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# PREDICT INDIA

One Health in action (2014-2020)







# INDIA

The Indian subcontinent is known for its extraordinary biodiversity. Due to its unique geographical location and evolutionary history, India contains multiple biodiversity hotspots – globally important regions with large number of unique species. Such hotspots are still being explored and are expected to be a treasure trove of unknown wildlife – from microorganisms to vertebrates. In addition to the hotspots, vast number of Indians still live close to natural habitats and regularly interact with wildlife – both directly and indirectly through their livestock. India is also a rapidly developing country. As a result, vast natural areas of the country are being modified. Such anthropogenic modifications may often create novel interfaces between humans and wildlife, which may eventually cause spillover of novel zoonotic pathogens.

Pathogens shared between people and animals result in millions of deaths annually and a single outbreak may cause economic losses amounting to trillions of dollars. Such tremendous losses are incurred because response to viral outbreaks are often late. These diseases represent major public health risks especially to low- and middle-income countries. Therefore, early detection and prevention of zoonotic spillover and spread are key to reducing the impact of epidemics and pandemics.

Given India's high population density and increasing regional and international connectivity, local outbreaks are likely to rapidly cross national boundaries causing pandemics. Therefore, for the benefit of both Indian and the global populations, potential EIDs must be identified and their risks

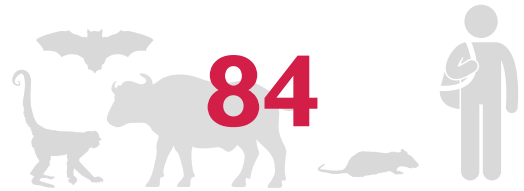
characterized in detail. In India, the PREDICT project focused efforts on the highest risk locations and interfaces, where animals and people share changing landscapes, and diseases of unknown origin continue to take a significant toll. An example being the state of Uttar Pradesh, which has among the highest rates of undiagnosed encephalitis in India. The project was led the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPIMS) in Lucknow in partnership with EcoHealth Alliance.

## LOCAL PARTNERS

- Chief Medical Officer Gorakhpur, Government of Uttar Pradesh
- Community Leaders/representatives, Maharajganj Field area, Uttar Pradesh
- Forest and Wildlife Department, Government of Uttar Pradesh
- Health Department, Government of Uttar Pradesh
- Medical College, Gorakhpur, Government of Uttar Pradesh
- Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPIMS), Lucknow
- USAID India



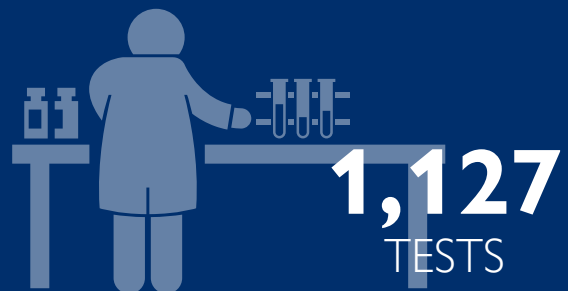
**DEVELOPED** the One Health Workforce by training 20 people in India.



**OPERATIONALIZED** One Health surveillance and sampled 84 animals and people, helping minimize the spillover of zoonotic disease threats from animals into human populations.

## LABORATORY STRENGTHENING

· Sanjay Ghandi Postgraduate Institute of Medical Sciences



**DETECTED** 6 unique viruses in human populations.





## RAJESH BHATIA

Former Director  
Communicable Diseases  
WHO Regional Office for  
South-East Asia, New Delhi, India

*“PREDICT enhanced national capacity and strengthened global security against emerging threats of novel zoonotic viruses. Augmented advocacy on One Health approach is likely to catalyze the policy decisions to accelerate OH implementation across several priority health issues. The project should be scaled up and integrated into the national disease surveillance programme.”*



## HARJEET SINGH MAAN

Laboratory Lead  
Sanjay Gandhi Postgraduate  
Institute of Medical Science

*“I have since taken my expertise in microbiology to work as a Senior Scientist at the State Virology laboratory, at Gandhi Medical College in Bhopal Madhya Pradesh, India, where I am now in charge of a virology lab.”*

# ACHIEVEMENTS

- Identified high-risk areas and performed site characterization within rural/agrarian Maharajganj district, Uttar Pradesh. Subsequently conducted wildlife surveillance and biological sampling of bats, rodents, and non-human primates to discover emerging zoonotic disease threats.
- Engaged in community partnership building and syndromic surveillance at a rural Maharajganj district clinic and conducted surveillance and behavioral risk investigations with patients.
- Trained the laboratory team at SGPIMS in disease detection, outbreak response, biosafety and PPE, cold chain management, laboratory safety, and ethical research practices, all skills related to the detection of priority zoonotic diseases and emerging viral threats. As a result, the lab now has adequate capacity to safely detect known and novel viral threats and to test for viral families that include priority zoonotic diseases.
- Detected 6 known viruses in samples collected from febrile patients at our One Health surveillance site including Influenza A, the known Human Coronavirus 229E, 3 known Human Parainfluenzaviruses, and West Nile virus.
- Regularly participated in GHSA India meetings to present PREDICT project surveillance activities.



