanced health and well-being and improving outbreak awareness and preparedness among the community.

The participating institutes and potential collaborators for this initiative include a diverse array of organizations: Bruhat Bengaluru Mahanagara Palike (BBMP), Bangalore Chamber of Industry & Commerce (BCIC), National Centre for Biological Sciences (NCBS-TIFR), Indian Institute of Science (IISc), Molecular Solutions Care Health LLP, Tata Institute for Genetics and Society (TIGS), ATREE, Biodiversity Collaborative, Indian Institute of Public Health, Ashoka University, Biome Environmental Solutions, Bengaluru Sustainability Forum, Initiative for Climate Action, Centre for Cellular and Molecular Platforms (C-CAMP), and The Echo Network.

Photos taken at the Launch of BeST's One Health Bengaluru City Consortium

In this regard, BeST launched the 'One Health Bengaluru City Consortium' on 3rd March 2023 as a significant first step towards the goal of integrating existing one-health efforts, facilitating collaboration, and building a one health framework for the city of Bengaluru. Representatives from 25+ organizations consisting of researchers, academicians, technologists, industry experts, practitioners, policymakers, city planners, health authorities, not-for-profit organizations, and civic officials were gathered.

3.2.2 Metropolitan Surveillance Unit by PKC

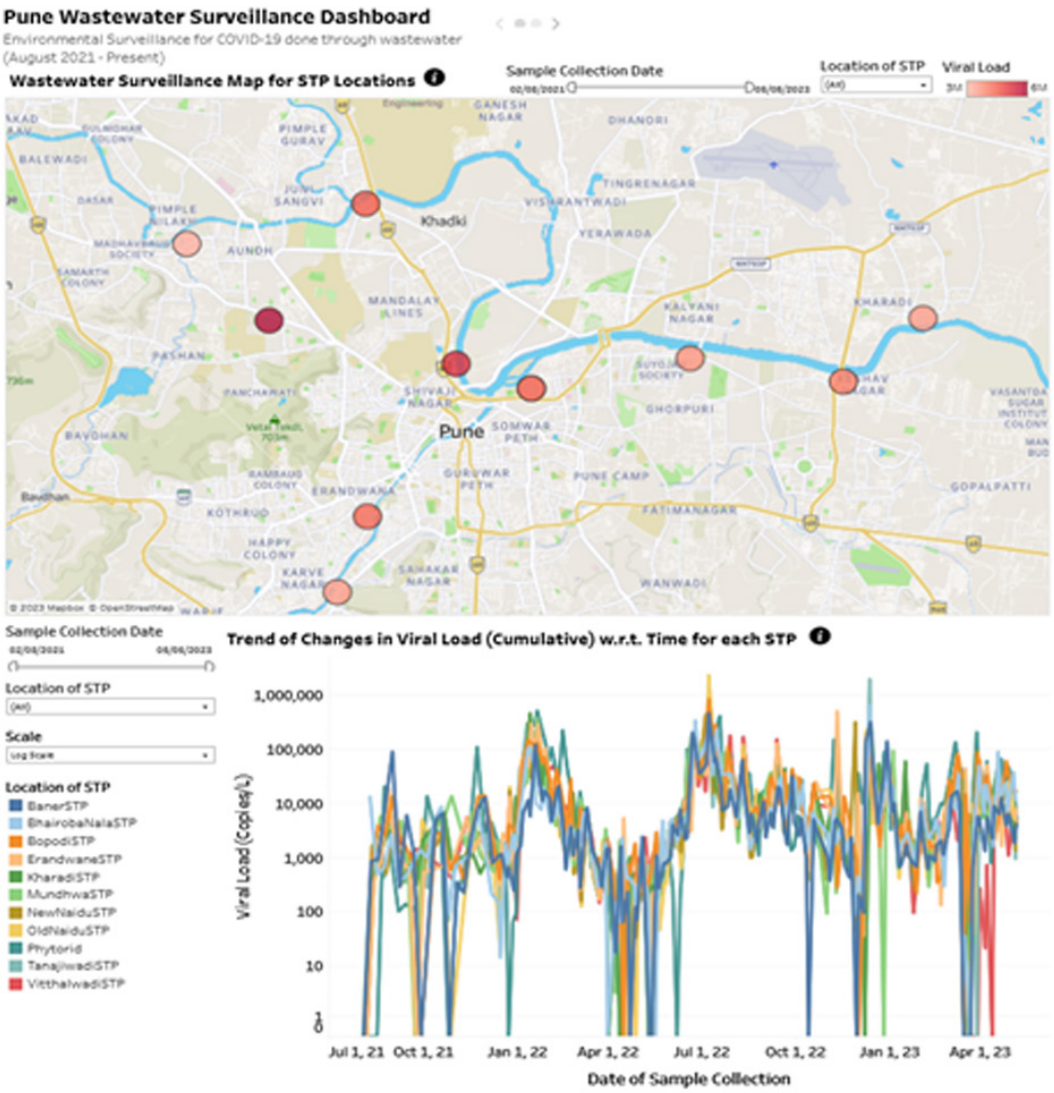
As part of PM Ayushman Bharat Health Infrastructure Mission, PKC is part of the central government's pilot project under the Integrated Disease Surveillance Programme (IDSP) with the latter funding the campaign. Under the project, to strengthen surveillance of infectious diseases and outbreak response, 20 Metropolitan Surveillance Units (MSUs), 5 Regional National Centre for Disease Control (NCDCs) and implementation of Integrated Health Information Platform (IHIP) in all states. Pune is one of the 20 MSU sites and PKC is working with the PMC to establish the MSU in collaboration with Jhpiego. PKC hosted a closed-door meeting with PMC, Jhpiego and other partners on the 27th of July 2023 to discuss the development plan of MSU.

3.2.3 Antimicrobial Resistance Study by PKC

Antimicrobial Resistance (AMR)

AMR poses a critical global health threat, undermining the efficacy of antibiotic treatment in clinical settings. Pathogenic bacteria, linked to various diseases, display variable AMR patterns influenced by regional antibiotic usage. Prolonged and widespread antibiotic application in human and animal healthcare, alongside inadequate waste disposal, fuels the emergence and dissemination of AMR. The interconnectedness of global travel facilitates swift microbial transfer, exacerbating the spread of AMR. This complex challenge demands interdisciplinary efforts on a worldwide scale. As resistance escalates, treating common infections and conducting life-saving procedures becomes increasingly precarious, prompting international initiatives and governmental actions emphasizing the pivotal role of surveillance in combating AMR. Regular monitoring across diverse environments and attention to potential zoonotic sources are imperative for effective intervention.

In 2023, PKC and its Pune partners aimed to comprehensively map the prevalence of AMR. The initiative involves supporting the Delhi cluster through leveraging hospital connections to furnish Antibiograms. Utilizing Whole Genome Sequencing (WGS), the project identified genotypes of AMR in clinical hospital inpatients, hospital environments, and animal sources, employing molecular surveillance for bacterial pathogen sub-groups.



Pune Wastewater Surveillance (WWS)

This initiative enhanced regional collaboration between Pune and Delhi clusters and strengthened efforts to combat AMR by facilitating the sharing of resources and information. Advanced genomic surveillance, utilizing Wastewater Surveillance (WWS) and Whole Genome Sequencing (WGS) technologies, allowed for the precise identification and cataloging of AMR genotypes, providing crucial insights for tailored interventions. Additionally, the holistic approach of studying bacterial pathogens and AMR genotypes in diverse settings, including animal sources such as raw milk, contributed to a comprehensive understanding of AMR prevalence. This broader understanding will aid in the development of targeted mitigation strategies, ultimately improving public health outcomes.

3.2.4 Dashboard to track Antimicrobial Resistance by DRIIV

In the process of developing a Scalable, NDHM compliant and AI-enabled Antimicrobial Resistance (AMR) Tracker, DRIIV along with PKC in collaboration with AIIMS developed an AI enabled data port, analytics and federated AI platform for predictive modeling in re-emerging epidemics data visualizations. Additionally, temporal tracking of AMR is aimed to be carried out upon specific datasets. This portal was created from an antibiotic resistance database of 0.7 million records globally. It is an android app based on active surveillance of AMR. The nationalized AMR dashboard on UTI infections based on data across 20 cities is being launched with ICMR.

Antimicrobial Resistance (AMR) Tracker

3.2.5 Advanced Composites for Enhanced Antibacterial Activities by Bhubaneswar City Knowledge Innovation Cluster (BCKIC)

Nanomaterials such as silver nanoparticles and graphene-based composites are known to exhibit biocidal activities. However, interactions with surrounding medium or supporting substrates can significantly influence this activity. The proposed project is aimed at developing various quantum engineered alloys, composites which can be used as antimicrobial agents and can also complement and reduce the usage of major metals like copper with easily available ones like aluminum. The lead institute for the project is IIT, Bhubaneswar. The partners for the project are research and academic institutes such as, Institute of Chemical Technology (ICT), Mumbai, CSIR - Institute of Minerals and Materials Technology (CSIR-IMMT), National Institute of Science Education and Research (NISER), Bhubaneswar, Kalinga Institute of Industrial Technology (KIIT) University, Bhubaneswar and Industries such as, Nalco and Karma Tech.

