

INDIA HEALTH FUND

A TATA TRUSTS INITIATIVE

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India Health Fund: catalysing India's progress towards elimination of infectious diseases

It was in 2016, the Tata Trusts launched the India Health Fund (IHF) in a strategic partnership with The Global Fund to Fight AIDS, Tuberculosis and Malaria. IHF was to be a pioneering vehicle designed to serve as a trusted mechanism to generate significant impact in addressing key health challenges in the country – starting with malaria and tuberculosis.



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“The India Health Fund is an ambitious project undertaken by Tata Trusts along with The Global Fund and the Government of India. Infectious diseases such as Malaria and Tuberculosis though widespread are treatable and controllable. In order to overcome the challenges associated with this issue, we should use innovations to create models that are not geographically bound and can be replicated anywhere in the world. The India Health Fund will endeavour to combine innovation and effort for the implementation of the project at a large scale.”

*Mr. Ratan N. Tata, Chairman,
Tata Trusts, on the launch of IHF*

Since then, IHF's work has supported programs and projects that develop new products or strategies for innovative business models and innovative partnerships or financing mechanisms that significantly scale existing effective solutions in healthcare.



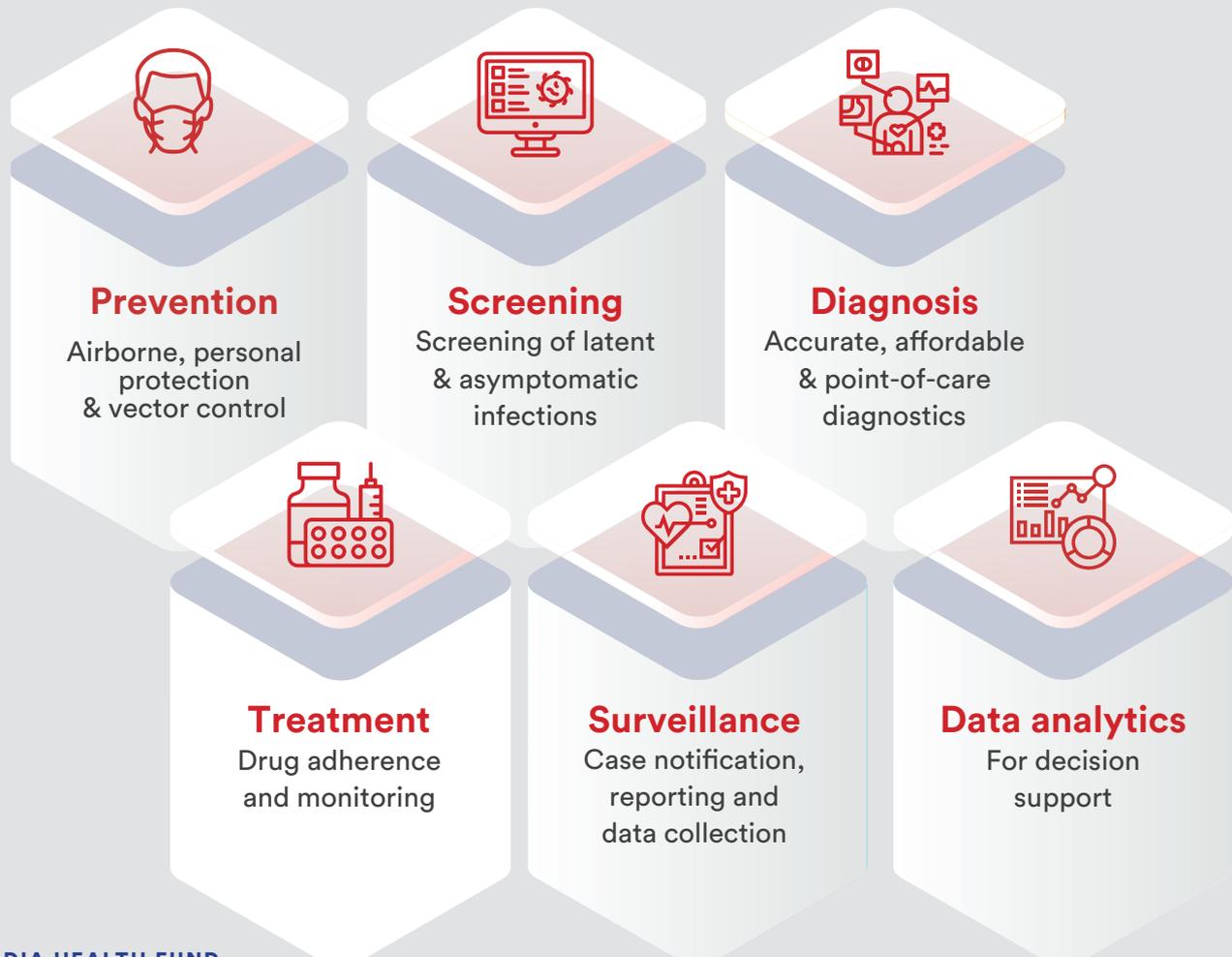
Transforming an idea to large-scale impact