# ONE HEALTH SURVEILLANCE



*In India, the PREDICT project conducted One Health surveillance in the Maharajganj district, Uttar Pradesh and its vicinity. Maharajganj is a border region between India and Nepal and as such is a potential corridor of transboundary transmission of emerging infectious diseases. The mostly rural, agrarian site is home to rodents, rhesus macaques, and bats that have frequent contact with people. Its proximity to the Nepal border also results in transboundary livestock movement. The Maharajganj district has a history of severe outbreaks of Acute Encephalitis Syndrome, AES, a clinical condition with symptoms that include high fever, confusion, disorientation, headache and in severe cases coma. These symptoms may result from multiple known pathogens, including Japanese encephalitis virus, Herpes simplex virus, enteroviruses, Chandipura virus, and Nipah virus. But, these symptoms can also be caused by as of yet unknown pathogens, which like Nipah may spillover into people from wildlife populations. Our PREDICT team in India put One Health in action to sample wildlife and people in partnership with a local hospital, a hotspot for AES and febrile illnesses.*

## VIRUS DETECTION

The PREDICT project's strategy for viral detection included screening samples using broadly reactive consensus PCR (cPCR) for priority viral families, including corona-, filo-, flavi-, and paramyxo- families, and influenza virus. Positives detected using these assays were sequenced to identify the viruses and compare their relationship to known pathogens, and viruses were prioritized for further characterization. This approach allows for detection of both known and novel viruses and improves our understanding of the presence and diversity of viruses, as well as potential pathogens, in humans and animals.

In India, PREDICT project protocols were implemented at the laboratory of the Sanjay Gandhi Postgraduate Institute

of Medical Science. The PREDICT program strengthens national laboratory systems by enabling disease detection through a One Health laboratory network based at partner labs mainly at the SGPIMS, Lucknow Uttar Pradesh. This lab maintains strong ties to the national system, and protocols and information will be shared openly with animal and human health labs working to actively improve interlinkages. Through in-service trainings, the PREDICT project provides opportunities for staff from the national system to enhance skills in virology, quality systems, biosafety, lab safety, and methods for detecting zoonotic diseases and emerging threats.



# VIRUS FINDINGS IN PEOPLE

A total of 129 samples were tested from 65 people enrolled at the local Maharajganj district clinic and 6 known viruses from 4 viral families were detected.

A strain of Human Coronavirus 229E was detected in 6 people with febrile illness sampled at the clinic. This is a strain of the known alphacoronavirus Human Coronavirus 229E. This human 229E virus is known to cause respiratory illness in people.

Influenza A was detected in 22 people (13 children and 9 adults) with fever and influenza-like illness sampled at the clinic. This is the known virus Influenza A; influenza viruses are important pathogens in animals and people; therefore subtyping was recommended.

Three known paramyxoviruses were also detected. The known Human Parainfluenzavirus 2 was detected in 3 people (2 children and 1 adult) with febrile illness sampled in the clinic. A strain of the known Human Parainfluenzavirus 1 was also detected in 11 people (7 children and 4 adults) with febrile illness sampled in a clinic. Finally, a strain of Human Parainfluenzavirus 3 was detected in 6 people (3 children and 3 adults) with febrile illness sampled in the clinic. Human parainfluenza viruses are major causes of lower respiratory tract infections in infants and elderly persons. Human Parainfluenzavirus 3 virus has been previously found in other non-human primates but further studies are needed to determine whether it is transmitted between humans and non-human primates. PREDICT project investigators continue investigations to further characterize this virus.

We also detected a strain of West Nile virus (a known member of the flavivirus family) in 3 people (1 adult and 2 children) sampled at the clinic. West Nile virus is spread by mosquitoes and causes few or no symptoms in the majority of people. About 20% of people develop a fever, headache, vomiting, or a rash and in less than 1% encephalitis or meningitis occurs.