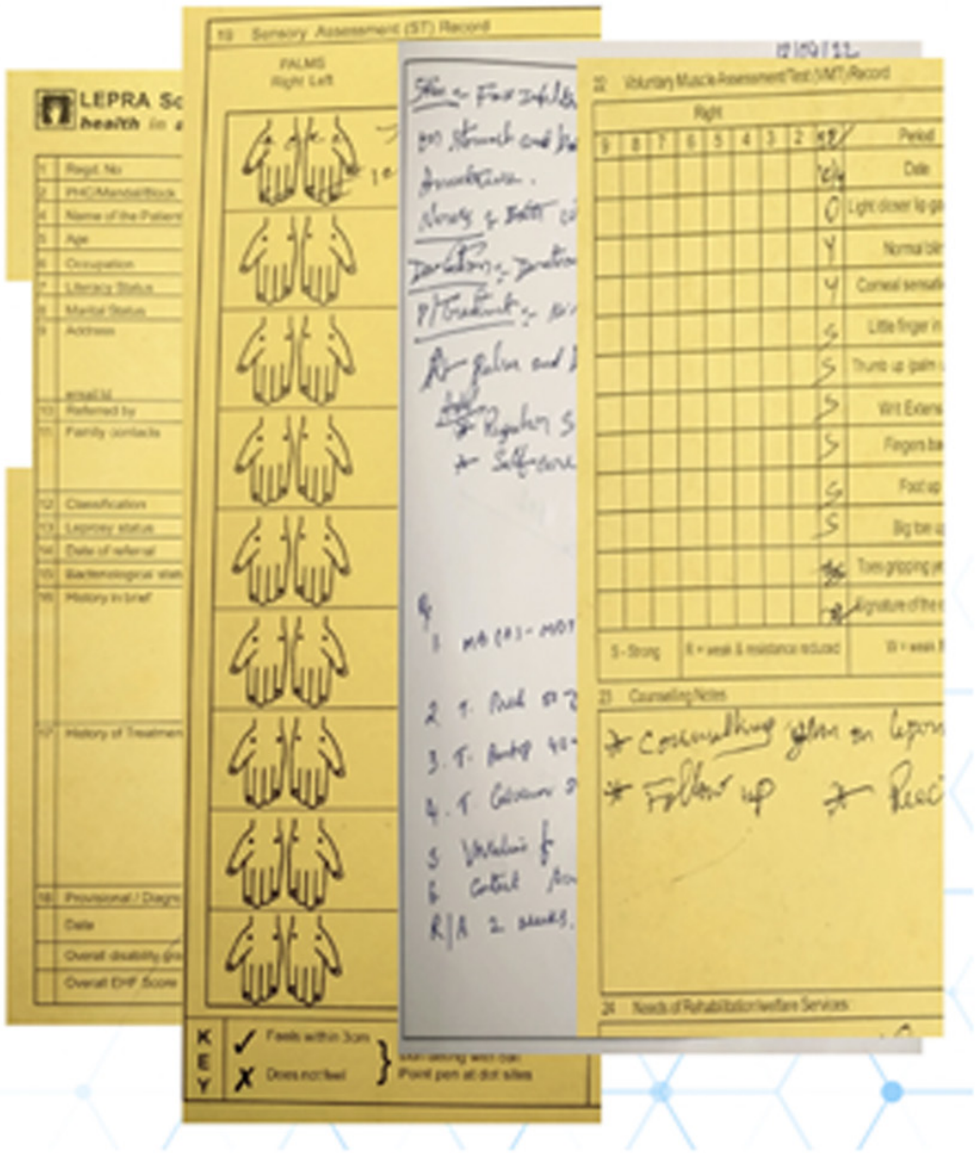
The project aims to prepare and characterize graphene oxide. Followed by process optimization for coating the surfaces. The crux of the project is to compare and validate graphene oxide coated metals for antimicrobial properties with respect to bare metals. The developed prototype will also be validated for cost economics. The results of the project can lead to new graphene oxide coated antibacterial metal surfaces for important environmental and biomedical applications.

3.3. Health Data Digitalization & Digital Health Initiatives

The digitalization of health data and the implementation of digital health initiatives are crucial for advancements in modern healthcare. These efforts streamline the management and accessibility of patient information, enhancing the efficiency and accuracy of medical services. By digitizing health records, healthcare providers can improve patient outcomes through better coordinated care and timely access to critical information. Additionally, digital health initiatives foster innovation in medical treatments and preventive care, empowering patients with tools to manage their health proactively. Thus S&T clusters have taken up pilot projects to demonstrate the transition to digital health systems which promises significant improvements in healthcare quality, accessibility, and cost-effectiveness.

3.3.1 Digitalization of Clinical Data Use-Case by RICH

RICH initiated a partnership between The LEPRA Society and IIIT-Hyderabad's INAI institute to embark on a transformative project to digitize over two decades of clinical data. This initiative aims to create a comprehensive digital tool and database that will revolutionize the management and analysis of LEPRA Society's extensive patient records.



LEPRA Society's extensive patient records

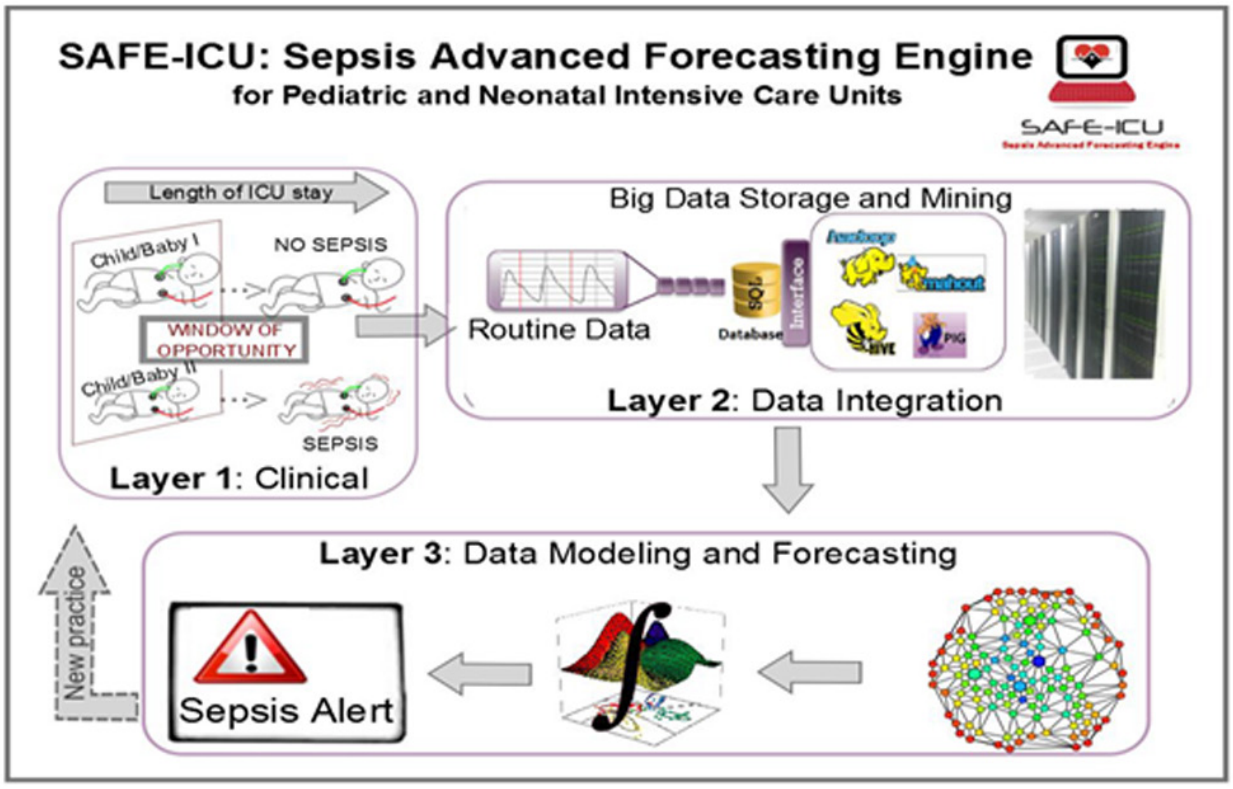
The LEPRA Society, a leading organization dedicated to the prevention and treatment of leprosy and other neglected diseases, is collaborating with the Applied Artificial Intelligence Institute (INAI) at the International Institute of Information Technology, Hyderabad (IIIT-H). INAI is renowned for its cutting-edge research and development in artificial intelligence and data sciences, making it an ideal partner for this ambitious project.

This digitization project will have a profound impact on the LEPRA Society's operations. By transitioning from paper-based records to a sophisticated digital database, the organization will be able to enhance the accuracy and accessibility of patient information. This will facilitate more efficient patient management, improve the quality of care, and enable advanced data analysis to inform public health strategies and medical research. Ultimately, the digital tool will empower the LEPRA Society to better serve its patients and contribute to the global fight against leprosy and other neglected diseases.

3.3.2 AI - Enabled Clinical Decision Use-cases by DRIIV

DRIIV initiated 2 use-cases to demonstrate the applicability and usefulness of AI based digital healthcare data analytics.

I. SAFE-PICU: Sepsis Advanced Forecasting Engine



Framework of SAFE-PICU: Sepsis Advanced Forecasting Engine

Sepsis Advanced Forecasting Engine (SAFE) is an impactful initiative designed to revolutionize the early detection and management of sepsis in pediatric intensive care units (PICUs). By integrating sophisticated machine learning (ML) algorithms with clinical knowledge, this advanced forecasting engine addresses significant gaps in critical care, focusing on the early prediction of hemodynamic shock and hypothermia in pediatric patients. SAFE-PICU leverages vast amounts of clinical data to identify patterns and predictors that may not be apparent to human clinicians, allowing for a more nuanced understanding of a patient's condition and timely identification of potential complications. The engine's ability to predict hemodynamic shock—a life-threatening condition where the heart cannot pump enough blood to the body—is particularly crucial, as early detection allows for timely interventions that can significantly improve patient outcomes. Additionally, SAFE-PICU's capability to forecast the onset of hypothermia enables clinicians to implement preventative measures to maintain the patient's body temperature, thereby avoiding further complications.

The implementation of SAFE-PICU in pediatric intensive care units at the All India Institute of Medical Sciences (AIIMS) marks a significant advancement in pediatric healthcare. The adoption of this AI-based early detection system for sepsis has resulted in enhanced patient outcomes through timely interventions, informed clinical decisions, and reduced healthcare costs. By providing real-time data and predictive insights, SAFE-PICU empowers clinicians to make more informed and timely decisions, ultimately leading to shorter hospital stays and fewer complications.

II. Decision support system for Primary Healthcare (PHC)

Decision support system for Primary Healthcare (PHC) by DRIIV

DRIIV has enabled digitization of PHC to enhance the efficiency, accessibility and quality of services at the primary care level through technological solutions like e-health records and clinical decision support systems. The digitization of PHC creates a more resilient, responsive, and equitable healthcare system. Electronic health records (EHRs) replace paper-based records, offering easily accessible and updatable patient information that streamlines documentation and enhances care coordination. Clinical decision support systems use AI to provide evidence-based guidelines and recommendations, improving diagnostic accuracy and patient outcomes.

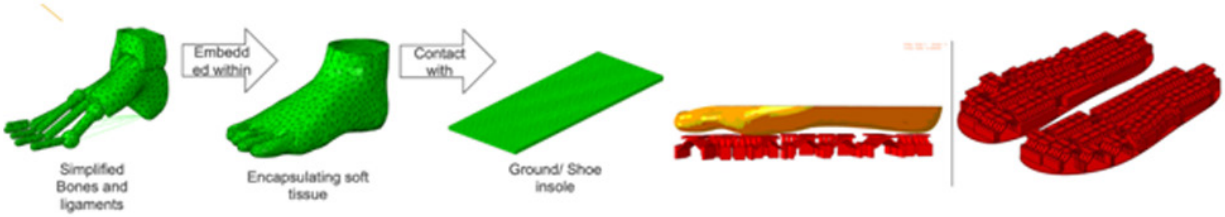
User-friendly data systems ensure patients can manage their health information securely, maintaining privacy and building trust. Real-time health dashboards aggregate data to provide policymakers with actionable insights. These dashboards facilitate real-time monitoring of health trends, resource allocation, and intervention effectiveness, allowing for informed decision-making and quick responses to health issues. Digitizing facilities like mohalla clinics and polyclinics transforms healthcare delivery, enhancing efficiency, reducing administrative burdens, and improving patient care. Digital interventions lead to better health management, timely diagnosis, and personalized treatments, empowering patients with access to their health information.

