Emerging infectious diseases pose a significant burden on human and animal health and global economies. Conventional approaches to epidemic control have most often been reactive. However, explosive human population growth, dramatic changes in land use, and increased global trade and travel require a shift toward a proactive, predictive approach. The PREDICT project aims to prevent, detect, and rapidly respond to the spillover of novel infectious pathogens from wildlife to humans.

While the linkage of human, animal, and environmental health is at the heart of our One Health approach – an increasingly important and recognized lens through which governments, NGOs, and practitioners view public health – the global health community still has three critically important needs:

1) Broader and deeper knowledge of pathogens with the potential to emerge from animals;
2) Targeted surveillance to maximize available resources;
3) Tools to characterize organisms that could be pathogens of significance and to predict where and how they might spillover to susceptible hosts.

**Challenge:** Develop a strategic framework to identify pathogens of pandemic potential that have not yet emerged.

**Opportunity:** Current infrastructure improvements and technological advances have dramatically and rapidly improved our ability to identify high-risk interfaces for disease transmission and to detect novel pathogens before widespread spillover occurs. These advances include improvements in information technology, molecular diagnostics, and risk modeling.

PREDICT has built a broad coalition of partners to discover, detect, and monitor pathogens at the wildlife-human interface using a risk-based approach. Our efforts integrate digital sensing and on-the-ground surveillance at critical points for disease emergence. PREDICT is at the cutting-edge of recent technological advances allowing rapid detection and diagnosis of high-risk viral families, even in settings where resources are limited.
The goal of PREDICT in Malaysia was to integrate wildlife disease surveillance into the public health infrastructure in order to create an early warning system for potential zoonotic disease spillover into domestic animals and humans. PREDICT-Malaysia was a collaboration between Department of Wildlife and National Parks (DWNP), the Ministry of Health (MoH), Department of State Health Sabah (DSHS), Sabah Wildlife Department (SWD), Danau Girang Field Centre (DGFC), and Department of Veterinary Services (DVS) and the Veterinary Research Institute (VRI).

**Background**

- The health of humans, livestock, wildlife, and the environment are all connected. More than half of all infectious diseases are shared between humans and animals. Further, seventy five percent of these originate in wildlife.
- In Malaysia, land-use change (deforestation, land conversion for agriculture) and human encroachment into previously pristine areas are a major cause for concern from a conservation and public health perspective.
- This has led to heightened interactions between people and wildlife, resulting in increased potential for disease transmission as we saw in Malaysia in 1999 with the spillover of Nipah virus.

**Disease Surveillance**

- Wildlife surveillance was implemented across Peninsular Malaysia with DWNP and in Sabah with SWD and DGFC.
- MoH and PREDICT screened archived Orang Asli samples from patients with acute febrile illness, at the National Public Health Laboratory at the viral family level using PREDICT protocols.

PREDICT characterized zoonotic disease risks at critical animal-human interfaces in Malaysia.
Making a Difference for Global Health

- Trained 130 individuals from government partners, local universities, and NGOs in surveillance and diagnostic techniques, including sharing standard operating procedures (SOPs) and protocols. Many training sessions were run with participants from multiple government departments, helping to build working relationships and strengthen communication.
- PREDICT formed the Zoonosis Technical Working Committee with DVS, MOH, and DWNP and participates in inter-ministerial meetings on zoonoses. PREDICT has regular meetings with SWD and DSHS to discuss issues related to biodiversity and zoonoses. This coordination has helped strengthen a national network for wildlife health and diagnostics.
- DWNP established dedicated, self-sufficient team trained by PREDICT to conduct active wildlife surveillance across Peninsular Malaysia.
- PREDICT/SWD/DGFC established a Wildlife Health Unit to conduct active wildlife surveillance across Sabah.

Surveillance and laboratory improvements

- Wildlife Health Unit collected 11,291 specimens from 1,179 animals.
- PREDICT and DWNP collected 15,656 specimens from 1063 animals in Peninsular Malaysia.
- DWNP dedicated sample team collected 4900 specimens from 720 animals in Peninsular Malaysia.
- PREDICT established a proper cold chain from sample collection in the field to sample storage at the three laboratories with adequate backup in case of power or freezer failure.
- PREDICT helped to standardize protocols and SOPs for the three laboratories it has helped to develop.
- PREDICT and DWNP personnel spent 4 weeks at Columbia University (CU) learning laboratory techniques for novel pathogen detection and using the PREDICT protocols to screen for 25 viral families.
- PREDICT shared protocols and diagnostic material with DWNP, VRI, MOH, and SWD.
- Samples from Peninsular Malaysia and Sabah were sent to CU for novel pathogen detection using techniques not readily available in Malaysia.
- Screening at CU, DWNP, VRI, and WHGFL found 9 novel viruses and 16 known viruses.

Capacity Building

- PREDICT helped refurbish the animal treatment room and BSL-2 molecular diagnostic lab at DWNP.
- Supported a BSL-2 molecular diagnostic lab in the new BSL-3 AG building at VRI.
- PREDICT/SWD/DGFC set up the Wildlife Health, Genetic and Forensic Laboratory (WHGFL) in Sabah, including a BSL-2 lab certified in accordance with laboratory standards set by the NIH and the CDC.

Partnerships for Sustainability

- Department of Wildlife and National Parks (DWNP)
- Department of Veterinary Services (DVS)
- the Veterinary Research Institute (VRI)
- Ministry of Health (MoH)
- Department of State Health Sabah (DSHS)
- Sabah Wildlife Department (SWD)

Disease Outbreak Response

- Training with DWNP and SWD surveillance teams on outbreak response preparation.
- Provided PPE, SOPs, and protocols to assist with outbreak response preparation.

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