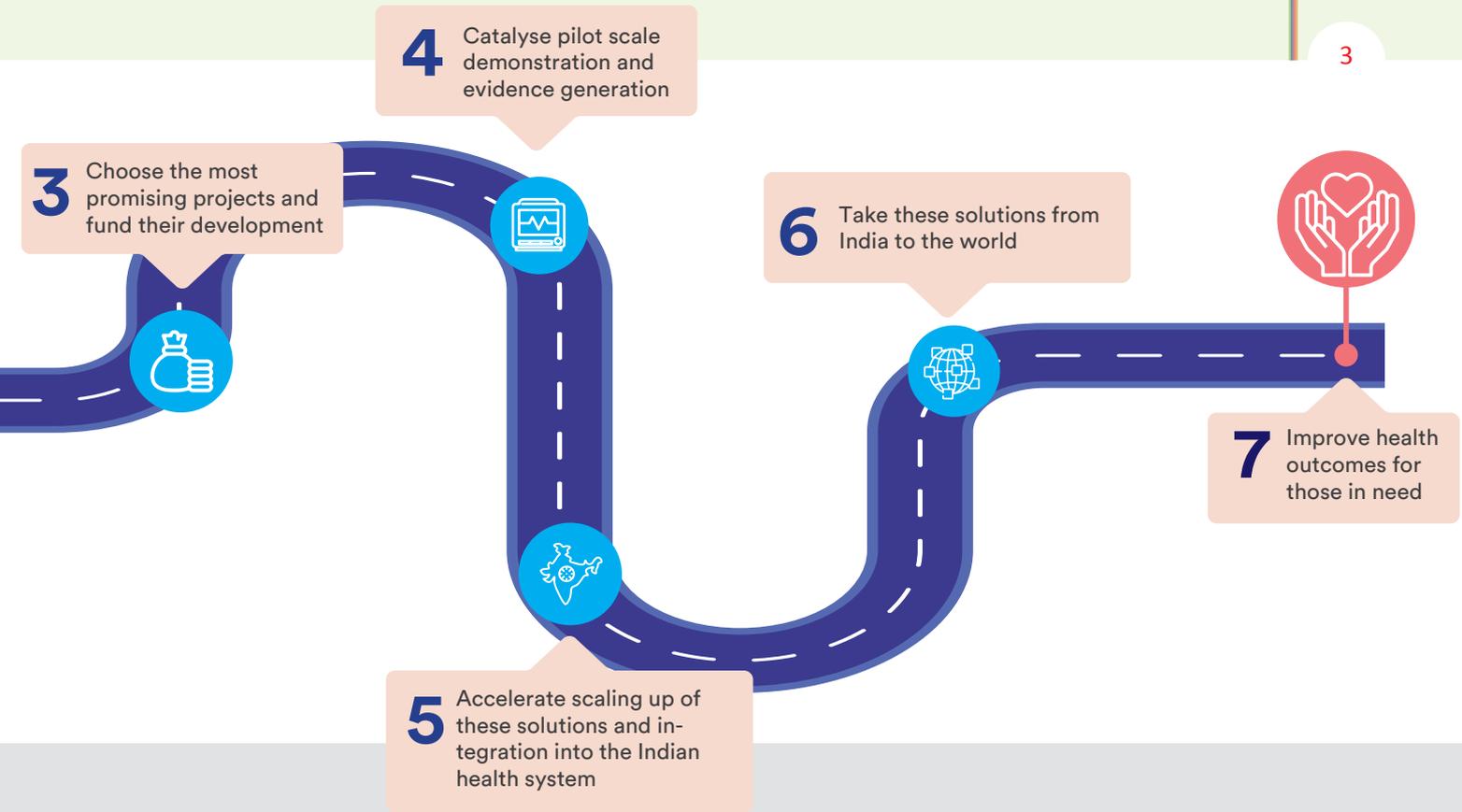
India Health Fund collaborates with partners to:



Areas of work

Identifying and enabling innovations across six key pillars





The Impact

Since inception in 2017, the India Health Fund has



Evaluated over **800 potential** innovations



Funded and supported the development and adoption of **10 innovations**



5 of 10 projects have now entered the public health system



Established 15 partnerships to enable innovation development, validation, evidence generation and market access



Helped **IHF-supported innovations** secure co-funding commitments

Changing lives... one innovation at a time

1 Truenat: a fast PCR-based TB detection method to find the missing millions

The absence of specialized testing facilities and skilled technicians to diagnose TB leads to several cases going undiagnosed (“the missing millions”), thereby hampering efforts to eliminate the disease around the world. TB patients in low-resource settings lack access to accurate and rapid TB diagnostic tests at point of care leading to delay in diagnosis and treatment initiation.

IHF funded the validation of Molbio Diagnostics’ Truenat. Truenat is a compact, chip-based, battery-operated RT-PCR system which provides test results at the point of care within 90 minutes. This enables same day reporting and initiation of evidence-based treatment of TB, which reduces the risk of infection spreading while waiting for test results and facilitates faster recovery due to early initiation of treatment. It is significantly cheaper per test than other RT-PCR tests and needs minimally trained manpower at community health centres. Furthermore, Truenat is a multiplexing platform which supports tests for several diseases, including COVID-19, making it a cost effective and capital efficient solution.



Development to deployment

- Truenat is currently in use nationally by Central TB Division for TB diagnosis
- Truenat is the first PCR based platform which can be used to test patients for TB and COVID-19 and was validated for effectiveness as a TB diagnostic test at community health centres in Uttar Pradesh with support from India Health Fund.
- The India Health Fund together with FIND and Brihanmumbai Municipal Corporation (BMC) successfully implemented India’s largest bi-directional testing initiative for TB and COVID-19 using Truenat. This has created long term capacity for increased TB testing and surge capacity for COVID-19 testing in Mumbai without the need for additional manpower.

2 qXR: an automated chest X-ray screening solution for tuberculosis

Quick diagnosis of TB continues to be a challenge. Screening an X-ray to look for changes in the appearance of lungs that are suggestive of TB is a workforce-heavy and time-consuming process. With India facing an acute shortage of trained radiologists, getting confirmed TB diagnosis can take weeks leading to missed TB cases, increased disease spread, delayed initiation of treatment and higher risk of mortality.



IHF and Qure.ai identified this problem and developed a breakthrough AI-based chest X-ray screening software – qXR. qXR

rapidly classifies X-rays, identifies lung abnormalities and highlights them on the X-ray, enabling the detection of TB within minutes, so that the treatment can start promptly. CE certified, the qXR software, is trained and tested on over 3.7 million chest X-rays using deep learning. qXR is not only more accurate with upto 33% additional TB cases detected, but also affordable projected at INR 100 per test and can be used easily at primary health centres, without need for radiologists.