3.3.3 Digital Health Use-case by BeST

The project by BeST endeavors to develop and deploy digital foot clinics to significantly enhance diabetic foot care. By leveraging advanced technology and fostering collaborative partnerships, it aims to achieve three primary objectives: ensuring accessible screening, delivering personalized solutions, and conducting thorough validation processes.

Through strategic collaborations with esteemed academic institutions such as Karnataka Institute of Endocrinology and Research (KIER) and Indian Institute of Science (IISc), alongside innovative startups like Mimyk Healthcare Simulation Pvt Ltd and Foot Secure, the project harnesses a diverse range of expertise and resources to drive innovation and excellence.

The implementation of digital foot clinics holds immense potential to prevent up to 80% of amputations among diabetic patients, resulting in substantial cost savings of up to INR 1.3 lakhs per individual. With an estimated reach of 6,500 beneficiaries annually per Digital Podiatry Kiosk, the project promises to revolutionize diabetic foot care, offering accessible, personalized, and transformative solutions to those in need.



Schematic of digital foot twin system

A pilot kiosk has been established at the KIER Hospital. This innovative setup focuses on comprehensive patient screening, encompassing conditions such as calluses, ulcers, wounds, peripheral neuropathy, peripheral arterial disease, and abnormal plantar pressures. The kiosk employs cutting-edge technology, including a digital foot twin system, for predictive diagnosis and prognosis. As part of the initiative, patented self-offloading footwear is currently undergoing clinical validation, offering a potential breakthrough in the management of foot-related complications. This integrated approach defines a commitment to advancing healthcare by leveraging state-of-the-art tools for early detection, monitoring, and intervention in foot health.

3.4 Disease & Wellness Interventions

S&T clusters have initiated interventions that are imperative for addressing disease conditions and wellness of an individual.

3.4.1 Creation of Biobank in Government Hospitals by RICH

The project by RICH endeavors to establish a pioneering biobank, leveraging cutting-edge digital technology to meticulously digitize and safeguard the health records and biological samples sourced from a diverse spectrum of patients receiving treatment at eminent government hospitals. By encompassing a broad cross-section of the populace, this initiative ensures the creation of a repository that authentically mirrors the demographic fabric of the nation, to begin with the state.

Process Flow of a Biobank

The resultant open datasets, comprising invaluable insights into disease prevalence, patient characteristics, medication patterns, and an array of laboratory analyses encompassing pathology, radiology, and other diagnostic modalities, will serve as a treasure trove for researchers, policymakers, and healthcare practitioners alike. This wealth of information not only streamlines governmental fund allocation and policy formulation but also empowers researchers to swiftly identify and address pressing health challenges while expediting the validation and adoption of innovative solutions. Furthermore, the project fosters dynamic collaborations between national and international academic institutions, industry stakeholders, and research consortia, nurturing a fertile ecosystem conducive to groundbreaking scientific discoveries and technological advancements. In parallel, the establishment of such a comprehensive biobank generates a plethora of employment opportunities for a highly skilled workforce within the burgeoning biotechnology sector, thereby fortifying the economy and catalyzing societal progress.

3.4.2 Genome Atlas for Cancer by RICH

This collaborative initiative aims to bring together esteemed partners from both the healthcare and research/academic sectors, forging a multidisciplinary approach to tackle the complexities of Indian stomach and biliary duct malignancies. Hospital Partners including AIG Hospitals, Basavatarakam Indo-American Cancer Hospital and KIMS Hospitals will lend their clinical expertise and patient resources, ensuring direct access to diverse patient populations and clinical data essential for the project's success. Complementing this clinical infrastructure, Research/Academic Institutes such as CSIR-CCMB will contribute cutting-edge genomic technologies and analytical prowess, driving the comprehensive sequencing efforts encompassing whole genome, epigenome, metagenome, and transcriptome analyses.

KEY ORGANISATIONS INVOLVED

HOSPITAL PARTNERS

RESEARCH/ACADEMIC INSTITUTES

AIG HOSPITALS

BASAVATARAKAM INDO-AMERICAN CANCER HOSPITAL & RESEARCH INSTITUTE

KIMS HOSPITALS

CCMB

Partners of Genome Atlas for Cancer by RICH

The potential impact of this comprehensive genomic profiling is profound, transcending mere molecular characterization to fundamentally reshape our understanding of gastric carcinoma and biliary duct tumors. Beyond uncovering novel targets for drug development, the initiative holds the promise of predicting clinical outcomes with unprecedented accuracy, enabling clinicians to tailor treatment strategies to individual patients based on their unique genomic profiles. Moreover, by dissecting the genetic, epigenetic, and metagenomic determinants of disease, the project aims to unveil novel disease-modifying factors that could serve as biomarkers for early detection, prognostication and therapeutic intervention.

Through its collaborative spirit and visionary goals, this transformative initiative aspires to not only advance our scientific understanding of gastric and biliary malignancies but also revolutionize clinical practice, ushering in a new era of precision oncology for the benefit of patients across India and beyond.

3.4.3 Infectious disease screening model by DRIIV

DRIIV has developed an innovative AI-based mobile screening tool that is meticulously designed to transform the detection of infectious diseases, with a particular focus on safeguarding vulnerable populations such as migrant workers. This innovative tool aims to empower social organizations and healthcare providers alike with its unparalleled efficiency and accuracy. By harnessing the power of AI, this tool transcends traditional screening methods, significantly reducing the time and resources required while maximizing the precision of diagnosis. Its sophisticated algorithms not only expedite the screening process but also prioritize the surveillance of critical illnesses like childhood pneumonia and tuberculosis (TB), ensuring that no potential case goes unnoticed.

Infectious disease screening model by DRIIV

This comprehensive approach underscores a commitment to proactive healthcare management, especially in marginalized communities where access to quality healthcare may be limited. Recently, in Mohammadpur, Delhi, migrant workers had the opportunity to benefit from this cutting-edge technology, undergoing TB screening with unprecedented ease and effectiveness. This milestone represents a pivotal moment in the quest for better public health outcomes, marking a tangible step towards eradicating the barriers that hinder healthcare access for the most vulnerable among us.

3.4.4 Development of Sanitary Pads for Improved Women Hygiene by BCKIC

BCKIC's collaborative project with Ravenshaw University, Cuttack, and industry partners Welspun, Modulus Housing, and CISD is driven by a shared commitment to address the pressing need for improved women's health in tribal and economically disadvantaged regions. At its core, the initiative aims to develop an eco-friendly women's hygiene product tailored to the unique needs of these communities. Leveraging the expertise of Ravenshaw University in academic research and product development, alongside the resources and market insights contributed by industry collaborators, the project is poised to make significant strides in advancing menstrual hygiene practices.

Partners of Sanitary Pads for Improved Women Hygiene by BCKIC

By partnering with third-party manufacturing facilities, the project ensures the implementation of standardized production processes, guaranteeing quality and scalability. Additionally, the initiative includes a comprehensive awareness program on Hygiene Menstrual Practices, designed to educate women and girls about proper menstrual hygiene and the safe use of sanitary pads. Through workshops, seminars, and community outreach initiatives, the program seeks to dismantle social stigmas, empower women with knowledge, and foster positive health behaviors.

Ultimately, this holistic approach not only aims to improve women's health but also to stimulate entrepreneurship and promote skill development within these communities. By creating sustainable solutions and fostering local participation, the project endeavors to create lasting impact and empower women to lead healthier, more empowered lives.

3.5. Deep-Tech Start-Up Related Projects / Activities

Amidst the dynamic landscape of technological advancement, the necessity for Deep-Tech Start-Up activities and projects has become paramount, particularly in consonance with national priorities such as the National BioPharma Mission and the Make in India campaign. These endeavors serve as crucial drivers of innovation, nurturing indigenous capabilities and diminishing reliance on imported medical solutions. The Deep Tech Start-Up Policy, crafted under the guidance of the Office of the Principal Scientific Advisor to the Prime Minister of India, outlines a strategic framework. These national priorities and framework not only incentivizes pioneering research and development ventures but also fosters an ecosystem conducive to technological breakthroughs across various medical/health technologies domains. By cultivating an environment conducive to innovation, these initiatives bolster India's journey towards technological self-reliance, curbing medical dependency, and augmenting global competitiveness. They represent not merely a route to economic progress but also a means to tackle pressing societal challenges through cutting-edge solutions.

3.5.1 Acceleration Initiative for Devices & Diagnostics (AID) by RICH

RICH implements a comprehensive 6-month programme, coupled with 5 years of tailored market entry support, orchestrated in conjunction with esteemed partners such as Knowledge Partner - AIC-CCMB, Clinical Validation Partner - Malla Reddy Health City and Business Domain Partner - I-Venture@ISB. The programme is meticulously crafted to empower startups at their nascent and intermediate stages i.e. Technology Readiness Level (TRL) - 4 and above by offering a rich array of workshops, personalized one-on-one interactions, and invaluable networking opportunities. The initiative delves deep into critical domains including Intellectual Property (IP), Regulatory Compliance, Clinical Validation, Product Development, and Fundraising

Start-up Showcase of RICH's Acceleration Initiative for Devices & Diagnostics (AID) start-ups

The impact has been transformative: spanning the breadth of India, 36 startups have been provided with vital support. Notably, three standout startups – Briota Technologies, DoTo Health and Nemo Care – have undergone crucial validation studies at hospitals, facilitated by robust test bed support. Esteemed clinicians have lent their expertise, conducting rigorous clinical validation and usability assessments and strategic corporate partnerships are forged for market access. Impressively, over INR 6 Crore have been successfully raised in funding. The initiative's success is further underscored by the involvement of 35 dedicated mentors, the organization of 20 domain-specific workshops, and the facilitation of more than 50 invaluable one-on-one mentoring sessions. In sum, this initiative stands as an impactful support for empowerment of startups, catalyzing their growth trajectory and fostering a vibrant ecosystem of innovation and entrepreneurship.

