CAPACITY BUILDING
for One Health disease surveillance and viral discovery

OBJECTIVES

PREDICT 2 is working with EPT and other partners to operationalize One Health surveillance and strengthen functional technological capacities in local, national, and regional contexts for surveillance system design, field sampling, laboratory techniques, behavioral risk characterization, information management, public data dissemination, and data analytics and forecasting. PREDICT’s capacity building objectives are to support the development of the core skills and capabilities required by One Health professionals today. Training and capacity building activities conducted in Viet Nam have included biosafety; safe animal capture, handling, and sampling; human surveillance and sampling; safe sample transport and shipping; ethics; field epidemiology and surveillance; data and information management; laboratory safety and viral detection; social sciences and behavioral risk investigations; and modeling and analytics.

ACHIEVEMENTS

PREDICT has provided refresher and in-service trainings designed to enhance the skills of the existing health workforce. PREDICT has focused on increasing capacity within the animal and public health sector, especially with a focus on biosafety and safe sample collection with small mammals, such as bats and rodents, which represent the highest risk for viral spillover and spread to people. PREDICT in Viet Nam has trained a total of 142 individuals (32% female), including 88 government staff working on the frontlines of disease surveillance and detection, and 17 local and international students who are the future One Health workforce.

PREDICT-2/Viet Nam continued strengthening capacity with project partners and stakeholders

<table>
<thead>
<tr>
<th>Staff</th>
<th>Government</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>88</td>
<td>42</td>
</tr>
<tr>
<td>96 Male</td>
<td>46 Female</td>
<td></td>
</tr>
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PREDICT has provided ongoing training to improve the quality of information on zoonotic disease transmission in Viet Nam by frequently updating partners on any changes to sample collection protocols and sharing techniques for improving data collection through administration of questionnaires to collect data on human risk behavior. PREDICT surveillance and laboratory protocols all incorporate best practices in biosafety and biosecurity.

PREDICT has built capacity in Viet Nam’s national animal health and public health laboratories for the application of consensus polymerase chain reaction (cPCR) as a method for detection of both known and novel viruses in a wide range of samples and host species. The advantages of this approach include:

1. An inexpensive testing method (cPCR) run on basic equipment, such as thermal cyclers for conventional PCR already available in animal and human health laboratories in Viet Nam and globally.
2. The “universal” amplification of viruses within a given viral family or genus.
3. Synthetic ‘universal controls’ that provide standardized control material without any danger of pathogen transmission.
4. Increased safety to laboratory workers as any microbes in the samples are killed during the PREDICT nucleic acid extraction steps so laboratory workers are not exposed to dangerous pathogens.
5. Ability to extend the PREDICT diagnostic strategy beyond the detection of viruses in wildlife to the diagnosis of mysterious illnesses in medical hospitals or in solving an unknown disease outbreak in livestock or domestic animals.

PREDICT-2/Viet Nam conducted tests at its key partner laboratories

- **Viet Nam National University of Agriculture**: 3,394 completed viral PCR tests, 5 ongoing confirmatory tests
- **Regional Animal Health Office No.6**: 14,224 completed viral PCR tests, 612 ongoing confirmatory tests
- **National Institute of Hygiene and Epidemiology**: 18,802 completed viral PCR tests, 279 ongoing confirmatory tests

PREDICT trains staff in national animal health and public health laboratories in molecular diagnostic techniques for viral discovery.

PREDICT protocols for laboratory testing and training manuals for One Health surveillance.

The main PREDICT partner laboratories in Viet Nam include:

- The Regional Animal Health Office No. 6 (RAH-O6)
- The National Institute of Hygiene and Epidemiology (NIHE)
- The Viet Nam National University of Agriculture (VNU-UAA)
- Additional partner laboratories: RAH-O7 – trained to diagnostic wildlife samples using PREDICT protocols and Pasteur Institute in Ho Chi Minh City – shared protocols and universal controls.

PREDICT has built capacity for novel virus detection and identification of potential zoonotic viral pathogens strengthening capacity in Viet Nam’s national public health and animal health laboratories. The PREDICT partner laboratories in Viet Nam are the trained in the full range of activities required for safely detecting zoonotic viruses, including biosafety and biosecurity; cold chain, safe sample storage, data management, safe sample transport and shipping, and molecular viral detection techniques.
BIOLOGICAL SURVEILLANCE
for Zoonotic Viruses with Pandemic Potential

OBJECTIVES

PREDICT works to improve global surveillance for pathogens that can spill over from animal hosts to people by building capacities to detect and discover viruses of pandemic potential. PREDICT’s biological surveillance objectives are to better understand which geographic locations, epidemiological zones, animal-animal and/or animal-human interfaces, and environmental factors are most associated with the evolution, spillover, amplification, and spread of zoonotic viruses with pandemic potential to inform disease prevention and control strategies.

ACEHIEVEMENTS

HIGH-RISK INTERFACES FOR ZOONOTIC DISEASE TRANSMISSION

PREDICT’s One Health team worked with national, provincial, and district level veterinary and medical officers to extend Viet Nam’s disease surveillance systems to target high-risk areas for zoonotic disease transmission including sites with high rates of wildlife trade and intensive farming of wildlife.

PREDICT biological surveillance has resulted in the detection of 28 novel viruses and 8 known viruses with PREDICT-2 testing still on-going. To date PREDICT-2 testing has confirmed 161 virus positive samples.