Development to deployment

Following the outbreak of COVID-19 pandemic, the use of Qure.ai's technology was further developed to enable healthcare providers to identify and triage cases of COVID-19 along with TB using the AI-based qXR solution. The system was able to detect lung abnormalities related to COVID-19. IHF facilitated the fundraising and deployment of the qXR solution for COVID-19 with the Municipal Corporation of Greater Mumbai (MCGM) bolstering its COVID-19 response efforts across 15 sites in Mumbai. These efforts resulted in:

- Reduction in turnaround time by detecting radiological signs of COVID-19 in under a minute
- 25,000 chest X-rays processed
- 20% were instantly reported by qXR as having COVID-19 indications - this included asymptomatic cases. Screening and triaging COVID-19 suspects helped optimal utilisation of limited RT-PCR kits
- qXR was proven to be a reliable and progressive decision support tool, enabling non-specialists to screen patients without radiologists

3 CisGEN: cutting down cattle to human transmission of TB

Bovine tuberculosis (TB), an infectious disease of cattle, is the seventh largest disease threat to humans transmitted from animals. Currently, it takes a veterinary doctor nearly four days and two visits to diagnose bovine TB, making diagnosis an expensive and time-consuming process, which increases the ease of spread to humans.

To tackle this problem, IHF funded CisGEN Biotech Discoveries Private Limited to develop, validate and manufacture an accurate, rapid (under 10 minutes) and affordable (INR 50 per animal) bovine TB test kit that uses a unique combination of antigen proteins that can differentiate whether the bacterial infection is from TB-causing bacteria or from another environmental mycobacterium. First of its kind, the kit is truly a “One Health product” which looks at the interconnectedness between humans, animals, and the environment. Moreover, the Cisgen kit is deployable in farms with minimally trained manpower and does not need any bio-containment facility.

Development to deployment

The product was field tested by the National Dairy Development Board (NDDB) and was validated for 95% sensitivity and 100% specificity.



4 TMEAD: a smart pill-box friend that helps TB patients follow treatment

One of the difficulties in TB treatment is its long duration, where patients must take medicines anywhere from 6 months - 2 years. The side effects linked to the medications often drive patients to stop or skip doses. As a result, the illness returns, and the bacteria get an opportunity to develop resistance to the TB drugs. Ensuring proper adherence to medication can significantly reduce the incidence of drug resistance. Currently, checking adherence depends on healthcare workers following up manually with patients.



IHF-funded and Sense Dose Technologies-led TMEAD (Tuberculosis Monitoring Encouragement Adherence Drive) is a physical reusable device that helps TB patients successfully complete their treatment using digital adherence technology. The smart pillbox comes preloaded with 15 days of prescribed pills that can dispense 18 tablets



at a time, which are also pre-sorted by dose. Using Internet of Things & cellular network technology, TMEAD box reminds patients, dispenses medicines, monitors their uptake and rings a physical alarm as well as sends digital reminders when patients miss their medication. Moreover, the pill box also notifies health workers in real time about patients' adherence to treatment, thereby easing their workload, enabling remote patient monitoring and improving case tracking.

By categorizing patients based on their level of adherence, TMEAD helps healthcare workers provide differentiated care. It also helps them keep a track of patient prescription, which reduces the time a certain patient has to spend at primary healthcare center, thus reducing the risk of spreading the disease.

Development to deployment

TMEAD achieved 92% adherence rate after deploying their platform in Nashik in comparison to the average 62% adherence rate. The improved patient outcomes achieved by using TMEAD for TB treatment adherence in pilot scale deployments supported by IHF prompted the District TB Office of Ahmedabad to use the device among 350 drug sensitive TB patients in Ahmedabad, to be followed by use across Gujarat.

5 Moskeet: an intelligent surveillance solution to classify and predict mosquito-borne disease outbreaks

The mosquito is the most dangerous animal on Earth due to its ability to transmit vector-borne diseases like Malaria, Dengue and Zika. In India alone, there were 3.37 lakh cases of malaria and 1.30 lakh cases of dengue between April 2020 and March 2021. Moreover, the elimination of malaria by 2030 is estimated to add \$4 trillion to the Indian economy.