3.5.2 IHF Quest Grand Challenge focused on Infectious Diseases by BCKIC

India Health Fund, a pioneering initiative spearheaded by TATA Trusts in conjunction with the BCKIC Foundation, embarked on a mission to actively identify and cultivate innovative solutions aimed at tackling the multi-dimensional challenges posed by infectious diseases. Their innovative platform, Quest, fueled by the latest advancements in science and technology, meticulously sifted through a myriad of proposals to unearth multi-disease/modular innovations primed for scalability and seamless integration into primary healthcare frameworks.

Strategic alliances with esteemed institutions such as KIIT University and KIIT-Technology Business Incubator (KIIT-TBI), alongside partners such as ACT Capital Foundation, the Maharashtra Government, Social Alpha, Villgro, and AIC-CCMB, served to magnify the reach and impact of the initiative. Following a rigorous selection process that saw 55 applications vying for attention, 10 pioneering technologies emerged as frontrunners, ultimately culminating in substantial support for 2 impactful innovations, backed by a cumulative funding of 91 Lakhs. This collective endeavor stands as a resounding testament to the catalytic power of unified action in propelling healthcare innovation.

OmiX Labs Pvt Ltd

Transforming Nucleic Acid Testing of Antimicrobial Resistance (AMR) with innovations in Automation, Molecular Biology and Data Science

Salcit Technologies Pvt Ltd

Artificial intelligence platform as a screening tool and diagnostic aid in the assessment of respiratory diseases

3.5.3 UK – India Healthtech Bootcamp for Digital Health Startups by BCKIC

The Academic Health Science Network, Yorkshire and Humber, BCKIC Foundation and KIIT TBI organized a 3 days fully funded bootcamp for 25 selected Indian healthcare companies on the UK healthcare market, access to subject matter experts and the opportunity to engage directly with UK NHS stakeholders. A total of 148 applications across PAN India were received and finally top 25 companies were invited for the customized bootcamp sessions. Furthermore, 6 startups were selected for a 5 days UK NHS Immersion program at Yorkshire, UK to explore the commercialization and deployment aspects at NHS.

UK – India Healthtech Bootcamp for Digital Health Startups by BCKIC

a. Avay Biosciences Pvt Ltd

Sector: Biomedical Engineering
Innovation: Development of Advanced 3D Bioprinter

b. Karkinos Healthcare Pvt Ltd

Sector: Tele-Health
Innovation: A Technology Led Purpose Driven Oncology Platform

c. Manentia Advisory Pvt Ltd

Sector: Biomedical Devices
Innovation: 3D AI based deep learning platform for analysis & monitoring of CT lung cancer

d. LarkAI Healthcare Pvt Ltd

Sector: Biomedical Devices
Innovation: ThoraCare: A non-invasive easy to use early stage heart and lung abnormalities screening device

e. Cutting Edge Medical Devices Pvt Ltd

Sector: Tele-Health
Innovation: SCINTIGLO: Point of care diagnostic device for democratizing healthcare

f. Stimveda Neurosciences Pvt Ltd

Sector: Digital Health
Innovation: Personalized brain stimulation and digital cognitive-emotional therapy

3.5.4 Startup Technology Deployment Activities by BCKIC

a. MedTel Healthcare Pvt Ltd

iLAB & iRPM: Remote Patient Monitoring System

Innovation: MedTel's RPM platform incorporates connected diagnostic devices, a smartphone app, and a web-based dashboard for hospital access and review

Deployment Strategy: Deployment at Zila Swasthya Samiti, Balangir, Odisha, Berhampur Household, PMSMA, Kalahandi, Odisha

b. COSMO Systems: Safeguarding Lives from Air & Water Borne Infections

Innovation: Eta Purification's microcavity plasma systems (COSMO) offer 100% chemical-free, eco-friendly, human safe and sustainable methods for decontamination of water, air & surfaces to safeguard lives in healthcare, transit/ transport, institutions, industries and more.

Deployment strategy: The technology has been deployed at multiple hospitals and care centers as well as in Chennai Metro Rail Limited. Further, deployments are in pipeline at various other hospitals and clinics, institutions and transportation modes

c. IOT-enabled Point-of-care Blood testing Device for affordable and accessible healthcare powered AI/ML algorithms

Innovation: Mobilab™ is a Portable, Affordable, Easy-to-Use Diagnostic Device for early Detection of multiple parameters of Kidney, Liver, Heart and Pancreas at a 10x affordable price.

Deployment Strategy: The PoC device can be deployed at testing labs, care centers, hospitals, clinics, govt and private establishments at remote locations such as AIIMS Delhi, GNRC Hospital – Assam, GMCH – Assam, JL Rohtagi - UP

d. Sanjivani QCPR : Resuscitation Ecosystem For Cardiac Arrest Victims

Innovation: Sanjivani CPR assist device can enable common public to provide effective chest compressions with real time audiovisual feedback and connectivity to nearest hospital & ambulance

Deployment Strategy: At various public places like railway 37stations, Malls, community halls, large educational institutes, Indian army training institutes & Simulation centers through CSR / Govt or institutional purchase such as Fortis Hospital, Mumbai, Startup Odisha Office, Bhubaneswar

e. The Smartest Cardiac health monitoring device

Innovation: A portable device that replaces several distinct elements of a traditional ECG and Stethoscope setup. A novel AI algorithm which diagnose early stage real-time heart impulse and valvular disease for futuristic predictive analysis

Deployment Strategy: The PoC device can be installed and deployed in both rental as well as buy models at various hospitals, clinics, care centers, gyms and fitness centers, etc. Currently, the deployment is in progress at various UPHCs across Bhubaneswar city.

3.5.5 Forging Global Alliances for Fueling Innovation by BCKIC

BCKIC Foundation and the British High Commission in India demonstrated the power and necessity of local organizations and international diplomatic entities collaborating and coming together. One of the emerging Digital Health Startup, MedTel Healthcare showcased the incredible range of their innovative products to the representatives of the British High Commission. The event laid the foundation for fruitful partnerships, knowledge sharing, and the exchange of ideas that will pave the way for innovation and development.

3.6 Regional Ecosystem Strengthening Initiatives

3.6.1 ABCs of Medical Devices & IVDs Commercialization Journey by RICH

RICH initiated a month-long program aimed at promoting awareness and practical exposure for students, aspiring entrepreneurs, researchers, startups and industry players regarding the commercialization of Medical Devices and In-Vitro Diagnostics (IVDs) across categories A, B and C. The series was divided into four tracks covering intellectual property, regulatory compliance, industry immersion, and clinical exposure, culminating in a startup showcase event.

Experts from AvidInvent shed light on ideation research, patent due diligence, and navigation through the patent process. Participants gained insights into regulatory processes for entering Indian, European, and US markets from Central Drugs Standard Control Organisation (CDSCO), Global Regulatory Forum (IGRF) at IKP Knowledge Park. They also had the opportunity to visit leading medical device manufacturers in Telangana's Medical Devices Park, including Sahajanand Medical Technologies (SMT), Akriti Ophthalmic, Huwel Life Sciences, and PathnSitu Biotechnologies, for firsthand experience and learning.

Photos taken during ABCs of Medical Devices & IVDs Commercialization Journey initiative by RICH

The series finale fostered collaboration between hospitals and startups, reinforcing RICH's commitment to advancing Telangana's life sciences sector.

3.6.2 Sustainability and Digitalization Roadmap for Pharmaceutical Industry by RICH

RICH, in partnership with Dr. Reddy's Institute of Life Sciences and the Royal Society of Chemistry, organized an online conclave to help the pharmaceutical industry achieve its United Nations Sustainable Development Goals (UN SDGs), which serve as a blueprint to achieve a better and more sustainable future for the world. The objective of the conclave was to discuss innovative design, creation, processing, and usage, through which the pharmaceutical industry can play a major role in helping humanity to meet current environmental, economic, and societal challenges without compromising the progress and success of future generations. The conclave was conducted in partnership with the Royal Society of Chemistry (RSC), Dr. Reddy's Institute of Life Sciences (DRILS) and University of Hyderabad (UoH).

3.6.3 T-Health Café

Photos taken during T-Health Cafe initiative by RICH

RICH in association with OJAS BioNEST at CIE-IIIT Hyderabad, has been organizing a monthly event by engaging the MedTech consortium of research/academia institutes, hospitals, start-ups, incubators, investors, and industry to enable the MedTech, Healthcare, and Life Sciences innovation ecosystem.

3.6.4 Clinician Peer Support Program by BCKIC

The Clinician Peer Support Program (CPSP) emerged as a pioneering initiative from the collaborative efforts of the DST Centre of Excellence at KIIT Technology Business Incubator and the BCKIC Foundation. Its overarching objective is to redefine the landscape of healthcare innovation by creating a dynamic platform that brings together clinicians, surgeons, and professionals from various medical disciplines. Through a multi-dimensional approach, CPSP offers a comprehensive suite of services aimed at empowering innovators to catalyze change in healthcare.

Central to CPSP's mission is its commitment to capacity-building, clinician immersion, prototyping assistance and team-building activities. These pillars form the foundation upon which clinicians and entrepreneurs can collaborate, ideate, and translate ideas into tangible solutions. With 80 clinicians actively engaged and 60 healthcare startups collaborating, CPSP has become a vibrant ecosystem driving forward transformative healthcare innovations.

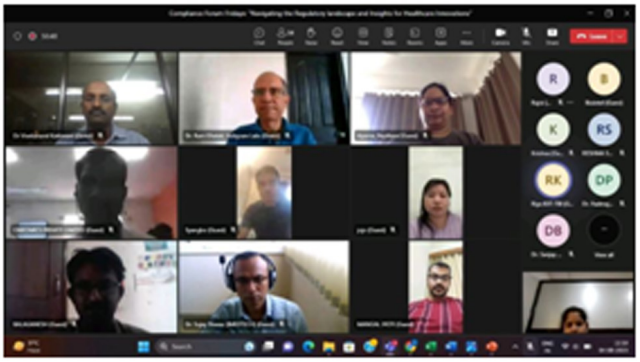
Furthermore, CPSP's facilitation of funding support totaling 25 lakhs and the development of 30 intellectual properties showcase its tangible impact on the healthcare innovation landscape. Beyond these metrics, CPSP serves as a catalyst for cultural change within the healthcare community, fostering a spirit of collaboration and collective impact.

Photos taken during Clinician Peer Support Program by BCKIC

3.6.5 Compliance Forum Fridays by BCKIC

Compliance Forum Fridays, a collaborative initiative between KIIT TBI and Valnizen Healthcare Pvt. Ltd., serves as a pioneering platform for startups in healthcare and food tech to navigate complex regulatory landscapes. This series acts as a guiding light for entrepreneurs, offering invaluable insights into regulatory requirements and crucial go-to-market strategies essential for their success. Through direct engagement with regulators, startups are empowered to tackle regulatory hurdles directly, facilitating smoother market entry.