Finally, several individuals (n = 11) exhibited co-infections with the following combinations of viruses:

- Influenza A and a strain of Human Parainfluenzavirus 1 (n = 3)
- Influenza A and a strain of Human Parainfluenzavirus 2 (n = 1)
- Influenza A and a strain of Human Parainfluenzavirus 3 (n = 2)
- Influenza A, a strain of Human Parainfluenzavirus 1, and a strain of Human Parainfluenzavirus 3 (n = 1)
- Influenza A, a strain of Human Parainfluenzavirus 1, and a strain of Human Coronavirus 229E (n = 2)
- Influenza A, a strain of Human Parainfluenzavirus 1, and a strain of West Nile virus (n = 1)
- A strain of Human Parainfluenzavirus 1 and a strain of West Nile virus (n = 1)

Samples from a total of 19 animals (7 bats, 4 non-human primates, and 8 rodents/shrews) were also tested for the five viral families. There were no viruses detected in these samples.



## VIRUS TABLE

VIRAL FAMILY	VIRUS	SPECIES	SAMPLING LOCATION	# OF POSITIVE INDIVIDUALS		
				TOTAL	WET SEASON	DRY SEASON
Coronavirus	Coronavirus 229E (Human strain)	Human	Clinic (Maharajganj district)	6	0	6
Paramyxovirus	Human parainfluenzavirus 1	Human	Clinic (Maharajganj district)	11	0	11
	Human parainfluenzavirus 2	Human	Clinic (Maharajganj district)	3	0	3
	Human parainfluenzavirus 3	Human	Clinic (Maharajganj district)	6	0	6
Influenza virus	Influenza A	Human	Clinic (Maharajganj district)	22	0	22
Flavivirus	West Nile virus	Human	Clinic (Maharajganj district)	3	0	3
<b>Total</b>				<b>36*</b>	<b>0</b>	<b>36*</b>

\*Numbers do not total due to individuals having co-infections with multiple viruses



# CAPACITY STRENGTHENING

In India, the PREDICT project lead implementing partner is SGPIMS, Lucknow, a tertiary care hospital and a premier research institute in medical sciences. Through the project, SGPIMS provided opportunities for students, interns, and staff to engage in One Health surveillance and enhance core One Health professional skills required for conducting field investigations (community sensitization and outreach on zoonotic disease risks, biosafety and PPE, safe sample collection from wildlife, livestock, and people, cold chain, safe sample storage and transport, behavioral risk investigations, and data management). The PREDICT project also provided multiple in-person trainings on safe and effective surveillance and sample collection to health professionals and health care workers in Gorakhpur and Maharajan, empowering India's frontline health workforce.

In addition, the PREDICT project provided technical expertise to the SGPIMS lab team in all core skills required to detect priority zoonotic diseases and emerging viral threats. This is a major capacity gain for an apex laboratory in Lucknow, a state which has among the highest rates of unknown acute encephalitis cases in India.

Finally, to encourage multi-sectoral information sharing across animal and human health sectors, the PREDICT team distributed reports on laboratory, capacity, and surveillance progress to the USAID Mission, the Global Health Security Agenda (GHSA) cell (including partners with the US Center for Disease Control in New Delhi), and local institutions such as the Forestry Department, government partners, and university collaborators. In an effort to coordinate across local institutions, the PREDICT team also shared information and reported to the Indian Council of Medical Research, National Centre for Disease Control, and UP State Health Department. In addition to multi-sectoral collaboration, cross-border collaboration was also implemented, as the PREDICT India field lead trained with the PREDICT Bangladesh team in Bangladesh, an illustration of the importance of the PREDICT network and the value of South-South collaboration.



# PRACTICAL IMPLICATIONS

## STRENGTHENED STATE LABORATORY CAPACITY FOR DETECTION OF EMERGING VIRAL THREATS

The PREDICT project in India empowered and established a One Health laboratory team, with the capability to safely test samples from both wildlife and human populations. This is the first lab in Lucknow, and one of the first in India within the GHSA lab network, that has the capacity to screen both human and wildlife samples for priority zoonotic diseases and newly emerging threats such as Disease X.

## PUT ONE HEALTH IN ACTION IN NORTHERN INDIA

The PREDICT project's work in northern India shed light on the causes and risks for undiagnosed acute encephalitis and helped develop capacity for surveillance and disease detection, critical skills for empowering the health workforce and for sustaining effective disease investigations and response to disease threats.

For more information  
view the interactive report at  
**[p2.predict.global](https://p2.predict.global)**





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