Most vector-borne diseases are not preventable by vaccines and can be controlled only through an integrated approach that includes surveillance, vector control, prompt case detection, and health awareness.

Currently, vector surveillance depends on manual methods to catch, collect, count and classify mosquitoes, and requires expert entomologists for analysis and reporting. The delay caused by manual processes and the shortage of entomologists makes timely vector control activities difficult to implement.



To tackle this problem IHF funded TrackItNow to develop Moskeet, which is the world's first commercially available smart mosquito trap that can autonomously identify and count broad spectrum of mosquito species based on their wing beat frequencies using artificial intelligence and Internet of Things. By transmitting live data to central surveillance centres, Moskeet enables effective vector surveillance, determines hotspots in real time and ensures fast and efficient management of Malaria, Dengue, Chikungunya, Japanese Encephalitis and Zika Virus. By numbers: Moskeet gathers and interprets data 20 times faster, 3 times more accurately, and at 15% of the current cost of manual methods.

Development to deployment

Moskeet is being used by three municipalities (Greater Hyderabad, Thiruvananthapuram and Panjim) as it helps improve vector surveillance and control by reducing manual methods.

6 Gazelle: screening malaria in one minute with a \$1 test

India is home to 3% of the 241 million world's malaria cases and 2% of the 627,000 global malaria deaths with Plasmodium falciparum (Pf) and Plasmodium vivax (Pv) being the most common types found in the Indian population. Pv infections are becoming increasingly prevalent in India, however, these infections tend to have low parasite counts and are therefore often missed by conventional diagnostics.

Among the existing range of diagnostic tests, while PCR and LAMP molecular tests are very sensitive, they are also very expensive. On the other hand, microscopy-based diagnosis is a challenge in peripheral settings due to the need for highly skilled microscopists. Moreover, microscopy has accuracy limits in detecting low parasite counts associated with Pv infections.



The lack of an accurate, affordable and quick diagnostic test for malaria detection and species identification often delays treatment initiation and thus contributes to mortality.

To address this gap, IHF funded Hemex Health to develop Gazelle – a one-minute, highly sensitive and accurate, point-of-care, rapid diagnostic test for malaria, which simply detects Hemozoin, a metabolic byproduct of malaria infections. Using a single blood sample at the patients' doorstep, the device can detect the presence of both Pf and Pv parasites in just one minute. Gazelle enables automated data acquisition and transmission of case-patient details to the malaria surveillance system resulting in real-time reporting. Targeted at cost of \$1 per test, Gazelle also supports multiplexing by testing for other diseases such as sickle cell disease, beta thalassemia, that often occur in the same area as malaria.



7 The world's first point of care biomarker-based test to enable rapid and low-cost triage of potential TB patients

Currently, India spends large resources testing millions of TB suspects annually to identify the confirmed cases. 7-10 presumptive TB suspects have to be tested to identify one TB patient. Conventional methods for diagnosing TB are not very accurate and can take 6-8 weeks to produce results. On the other hand, accurate culture and molecular TB confirmatory tests are time-consuming, expensive and cannot be used for screening all suspected TB patients. Also, the available diagnostic tools can fail to identify patients with low bacterial burden and result in missing millions of cases.

Towards helping find these missing millions with an affordable, accurate and fast triage solution, IHF funded Stellar Diagnostics India Pvt. Limited. The TB triage test with a target cost of under \$1.7 per test has the potential to enable rapid triage (within 20 minutes at point of care) of potential TB patients, speeding up diagnosis and linkage to treatment and narrowing the number of TB suspects that need to be referred for confirmatory testing. Moreover, the test requires no laboratory infrastructure and requires minimal training of health care workers. This innovation holds the potential to dramatically reduce the financial burden on the TB control program.