With over 130 startups and innovators actively participating, supported by ten experienced mentors providing a total of 20 hours of mentoring, the impact of Compliance Forum Fridays is deeply felt within the startup community. Moreover, the facilitation of 15 regulatory projects, along with connections to Contract Research Organizations, highlights its tangible contribution to expediting market authorization processes. In essence, Compliance Forum Fridays not only provides regulatory guidance but also catalyzes sustainable growth and innovation in the healthcare and food tech sectors, bridging the gap between compliance requirements and entrepreneurial endeavors.



Photos taken during Compliance Forum Fridays initiative by BCKIC

3.6.6 Joint programs in medical technologies (IIT J & AIIMS J) by Jodhpur City Knowledge and Innovation Cluster (JCKIC)

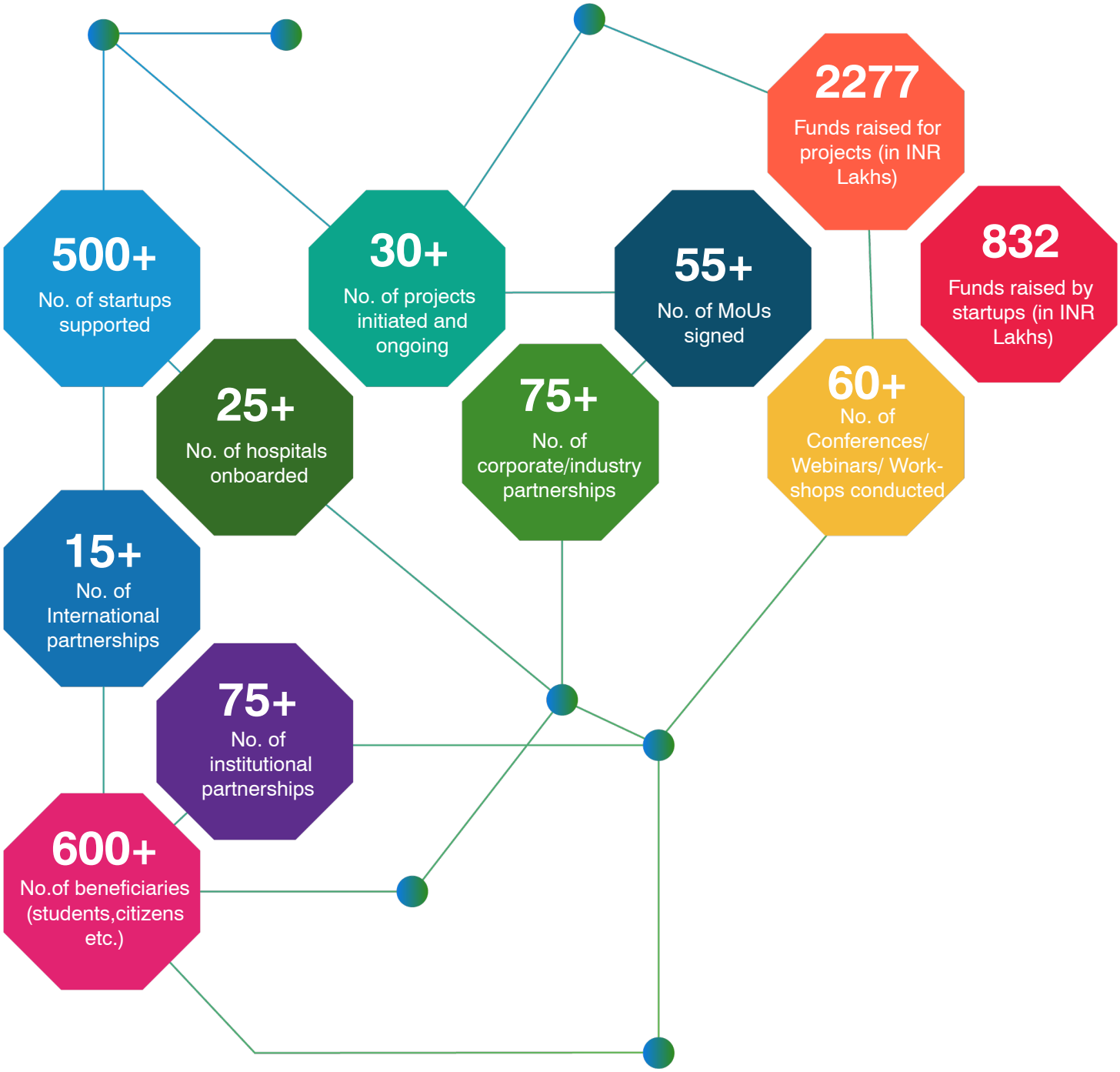
Masters in Medical Technologies, Ph D in Medical Technologies and joint degree Masters, PhD i.e. Master-PhD in Medical Technologies is offered by IIT Jodhpur and AIIMS Jodhpur along with JCKIC's support. These programs aim to provide a common platform for doctors and engineers fostering knowledge sharing and innovation, leading to development of indigenous healthcare devices and systems through the process of incubation and entrepreneurship.

4. Major Achievements

The accomplishments of Science and Technology (S&T) clusters in India are emblematic of a steadfast commitment to fostering innovation, collaboration, and regional development, resonating with the strategic objectives outlined by the O/o PSA. These clusters serve as vibrant nuclei, where academia, research institutions, industries, and governmental bodies converge, forging synergies that propel cutting-edge research and transformative innovation.

Through strategic partnerships and collaborative initiatives, S&T clusters have transcended traditional boundaries, catalyzing the exchange of expertise, resources, and infrastructure. This concerted effort has manifested in elevating the technological prowess of the nation. With over 75 institutional partnerships and an equivalent number of corporate/ industry collaborations, alongside more than 55 Memoranda of Understanding (MoUs) inked, these clusters have laid the groundwork for a robust ecosystem that fosters innovation.

Beyond their immediate realms, S&T clusters have played a pivotal role in addressing regional challenges and driving socio-economic development. Leveraging their collective expertise and resources, they have emerged as essential catalysts for local innovation ecosystems. By nurturing over 500 deep tech startups focussed on healthcare solutions and providing critical infrastructure and mentorship to promising entrepreneurs, these clusters have sown the seeds of economic empowerment and technological innovation at all levels. Moreover, by forging partnerships with more than 25 hospitals, they have facilitated access to cutting-edge healthcare facilities and expertise, thereby augmenting the quality of technology development, validation and commercialization.



Impact Numbers of Health Theme of S&T Clusters

At the national and global scales, S&T clusters have positioned themselves as engines of progress and innovation, with a nuanced focus on domains where they possess distinctive strengths. Actively participating in national missions and forging strategic alliances with international counterparts, these clusters have become linchpins in tackling multifaceted challenges and pushing the boundaries of scientific exploration. Notably, their emphasis on sectors such as Health has not only yielded impactful innovations but has also translated into tangible improvements in healthcare outcomes and accessibility for millions.

With over 30 initiated and ongoing projects, complemented by more than 15 international partnerships and funds raised amounting to INR 2277 Lakhs, S&T clusters are at the vanguard of pioneering research and collaborative innovation. In addition to their substantive contributions to research and innovation, these clusters have fostered a culture of collaboration and knowledge-sharing through a plethora of conferences, webinars, and workshops. These platforms, totaling over 60 events, have provided invaluable avenues for over 500 stakeholders to exchange ideas, forge partnerships, and catalyze innovation across the Health domain, benefiting a wide spectrum of beneficiaries, including students and citizens alike.

In essence, the achievements of S&T clusters in India highlight their indispensable role in propelling socio-economic growth, nurturing innovation, and enhancing regional, national and global competitiveness. By cultivating a collaborative and inclusive ecosystem, these clusters are poised to continue shaping the future of science, technology, and innovation, not only within the confines of India but also on the global stage. The few success stories or breakthrough innovations highlighted in Section 4.1, along with a sample of testimonials featured in Section 4.2, vividly depict the transformative nature of S&T clusters. These narratives illustrate how collaborative ecosystems enable startups to flourish and synergize, demonstrating how S&T clusters foster innovative and economic growth, additionally facilitating positive change. They not only showcase the ingenuity of individual ventures but also demonstrate the collective impact of diverse talents and resources collaborating to push boundaries and shape the future of Nation's Health.

4.1 Success Stories or Breakthrough Innovations

a. Alfaleus Technology Pvt Ltd

Funds Raised / Achievements

- INR 40 lakhs in Loan
- INR 64.3 lakhs in Grants (BIRAC)
- INR 44 lakhs in Equity

b. Aikenist

Funds Raised / Achievements

- Funds: 1.5 Cr INR from C-CAMP & MARL US fund
- Awards: Karnataka Elevate 100, TIDE 2.0 MEITY grant, CE Emerging Unicorn

BRIOTA

c. Briota Technologies

Funds Raised / Achievements

» Supported by BIRAC Government of India and Technology Development Board Government of India, Briota has won several national and international awards including JanCare Healthcare Innovation Startup of India 2023, OPPI's Most Innovative MedTech Startup of India 2021, ZS Most Disruptive Healthcare Startup of India 2023, MIT Solve Global Healthcare Challenge Finalist 2023.

d. Startoon Labs

Funds Raised / Achievements

» Startoon Labs has successfully raised around 4.5 crores till date

» It is ISO9001 and ISO13485 certified and has been recognized for its contribution to the IT SECTOR of the State of Telangana by the Government of Telangana. Startoon Labs has stringent quality measures and its flagship product - PHEEZEE, is CDSCO approved and USFDA 510K exempted.