Table 1: Viruses detected during PREDICT 1 & 2 in Viet Nam (Updated on July 03, 2019)

<table>
<thead>
<tr>
<th>Viral Family/ Genus</th>
<th>Known/Novel</th>
<th>Animal</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitisvirus (F)</td>
<td>2/NOVEL</td>
<td>Common Palm Civet and Asian Black Bear</td>
<td>Nest in restaurant bear rescued from trade in wildlife rescue center</td>
</tr>
<tr>
<td>H5N1 influenza (F)</td>
<td>1/KNOWN</td>
<td>Wild Pigeon</td>
<td>For sale in restaurant</td>
</tr>
<tr>
<td>Paramyxovirus (F1)</td>
<td>1/KNOWN &amp; 5 NOVEL</td>
<td>Rat, Rats, Red Junglefowl, Domestic pig</td>
<td>For sale in restaurant; For sale in the large market; In or near human dwelling; For sale in the large market</td>
</tr>
<tr>
<td>Rhabdovirus (F)</td>
<td>1/NOVEL</td>
<td>Bats, Rhabdovirus</td>
<td>For sale in restaurant; For sale in the large market; In or near human dwelling; And Wildlife farms</td>
</tr>
<tr>
<td>Coronavirus (F)</td>
<td>6/KNOWN &amp; 2 NOVEL</td>
<td>Bat, Rhabdovirus,丨Wildlife; 丨Wildlife farms,丨Wildlife farms,丨Wildlife farms,丨Wildlife farms,丨Wildlife farms,</td>
<td>Contact during religious activities; In or near human dwelling; For sale in restaurant; For sale in the large market; Wildlife farms; And Domestic pig farms</td>
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</table>

PREDICT is working with governments to make important data on the distribution of viruses of pandemic potential available publically to inform disease prevention and control. Once approved by government for release, all PREDICT surveillance and test result data appears on HealthMap.

Map of concurrent and independent surveillance sites

[Map image showing the geographical distribution of surveillance sites]

https://www.healthmap.org/predict
BEHAVIORAL RISK SURVEILLANCE for Zoonotic Viruses with Pandemic Potential

OBJECTIVES

A primary goal of PREDICT-2 is to strengthen global capacity for the detection and discovery of viruses with pandemic potential, specifically those that can move between animals and people (zoonotic viruses). PREDICT’s behavioral risk surveillance is designed to identify risk factors associated with zoonotic disease transmission to inform intervention recommendations for disease prevention. The objective of PREDICT’s behavioral risk surveillance activities was to apply qualitative and quantitative approaches (ethnographic interviews, focus groups, and behavior risk surveys) to identify risk factors and behaviors associated with the evolution, spillover, amplification, and spread of zoonotic viruses with pandemic potential.

ACHIEVEMENTS

PREDICT-2 conducted behavioral surveillance in human populations in Vietnam at key animal–human interfaces potentially associated with the spillover, amplification, and spread of zoonotic viruses. The behavioral surveillance was coupled with biological surveillance and samples were collected from humans enrolled in the project for viral testing. Quantitative and qualitative research methods were used to identify risk factors for viral transmission and obtain descriptive accounts of human behaviors and perceptions to support the development of effective public health interventions. An example of a PREDICT behavioral surveillance output is the campaign picture book entitled “How to Live Safely with Bats.”

PREDICT worked with the National Institute of Hygiene and Epidemiology (NIHE) to conduct surveillance for zoonotic viruses in humans in Hanoi, Dong Nai and Bac Giang Provinces. The protocol approved by the NHIE IRB includes biological sample collection, viral family level testing, and administration of a human behavioral risk questionnaire. A total of 1,230 people were surveyed and sampled, through community surveillance of people with occupational exposure to wildlife (630 people) and through syndromic surveillance of people with fevers of unknown origin in hospitals (600 people) as PREDICT-2 concurrent surveillance sites.

PREDICT worked with the Hanoi School of Public Health to conduct qualitative research to obtain descriptive, contextual accounts of human behaviors, perceptions, beliefs, and decision-making linked to zoonotic disease transmission. The qualitative behavioral surveillance included the ethnographic interviews and focus group discussions in Dong Nai Province. A total of 77 people were enrolled in the qualitative research, with 40 ethnographic interviews, and 4 focus group discussions completed. The qualitative research methods used by PREDICT received the IRB approval from the Hanoi School of Public Health.

Below are quotes from PREDICT interviews at two key animal-human interfaces:

“I’ve only heard about zoonotic diseases from poultry. Such as chicken, pigeon and also other livestock. I brought civets here and then vaccinated them. In my opinion maybe there are zoonotic diseases that pass from civets to humans but my animals are vaccinated so I have peace.” — a civet farm owner

“My father told me when I was a child, whenever I was bitten by snake and rat or when I got cut, just suck the blood. He taught me that.” — a rat hunter

Preliminary Data Analysis to Inform Intervention Recommendations

Behavior Questions

Concurrent Site I
market and value chain; wildlife restaurant; animal production

How do you cook or handle meat, organs, or blood from a recently killed animal? (Questionnaire #46)

How do you eat raw or uncooked meat or organs or blood? (Questionnaire #47)

Viet Nam: Animal contact behaviors (past year)

Base on questionnaire responses from 1230 individuals

Mechanisms underlying emergence and spread of zoonotic disease

Virus and host transmission dynamics among hosts

Hosts

ECOLOGICAL DRIVERS

Large-scale processes such as forest conversion and agricultural transmutation

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