Development to deployment

Ministry of Health and Family Welfare has begun validation of the rapid diagnostic test for TB by Stellar Diagnostics while the test is still under development as it meets an urgent national priority.

8 OmiXiAMP: a low-cost multiplex platform to detect and distinguish COVID-19, influenza and TB

India reported 1.93 million cases of TB in 2021. Influenza burden is estimated at 0.6 - 1 million while COVID-19 has claimed more than 5 lakh lives so far in India. Diseases like TB, influenza and COVID-19 manifest similar disease symptoms making diagnosis difficult for healthcare practitioners. Moreover, patients would need to take multiple, costly and time-consuming tests that could increase the risk of the patient's condition deteriorating.

IHF funded OmiX Laboratories to develop OmiXiAMP, a multi-disease diagnostic platform that uses Loop-mediated Isothermal Amplification (LAMP) technology to detect COVID-19,

TB and Influenza. The point-of-care, automated platform is designed for use in low-resource settings, with simplified sample extraction and visual readout to facilitate diagnosis, which reduces the need for a skilled workforce to interpret test results while making the test error-free. Moreover, the platform can potentially report 10x more tests in the same time at 1/10th the combined cost of RT-PCR tests, making vast scale adoption more feasible. Early diagnosis will not only improve patient outcomes by fast initiation of right treatment but also reduce the risk of spread of undetected infection.

9 Autogene: a one-stop shop for TB diagnosis

The Indian government has chalked out an ambitious plan to eliminate TB by 2025, however with present infrastructure it is able to notify only 58% of TB patients. A person infected with TB, if left undiagnosed, can infect on an average 10 to 15 healthy individuals in a single year.

To reduce the gap between TB incidence and the notified cases, IHF funded Valetude Primus Healthcare to develop Autogene. A one-stop shop for TB diagnosis, Autogene enables safe collection of sputum samples from patients in specially designed capture bottles, which protect the healthcare workers from exposure to highly



contagious TB bacteria. Furthermore, it provides rapid (TB diagnosis within 1 hour), accurate and affordable TB diagnosis without the need for skilled technicians at primary health level. The device includes a battery-operated RT-PCR diagnosis capability with an automatic gene detection feature that can be used for a broad range of automated applications including DNA isolation & extraction, enabling faster and error-free detection and allows for usage with minimal training of healthcare workers. It is a one-step detection solution – from sample collection, processing to report generation – that provides a holistic report to clinicians on disease confirmation as well as persisting bacterial resistance. Moreover, Autogene is integrated with National TB program and sends results for surveillance and reporting directly. Finally, it can also be used for the diagnosis of several bacterial and viral diseases including TB, COVID-19, Typhoid and Sepsis.



10 A breakthrough RT-PCR test to speed the diagnosis of DR-TB from 4 months to 2 weeks

The standard first-line TB treatment typically lasts for approximately 6 to 9 months. However, some patients do not respond to this first-line of treatment as the TB bacteria have become resistant. In the last two years, about 1.15 lakh people were detected with drug resistant TB (DR-TB) with fatalities accounting for about 20% of the detected patients. The 'low responders' to standard first-line TB treatment have a high chance of severe consequences, like organ failure, high probability of catching multiple drug resistance and, even, death. It also leads to increased risk of community transmission of DR-TB. In these drug-resistant cases, the patient must be switched to second-line treatment as soon as possible. Rapid diagnosis of drug resistance is a key step to make this happen. As per the current protocols, the effectiveness of TB treatment and thus presence of DR-TB is realised about four months following treatment initiation. Often, this leads to late diagnosis and is one of the key reasons for the increase in incidence of DR-TB and fatality linked to the disease.