MedTel HEALTHCARE PVT. LTD.

e. Medtel Healthcare Pvt Ltd

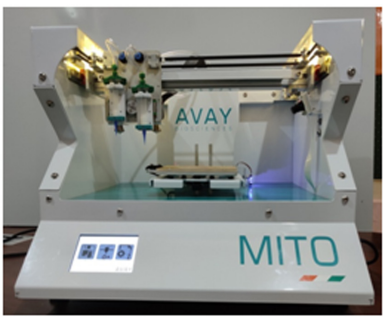
Funds Raised / Achievements

» BIRAC LEAP fund worth INR 50 lakhs

» Pre Series A: INR 5 Cr raised already. INR 2.5 Cr to be raised

~ 1000 units deployed across multiple districts in Odisha

» Conducted over 50 rural health camps across multiple remote locations of Odisha



AVAY BIOSCIENCES

f. Avay Biosciences Pvt Ltd

Funds Raised / Achievements

» Received INR 1 Crore from DST CAWACH

» Recognized as the first in India to provide a state-of-the-art technology to protect general public traveling through rapid urban transport

» Multiple units have been deployed in collaboration with Chennai Metro Rail Corporation

g. Dhanvantri Biomedical Pvt Ltd

Funds Raised / Achievements

- Raised INR 5 Lakhs from Social innovation immersion program by BIRAC
- INR 49.75 lakhs grant-in-aid from BIRAC BIG scheme
- Raised INR 48 lakhs fund from DST NIDHI4COVID
- Received INR 1 Cr from All Sharks in Shark Tank

h. ETA Purification Pvt Ltd

Funds Raised / Achievements

- Received INR 1 Crore from DST CAWACH
- Recognized as the first in India to provide a state-of-the-art technology to protect general public traveling through rapid urban transport
- Multiple units have been deployed in collaboration with Chennai Metro Rail Corporation

i. Inochi Care Pvt Ltd

Funds Raised / Achievements

- INR 49.07 lakhs grant-in-aid from BIRAC BIG scheme
- INR 3 lakhs grant-in-aid from DST NIDHI PRAYAS
- Winner for ASME 2022 and received cash prize worth 10,000 USD.
- DRDO TDF Funds of 65 lakhs
- Test license obtained from CDSCO
- Certified product from ISO, IEC & NABL
- Wholesale drug licence obtained from CDSCO

j. Larkai Innovations Pvt Ltd

Funds Raised / Achievements

- Received ISO and IEC Certifications for the product
- SASACT fund of INR 24 lakhs from KIIT TBI
- BIRAC BIG grant of INR 50 lakhs
- ACT Grant of INR 41 lakhs through IHF

k. Salcit Technologies Pvt Ltd

Funds Raised / Achievements

- Received ISO and IEC Certifications for the product
- SASACT fund of INR 24 lakhs from KIIT TBI
- BIRAC BIG grant of INR 50 lakhs
- ACT Grant of INR 41 lakhs through IHF

l. Primary Healthtech Pvt Ltd

Funds Raised / Achievements

- INR 50 lakhs from BIRAC BIG Grant
- INR 25 lakhs from BIRAC SEED fund at KIIT TBI
- Raised INR 25 lakhs from Pontaq Venture & STPI
- INR 33 lakhs from MeitY SASACT
- INR 25 lakhs from Villgro
- Raised INR 1 Cr from Sage Venture
- Selected for MeitY SAMRIDH Matching fund of INR 40 lakhs

4.2 Testimonials

RICH

LEPRA–BPHRC has garnered a productive partnership with RICH for the past few months. Our interaction with RICH started as a brief informal conversation that was built into a solid partnership that led to productive networking through the life sciences division of RICH.

Dr. Aparna Srikantham
Head–Research and Director–Lab
LEPRA–BPHRC

We have been working with RICH since the time of its inception and have been a part of the journey involving various programmes with stakeholders from research institutes, universities, industries, and start-ups.

DR. REDDY'S INSTITUTE OF LIFE SCIENCES

Dr. Srinivas Oruganti

Director, Dr. Reddy's Institute of Life Sciences

Having the strongest innovation ecosystem in Telangana, we would like to appreciate the team of RICH for actively engaging with the Innovation ecosystem stakeholders in the State.

ATAL INCUBATION CENTRE
CENTRE FOR CELLULAR & MOLECULAR BIOLOGY

Dr. Ramjee Pallela

COO, AIC–CCMB

"Our participation in the AID Cohort gave us important connections to potential users which enabled us refine our Target Product Profile and prioritize use cases. Connection to a leading investor group enabled us to understand what the investor community expects from our kind 50of technology. Network with Clinical CROs enabled us to understand data and budget requirements for a first Human PoC study in our next phase."

Transform SciTech
Research solutions

Dr. Badri Viswanathan

CEO & Founder, Transform Scitech

"Our selection in AID-Cohort 4 gave us the required visibility for our product prototype, received guidance on preparation of test license application, CE process and developed fruitful network. Now we are validating our product for other areas including veterinary."

Dr. Roshan Naik
Founder, Diagopreutic Private Limited

"Great work. Helped in clarifying lots of doubts. Paved the way for many potentially collaborative links. Would love to be a part of upcoming events. Thanks for providing the platform."

Mohamed Jameer Basha J
Caldor Health Technologies

"Thanks to RICH, Dr. Sushmitha Sundar, and Mr. Aravind Kumar for organizing the "ABCs of Medical Devices and IVDs Commercialisation Journey" and getting the stakeholders at one location for the startup showcase. Having been around for a while as a serial entrepreneur, I am confident to say that this is the first of it's kind I attended."

Ravi Chivukula
HeARTHealth Technologies

"Waste water surveillance became a critical part of the fight against the Covid-19 virus, not just as an indicator at the macro scale but also to understand micro neighbourhood patterns. The study and dashboard developed by PKC has built onto that strength not just for the virus but also against other indicators including antibiotic resistant bacteria etc. which can go a long way in a city's monitoring and preparedness."

Mr. Shekhar Singh

IAS, Commissioner, Pimpri Chinchwad Municipal Corporation

"The one-day workshop on vector-borne diseases for field workers of Pune Municipal Corporation, organized by PKC together with Pune Municipal Corporation and ICMR-NIV has been very valuable. The field workers were happy to get in depth scientific knowledge about the different mechanisms of spread of vector-borne diseases, especially dengue. I thank all the organizers for this insightful workshop- it is the first time, that such kind of a workshop has been organized for the field workers and they would love to attend more such workshops!"

Dr. Suryakant Deokar

Assistant Medical Officer of Health, Pune Municipal Corporation

"Incepted during the pandemic, PKC had the foresight to initiate some very important work at the city level for COVID-19. KEMHRC, Vadu was privileged to be associated with PKC for several collaborative studies, including the VISION101 study which aims to understand the differences in magnitude and longevity of humoral and cellular immune responses generated following COVID-19 vaccination. Another study which we worked together on involved digitization and curation of retrospective data from confirmed hospitalized COVID-19 cases. These efforts will help in identification of correlations between virus genetics, clinical presentation, and the potential impact of interventions using machine learning and systems biology approaches. This is also an important capacity building exercise for all partner hospitals to venture into enhancing usability of hospital records which otherwise remain unutilized. Working with the PKC Team has been a pleasure because it gives a good sense of togetherness and confidence that data as well as knowledge generated will be used responsibly for the benefit of humankind."

Dr. Sanjay Juvekar

Vadu Rural Health Program, KEM Hospital Research Centre, Pune

"PKC has been a key partner with organizations across the country that have been using GenePath quantitative SARS-CoV-2 RT-PCR kits to monitor viral abundance in waste-water samples. This work has allowed advance prediction of localized spikes through the multiple 52waves seen in the country without the need to test individuals. In addition to all the practical benefits of the work carried out by the PKC-led coalition during the pandemic, there has also been a tremendous building of community, pan-organizational collaboration, and academic progress. We look forward to a continued long-term mutually beneficial association between all the partners under the PKC umbrella."

GENEPATH DX

Dr. Nikhil Phadke

Founder-Director, Chief Scientific Officer, GenePath Diagnostics

5. Way Forward

The Science and Technology (S&T) clusters have made significant strides in addressing critical health challenges, particularly through their efforts in COVID-19 initiatives, pandemic preparedness, and other health-related interventions. This section outlines the path forward based on the foundational work accomplished across various cities and introduces new projects informed by these past learnings. From Hyderabad's Reagents Consortium and Pune's comprehensive COVID-19 analysis, to Delhi's AI/ML-based early warning systems, these initiatives highlight the collaborative and innovative responses to the pandemic. Additionally, the clusters' work on One Health and Antimicrobial Resistance (AMR), including Bengaluru's One Health approach and Pune's metropolitan surveillance unit, showcases their commitment to integrated health solutions. The section further explores advancements in health data digitalization, with examples like Hyderabad's clinical data use-case and Delhi's AI-enabled clinical decision-making. Moreover, disease and wellness interventions, deep-tech startup activities, and regional ecosystem strengthening initiatives underline the clusters' holistic approach to enhancing public health infrastructure and resilience. Building on these achievements, the introduction of new projects aims to leverage past experiences, fostering a more robust, adaptive, and innovative health ecosystem for the Nation's future.

The future plan for One Health & Antimicrobial Resistance (AMR) will incorporate several key initiatives. RICH aims to build the Hyderabad One Health model which will feature three main components. It will begin with a focus on infectious disease surveillance and understanding disease ecology. Next, it will emphasize environmental, zoonotic, and vector surveillance in both urban and peri-urban areas. Finally, it will involve developing policies, strategic planning, effective management, and implementation strategies to address One Health challenges comprehensively. PKC will prioritize wastewater surveillance, particularly targeting samples from areas where human and animal populations converge. The Bengaluru One Health Model (BeST) will lead consortium-based projects aligned with the National One Health Mission, fostering the development, validation, and deployment of innovations for communicable diseases and AMR through the One Health Innovation Challenge in collaboration with C-CAMP. DRIIV will implement One Health strategies to address emerging epidemics and AMR, working with large pharmaceutical companies and digital health platforms to utilize clinical data for AMR models and also, use the same to design interventions for chronic diseases such as diabetes and heart disease.

Moving forward, S&T clusters will continue to focus on advancing data and digital health initiatives through the RICH and DRIIV programs. RICH will spearhead the creation of a comprehensive digital database specific to cancer within the Indian population, integrating clinical and genomic multi-modal data for both research and commercial applications. Additionally, RICH will aim to develop AI-ML tools for descriptive, prescriptive, and predictive analysis at both personal and population levels, leveraging Telangana Government's T-Diagnostics platform to enhance pathological services. Concurrently, DRIIV will deploy a robust ABDM-compliant data platform to support industry, academia, and policy makers. This will be complemented by the digitalization of health solutions and the establishment of data centers in Mohalla Clinics and Polyclinics, ensuring widespread and efficient access to healthcare data and services.

Additionally, S&T clusters will implement a series of strategic disease and wellness interventions through various collaborative efforts. PKC will partner with IITM, IISC-ARTPARK, and IMD-Pune to enhance existing disease models, integrating these specialized dashboards and analytical tools into governmental frameworks for efficient disease management. Specifically, PKC will work closely with PMC and PCMC to ensure seamless data integration. Additionally, we will establish a Wastewater Surveillance system (WWS) within hospital environments to correlate hospital disease data with WWS observations, enabling population-level extrapolations. Our WWS efforts will also expand to cover additional diseases and rural areas. For dengue management, PKC will collaborate with the state to formulate a comprehensive policy paper. BeST will focus on non-communicable diseases, implementing diabetes and sickle-cell anemia screenings in Primary Health Centers (PHCs) and advance public health initiatives by deploying robotic obstacle removers to eliminate manual scavenging. Moreover, the JCKIC will aim to inaugurate the Center for Advanced Research on Cardiovascular Disease and Stroke Technologies (CARDIOTech) to drive innovative research in these critical areas.

In summary, the importance of health in India is profound, and it's crucial to tackle health challenges with comprehensive policies, innovative solutions, and integrated approaches for sustainable growth and development. Various initiatives like the National Biopharma Mission, Make in India, NHM, NDHM, the National One-Health Mission and others show India's dedication to enhancing health outcomes. The COVID-19 pandemic has highlighted the urgent need for strong healthcare systems that can uphold economic and social stability both during crises or not. By investing in health infrastructure, digital solutions, and preventive care, India can alleviate the healthcare burden on families and the government. Addressing both communicable and non-communicable diseases through targeted programs is essential for building a resilient population. Collaborative efforts such as the Integrated 54Disease Surveillance Programme and the National Vector Borne Disease Control Programme are crucial for early detection and response to health threats. Prioritizing innovative health solutions, as evidenced by projects in S&T clusters, drives progress in medical research and development, aligning with the broader Make in India initiative for self-reliance. By prioritizing health, India not only protects its citizens' well-being but also lays a strong foundation for sustained economic growth and national progress, ensuring a prosperous and resilient future for generations to come.

Annexure-1: Media Coverage

4th Cohort of RICH's Acceleration Initiative for Devices and Diagnostics Announced!

Narasimha Raju 7 months ago

Research and Innovation Circle of Hyderabad (RICH) today announced the members of the 4th cohort of its Acceleration Initiative for Devices and Diagnostics (AID) programme.

Hyderabad: RICH Launches Mission 10X-SIGs

By **Hyderabad Now**
Jul 20, 2022 #hyderabad, #Research and Innovation Circle (RICH)

Hyderabad: RICH Launches Mission 10X-SIGs

Hyderabad, July 20 (Hydnow): **Research and Innovation Circle (RICH)** of **Hyderabad** *(Hyderabad S&T Cluster)* and the *T-Incubators* and *Accelerators consortium* have launched the **Mission 10X – SIGs**, a three-month joint scale-up program for early-stage research connected startups.

Research and Innovation Circle of Hyderabad (RICH) Concludes the Workshop Series "ABCs of Medical Devices and In-Vitro Diagnostics (IVDs) Commercialisation Journey"

HYDERABAD: A month-long awareness and hands-on workshop series called "ABCs of Medical Devices and In-vitro Diagnostics (IVDs) Commercialisation Journey" came to a successful end. It was attended by aspiring entrepreneurs, researchers, start-ups, MSMEs, SMEs, and industry players. This was the first edition of this workshop series by Research and Innovation Circle of Hyderabad (RICH).

The series was divided into four tracks: intellectual property, regulatory, industry immersion, and clinical exposure. Each track was led by experts in the field, providing participants with in-depth knowledge and practical insights into the various stages involved in scaling a proof-of-concept validated idea to a marketable product.

"The journey of bringing a novel medical device to market is a long, complex, and daunting one," said Rashmi Pimpale, CEO of RICH. "Within the realm of MedTech innovation, risks and uncertainties loom even larger. However, with a clear process and collaborative efforts involving key stakeholders, success becomes attainable. The participants unanimously agreed that the series not only enriched their understanding but also facilitated the creation of beneficial connections."

The intellectual property track focused on ideation research, patent due diligence, and patent navigation under

the guidance of experts from AvidInvent, who are in the HealthTech and MedTech intellectual patent spaces. The regulatory track covered the key stages in bringing a medical device or IVD to market, including regulatory compliance, market authorisation, and post-market surveillance. Officials from Central Drugs Standard Control Organisation (CDSCO) under the Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India, along with ICICI Knowledge Park's (IKP) Global Regulatory Forum (IGRF) provided participants with a detailed understanding of the regulatory process for entering the Indian market.

The industry immersion track gave participants the opportunity to visit leading medical device and IVD companies in Telangana, such as Sahajanand Medical Technologies (SMT), Akriti Opthalmic, Huwel Life Sciences, and PathnSitu Biotechnologies, and learn about their manufacturing processes and compliance requirements. Finally, the clinical exposure track provided participants with the opportunity to observe clinical trials and gain insights into the clinical validation process.

The series concluded with a start-up showcase, which also provided networking opportunities for hospitals and start-ups to come together and forge new collaborations.

"The ABCs of Medical Devices and IVDs Commercialisation Journey" reflects RICH's continued commitment to driving the growth and transformation of the life sciences sector in Telangana.

RICH is the nodal agency for the Hyderabad Science and Technology Cluster, an initiative spearheaded by the Office of Principal Scientific Adviser to the Government of India. Established in 2017 by the Government of Telangana, the organisation focuses its work across three primary verticals: Food and Agriculture, Life Sciences, and Sustainability. Through its various initiatives, RICH aims to solve complex local and national challenges by fostering collaborative networks among diverse stakeholders in the research and innovation space, and empowering innovators to transform scientific research into impactful solutions that generate wealth and create social good.

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Events

RICH concludes workshop series on ABCs of medical devices and IVDs commercialisation

Our Bureau, Bengaluru
Friday, July 28, 2023, 16:30 Hrs [IST]

Research and Innovation Circle of Hyderabad (RICH) of the first edition of the month-long awareness and hands-on workshop series called "ABCs of medical devices and in-vitro diagnostics (IVDs) commercialisation journey" came to a successful end. It was attended by aspiring entrepreneurs, researchers, start-ups, MSMEs, SMEs, and industry players.

The series was divided into four tracks: intellectual property, regulatory, industry immersion, and clinical exposure. Each track was led by experts in the field, providing participants with in-depth knowledge and practical insights into the various stages involved in scaling a proof-of-concept validated idea to a marketable product.

‘Can adapt our covid model to any infectious disease’

1 min read • 07 Dec 2022, 09:05 PM IST

Join us

Leslie D'Monte

Shipra Misra, CEO & MD of Delhi Research Implementation and Innovation (DRIIV), talks on Project SAMEER to control air pollution in Delhi, the move to introduce solar-powered EV charging stations, and the use of AI in healthcare, among other things, in an interview

Companies

BENGALURU : Shipra Misra is chief executive and managing director of Delhi Research Implementation and Innovation

DRIIV’s Conference Spurs Global Dialogue on Equitable Climate, Health, and Open Access to Data

By Rabindra August 10, 2023 In Business No Comments

Climate Change May Release Ancient Germs Frozen In Ice: Experts

The experts, including NITI Aayog Member V K Paul and ICMR Director General Rajiv Bahl, highlighted another worry – heat-related injuries and as temperatures go up, the risk of getting hurt from the heat becomes higher

Press Trust Of India | August 9, 2023

The changing climate, causing more floods and heavy rainfall, could also lead to more waterborne and zoonotic diseases

New Delhi: Ancient germs frozen in ice for a long time might be released and pathogens could move to new places due to the climate change, experts have warned. The changing climate, causing more floods and heavy rainfall, could also lead to more waterborne and zoonotic diseases, they said at a conference by DRIIV (Delhi Research Implementation & Innovation), an initiative of the principal scientific advisor (PSA) to the government. The

Climate change may release ancient germs frozen in ice: Experts

The experts, including NITI Aayog Member V K Paul and ICMR Director General Rajiv Bahl, highlighted another worry - heat-related injuries.

PTI | AUGUST 10, 2023 / 12:34 AM IST

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The experts, including NITI Aayog Member V K Paul and ICMR Director General Rajiv Bahl, highlighted another worry - heat-related injuries. As temperatures go up, the risk of getting hurt from the heat becomes higher.

The way diseases spread might also change. Pathogens, which are tiny things that can make us sick, could move to new places because of climate change, Paul said at the conference held here on Tuesday.

IIT Delhi, DRIIV collaborate to control air-pollution levels in Delhi-NCR region

SAMEER will bring together IIT Delhi researchers, government authorities, NGOs, and corporates to look into t matter.

FPJ Education Desk | **Updated:** Wednesday, November 02, 2022, 04:26 PM IST

IIT Delhi |

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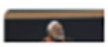

DRIIV's Conference Spurs Global Dialogue on Equitable Climate, Health, and Open Access to Data

By **Sujata**

AUG 10, 2023

Armed with science & tech solutions, govt & IIT-Delhi come together to fight air pollution

Office of Principal Scientific Advisor and IIT are working with tech & industry partners to monitor the city's AQI. Th project will run in Delhi NCR from Nov '22 to Feb '23.

MOHANA BASU 03 November, 2022 11:36 am IST

File photo of smog in Delhi | Suraj Singh Bisht | ThePrint

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IIT Delhi, DRIIV collaborate to tackle air pollution in Delhi-NCR

Vishu Verma
Assistant Manager
New Delhi, Updated on Nov 3, 2022 13:12 IST

Technology-based pilot project called SAMEER (Solutions for Air-pollution Mitigation through Engagement, Engineering and Research) to be undertaken in Delhi-NCR from November 2022 to February 2023.

Delhi Research Implementation and Innovation (DRIIV), an initiative of the Office of the Principal Scientific Adviser to the Government of India, is conducting a technology-based pilot project called SAMEER (Solutions for Air-pollution Mitigation through Engagement, Engineering and Research) in Delhi-NCR from November 2022 to February 2023.

The initiative will bring together local government authorities, IIT Delhi researchers, tech startups, corporates, non-governmental organisations (NGOs) and communities to collectively address the air pollution menace in the winter months. Prof Sagnik Dey,

DRIIV, IIT Delhi Join Hands To Tackle Air Pollution

In a first-of-its-kind initiative of the Office of the Principal Scientific Adviser to the Government of India, DRIIV will conduct a technology-based pilot project called Project SAMEER (Solutions for Air-Pollution Mitigation through Engagement, Engineering, and Research) in Delhi-NCR, from November 2022 to February 2023.

Joymala Bagchi

NEW DELHI | **Updated: 02 November, 2022 5:01 pm IST**

Printed from
THE TIMES OF INDIA

IIT-Delhi, central initiative try steps to curb air pollution

TNN | Nov 1, 2022, 08.27 AM IST

NEW DELHI: Delhi Research Implementation and Innovation (DRIIV), an initiative by the Centre, and IIT-Delhi have initiated a pilot project to keep pollution under control in the city. Named Sameer (Solutions for Air-Pollution Mitigation Through Engagement, Engineering and Research), the project will be active from November 2022 to February 2023 and will be executed with the help of Delhi government.