To shrink these timelines for diagnosis of DR-TB, IHF onboarded HealSeq Precision Medicine Private Limited. HealSeq's host RNA biomarker-based blood test can accurately detect drug resistance from TB patients as early as two weeks after treatment initiation. The abundance of these RNA signature genes can help physicians to classify patients as good - intermediate- or poor-responders to the treatment. Intermediate - or poor-responders, diagnosed as DR-TB patients, can be immediately shifted to second-line therapies. This is a breakthrough in the diagnosis and treatment of DR-TB as it has the potential to significantly speed up diagnosis, guide fast clinical decision of shifting to 2nd-line therapies, treatment initiation and thus curtail the spread of the disease. This easy-to-administer test, once developed, will be available at ~ Rs. 1000, which is 1/6th the cumulative cost of the multiple tests that need to be taken during the TB treatment course. The test itself takes ~ 12-24 hours turnaround time vs. current methods that take 4-6 weeks.

The journey so far

Reaching the hardest-to-reach and bringing them gamechanging innovations continues to be IHF's mission. Over the first five years of operation, IHF has carved a niche in the health innovation ecosystem by:

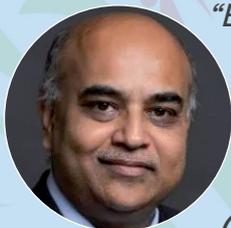
- Proving successful use cases which demonstrated improved patient outcomes – enabling partnerships and resource mobilization for scale up of solutions.
- Creating the first-of-its-kind platform for collaboration between government, public and private sectors to collaborate in the development, validation, financing and scale up of innovations to tackle infectious diseases.
- Establishing convergence among key stakeholders of the need to prioritise development of accurate, low-cost diagnostics and efficient digital tools for use by a minimally trained workforce in primary care to,
 - > Improve early diagnosis of infectious diseases
 - > Democratize access to treatment, and follow up care with digital solutions
 - > Provide data and analytics for decision support to healthcare providers
 - > Improve supply chains throughout the continuum of care
 - > Strengthen surveillance capacity and capabilities to improve case finding and control disease outbreaks.



Power of partnerships

Partnerships are at the core of IHF's work. IHF works closely with partners to co-create solutions. Collective action helps build an ecosystem that supports the development, adoption and funding of innovations and enables their growth journey to scale. Together, IHF ensures that the joint impact with its partners is larger than the sum of individual strengths. Here is what some of IHF's latest partners had to say about working with IHF:

*"IKP Knowledge Park looks forward to co-developing a pioneering innovation ecosystem with the India Health Fund to tackle challenges in healthcare harnessing the power of technology and innovation," said **Deepanwita Chattopadhyay, Chairman and CEO, IKP Knowledge Park.** "Our work together will especially converge on global priorities such as digital health, infectious diseases and One Health."*



*"BIRAC is excited to deepen its partnership with the India Health Fund. With BIRAC's strength in incubation and IHF's focus in late-stage development, the synergies of the two organizations will ensure that great ideas seamlessly reach the last mile," said **Dr. Shirshendu Mukherjee, Mission Director - Grand Challenges India; Mission Director - National Biopharma Mission (Additional Charge), BIRAC.** "Our latest collaboration in digital health initiatives including the ज्ञानCARE Challenge is a testament to the significant impact we can bring together."*

*"The Central TB Division, Government of India has been glad to support the India Health Fund in scouting for technology-based innovations that could help tuberculosis care continuum and also through the two-way conversations that ensure IHF-funded innovations reach their true impact and improve public health outcomes in the near future," said **Dr. Rajendra P Joshi, DDG (TB), Central TB Division, Ministry of Health and Family Welfare, Govt of India.***



*"Early diagnosis is key to saving lives. With this shared purpose, FIND and the India Health Fund are aligned to ensure that no one is left behind when it comes to screening and diagnosing critical public health diseases. Our partnership on expanding access to dual testing for TB and COVID-19 through an integrated approach using the gamechanging innovative multiplex diagnostic platform 'Truenat' has been a milestone in optimising the use of limited healthcare resources. The intervention brought several precious lessons to light, which could be capitalized to transform our healthcare system and prepare for future outbreaks and pandemics," said **Dr Sarabjit S Chadha, Regional Technical Director - India & SE Asia, FIND.***

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