"This is a first-of-its-kind initiative bringing together local government authorities, IIT-Delhi researchers, tech startups, corporates, NGOs and communities to collectively address the air pollution menace during the winter months. The project will have a public-centric approach and work by raising awareness and engaging the community and taking industries in loop by applying relevant technology to monitor and curb PM2.5 and PM10," said a statement from DRIIV.

The statement added, "Technological solutions can be deployed to bring down the pollutant levels. These solutions will be deployed in high AQI areas of Delhi and Gurgaon as a pilot to assess their efficacy. Senior leaders from the industry will be mobilised to adopt and support technological solutions to environmental problems."

Earlier reports by Teri and Automotive Research Association of India had named industrial activities as the greatest contributors to Delhi's noxious air quality, closely followed by road dust and transportation, which require an immediate solution.

'Genomic data critical for future pandemic preparedness'

Post

India Science Wire — New Delhi, Wednesday, 21 June, 2023

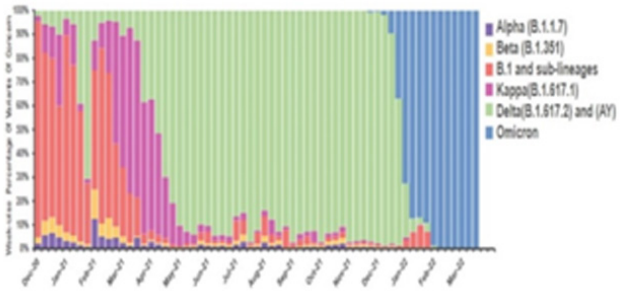

Figure Legend: The bar graph represents distribution of different variants from December 2020 to March-2022.

Different SARS-CoV-2 variants drove three major COVID-19 waves in India. A group of researchers has studied the effects of SARS-COV-2's Variants of Concern (VOC) using genomic surveillance.

The study is based on the surveillance and sequenced samples in Pune during December 2020 to March 2022.

"The next-generation technology was employed to sequence SARS-CoV-2 genomes obtained from RNA samples of COVID-19 positive patients (by RT-PCR). For our study, we considered 10,496 samples which were sequenced using two different platforms at IISER and NCL, Pune," informs Dr Krishanpal Karmodiya, the lead researcher.

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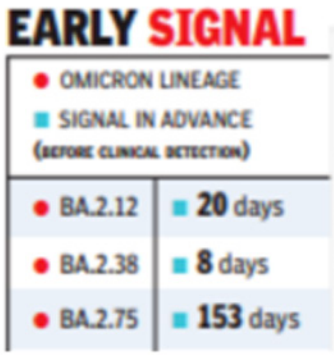
THE TIMES OF INDIA

'Omicron found in Pune sewage before detection in Botswana'

TNN | Mar 26, 2023, 09.19 PM IST

PUNE: Three out of 10 sewage sites in the city had traces of Omicron days before its first detection in a patient's sample at Botswana in southern Africa on November 11, 2021.
A wastewater study by Pune-based institutes CSIR-National Chemical Laboratory (NCL) and Indian Institute of Science Education and Research (IISER), Pune Knowledge Cluster, among others, revealed it. Omicron was initially touted as the South African variant after it was first detected in laboratories in Botswana.



Cities

Pune's Sassoon Hospital to start whole genome sequencing of dengue virus

Jul 22, 07:30 PM IST • 1 min read

Experts from Sassoon General Hospital (SGH) and BJ Medical College (BJMC) in Pune, India, will conduct whole genome sequencing of the dengue virus (DENV) in an effort to combat the disease. The study aims to identify the genotypes of the virus, any mutations, and specific serotypes or genotypes currently in circulation. The findings will help in developing vaccines against dengue and aid in managing and preventing outbreaks. The study is part of the Pune Knowledge Cluster's health...

Image used for representational purpose only

PUNE: The Pune Wastewater Surveillance project will also monitor H1N1, H3N2 and other subtypes of the influenza-A viruses along with the Covid-19 virus across the city.

Samples from treatment systems from several areas in Pune will be tested for early detection of community-wide disease prevalence.

The project by Pune Knowledge Cluster, funded by Rockefeller Foundation, started in August 2021.

In a first, Pune's B J Government Medical College to undertake genome sequencing of dengue virus

The project is facilitated by the Pune Knowledge Cluster and supported by the Rockefeller Foundation.

Can learnings from Covid genome sequencing and wastewater surveillance be leveraged to address the increasing problem of dengue? For the first time, concerted efforts have been taken under the aegis of the Pune Knowledge Cluster (PKC) — one of the six science and technology clusters established by the Office of the Principal Scientific Adviser to the Government of India — towards genomic sequencing of the dengue virus.

The B J Government Medical College (BJGMC) supported by the Rockefeller Foundation has taken up this ambitious project that has been facilitated by the PKC. Experts at the BJGMC will try to decipher the genetic material of the virus through the project.

"We want to track the spread of the viral infection, how it is changing and how this may affect public health," Dr Rajesh Karyakarte, state coordinator for genomic sequencing, told The Indian Express.

Consortium of national labs to upscale genome sequencing

'Continuously monitoring the situation in Bengaluru, Hyderabad, Delhi, Pune'

December 03, 2021 07:50 pm | Updated 07:50 pm IST - HYDERABAD

SPECIAL CORRESPONDENT

COMMENTS SHARE READ LATER

A consortium of national laboratories across four city clusters of Bengaluru, Hyderabad, New Delhi and Pune performing genomic surveillance of coronavirus is in the process of upscaling the work as part of the national efforts led by Indian SARS-CoV-2 Genomics Consortium (INSACOG), said top scientist Rakesh Mishra, the former director of Centre for Cellular and Molecular Biology (CCMB) on Friday.

Dr. Mishra, who is now the director of Tata Institute for Genetics and Society and is continuing to conduct research at his lab here, said the consortium is "continuously monitoring the situation in all the four cities and has upscaled its efforts to sequence as many samples as possible".

Printed from
THE TIMES OF INDIA

In just over a month, Omicron in 83% Covid samples in Pune

TNN | Jan 16, 2022, 10.24 AM IST

PUNE: Omicron is now the dominant SARS-CoV-2 variant here, fast replacing Delta in little over a month, an analysis of 1,769 samples sequenced at the Indian Institute of Science Education and Research, Pune, and the National Chemical Laboratory has revealed.

Genomic sequencing at the two institutes, between November 28 and January 8, found that Omicron was in just 1% of samples from November 28 to December 4. But in samples analysed between January 2 and January 8, the variant was in 83% of samples.

Scientists from the two institutes said the finding indicated that the new variant has been spreading in the community. The data also suggested that most of the Covid-19 cases being reported currently could be attributed to Omicron, Dr Krishanpal Karmodiya, professor of biology at IISER, told TOI.

Omicron present in 83% of samples sequenced in city

Delta, meanwhile, seems to have lost its hold on Pune, with just 0. 004% of samples sequenced in the latest week (January 2-8) reporting the variant and 14% reporting Delta sub-lineages.

Experts said though Omicron is seeing rapid spread, a silver lining is that it has replaced the more virulent Delta variant, which was associated with severe Covid and a large number of hospitalisations during the second wave.

The scientists, however, said the public needs to be cautious. "Omicron has exponential growth advantage which facilitates high transmission. This property of the virus threatens to offset any relief due to less severe disease caused by this variant," Dr Dhanasekaran Shanmugam, senior principal scientist and coprincipal investigator on the project at NCL, told TOI.

Pune Knowledge Cluster Plays Host to G20-CSAR Side Event on Pandemic Preparedness

लोकमत

साथरोगाच्या माहितीचे विश्लेषण आता 'एआय'द्वारे : डॉ. एल. एस. शशिधर

लोकमत न्यूज नेटवर्क

पुणे : साथरोगाचे सर्वेक्षण आणि त्या माहितीचे संकलन प्रत्यक्ष करावे लागते. परंतु, त्या जमा केलेल्या माहितीचे विश्लेषण हे आर्टिफिशिअल इंटेलिजन्सद्वारे सध्या आहे. भविष्यातील महामारी किंवा साथीच्या उद्रेकाबाबत धोक्याची घंटा आधीच समजू शकेल, असा प्रकारे राष्ट्रीय आणि आंतरराष्ट्रीय स्तरावर प्रणाली विकसित होणे आवश्यक आहे, असे मत पुणे नॉलेज सेंटरचे सहसंस्थापक डॉ. एल. एस. शशिधर यांनी व्यक्त केले.

जी-२० परिषदेअंतर्गत प्रमुख संशोधक आणि वैज्ञानिक सल्लागारांचे आरोग्य, साथरोग सर्वेक्षण आणि जागतिक साथीची तयारी या विषयावर चर्चासत्र 'इंडियन इन्स्टिट्यूट ऑफ सायन्स एज्युकेशन ऑण्ड रिसर्च (आयसर) पुणे' येथे सोमवारी पार पडले. त्यानंतर पत्रकारांशी डॉ. शशिधर बोलत होते. या परिषदेला

'जी-२० परिषदेअंतर्गत प्रमुख संशोधक आणि वैज्ञानिक सल्लागारांचे आरोग्य, साथरोग सर्वेक्षण आणि जागतिक साथीची तयारी या विषयावर चर्चासत्र आयसर पुणे येथे सोमवारी पार पडले. त्यावेळी बोलताना मान्यवर.

जागतिक आरोग्य संघटनेच्या माजी प्रमुख वैज्ञानिक डॉ. सौम्या स्वामिनाथन यांनी ऑनलाइन माध्यमातून सहभाग नोंदवला. याप्रसंगी आयसीएमआर-एनआयव्हीच्या संचालिका डॉ. नीलिमा गोडबोले, वैज्ञानिक आणि औद्योगिक संशोधन परिषदेचे माजी महासंचालक डॉ. शेखर मांडे, टाटा इन्स्टिट्यूट फॉर जेनेटिक्स ऑण्ड सोसायटीचे संचालक डॉ. राकेश मिश्रा, पुणे नॉलेज सेंटरचे सहसंस्थापक डॉ. एल. एस. शशिधर आदी मान्यवर उपस्थित होते.

सौम्या स्वामिनाथन म्हणाल्या की, "आजारांच्या सर्वेक्षणाची योजना आधीपासून होणे आवश्यक आहे. मानव, प्राणी आणि पर्यावरणातील बदलांचा अभ्यास करून सर्वेक्षण योजना एकात्मिक आणि परस्परपूरक बनवण्यासाठी प्रयत्न करायला हवेत. डॉ. मांडे यांनी एक आरोग्य, सर्वेक्षण आणि साथीच्या आजारांची तयारी याबाबत चर्चेची आणि धोरणाची नितांत आवश्यकता आहे, असे स्पष्ट केले.

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