Surveillance for Five Viral Families of Public Health Importance and Investigation of Human Behaviors at Wildlife/Human Interfaces in Viet Nam with High Risk For Zoonotic Disease Transmission

Long Nguyen, Amanda Fine, Nga Nguyen, Ngoc Pham, Sarah Olson, Thuy Hoang, Nam Vu, Duoc Vu, Anh Dang, Thinh Nguyen, Tracey Goldstein, Jonna Mazet

SEAOHUN 2018 International Conference
November 14, 2018
SARS Outbreak

Emerging Pandemic Threats Program 2 (EPT-2)
Emerging Pandemic Threats Program 2 (EPT-2)

Summary of PREDICT-1 Results

PREDICT-1’s focus on **Wildlife Surveillance** at High Risk Interfaces for Zoonotic Disease Transmission

### Number of Animals Sampled by Interface

<table>
<thead>
<tr>
<th>Interface</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild animal farm</td>
<td>597</td>
</tr>
<tr>
<td>For sale in restaurant</td>
<td>430</td>
</tr>
<tr>
<td>For sale in large market (&gt;20 vendors)</td>
<td>372</td>
</tr>
<tr>
<td>In or near human Dwellings</td>
<td>354</td>
</tr>
<tr>
<td>Private sale</td>
<td>189</td>
</tr>
<tr>
<td>Rehabilitation center</td>
<td>72</td>
</tr>
<tr>
<td>Zoo</td>
<td>18</td>
</tr>
<tr>
<td>Contact during religious activities</td>
<td>12</td>
</tr>
<tr>
<td>Private wildlife collection or pet</td>
<td>2</td>
</tr>
<tr>
<td>Sanctuary</td>
<td>8</td>
</tr>
</tbody>
</table>

### Surveillance Events

- Total: 90

### Animals Sampled

- Total: 2,054

### Specimens Collected

- Total: 6,854

### Diagnostic Tests Run

- Total: 16,334
Evidence of risk of disease emergence along the wildlife trade chain

- Corona, Rhabdo, Herpes, Paramyxovirus and Influenza viruses infecting several different species of wildlife

- Wildlife farms – multi-species farming (wild and domestic animals) in close proximity to human populations with evidence of bat corona viruses circulating in farmed rodents.
Early disease detection and response through concurrent surveillance in humans and animals

One Health approach to understanding the dynamics of zoonotic virus evolution, spillover from animals to people, amplification, and spread to inform prevention and control
PREDICT 2 Objectives

- Conduct concurrent surveillances targeting “high-risk” interfaces between wildlife/domestic animal and humans in order to **investigate** and **detect** potential emerging zoonotic diseases;

- Characterize risk factors associated with zoonotic diseases by Human Behavior surveillance

- Build local capacity for surveillance & laboratory diagnostics
PREDICT 2 Partners

Ministry of Agriculture and Rural Development:
- Forest Protection Department,
- Department of Animal Health,
- Regional Animal Health Office No. 6 & 7
- Vietnam National University of Agriculture

Ministry of Health:
- National Institute of Hygiene and Epidemiology
**Concurrent surveillance:**
- **Bac Giang:** Humans and bats
- **Hanoi (Thach That District):** Humans and rodents
- **Dong Nai:** Humans and wild animals

**Independent surveillance:**
- **Ninh Binh:** Wild animals
- **Dak Lak and Dak Nong:** Wild animals
- **Dong Thap:** Bats and rodents
Concurrent Surveillance

**Human surveillance:**
- People with occupational risk for zoonotic disease transmission: Farmers, hunters, sellers, butchers, consumers
- Patients in hospitals:
  - Fever of Unknown Origin (FUO)
  - Influenza-like illness (ILI) unknown origin
  - Severe Acute Respiratory Infections (SARI) unknown origin
  - Acute Encephalitis Syndrome (AES) unknown origin
* Epidemiological factors: contact with animals (wildlife and/or domestic) and duration

**Animal surveillance:** Collect samples in animal value chain, such wildlife farms, rat markets, bat guano collection sites
**Emerging Pandemic Threats Program 2 (EPT-2)**

### Concurrent Surveillance

<table>
<thead>
<tr>
<th>Province</th>
<th>Targets of sample collection</th>
<th>Sampling Complete (Individuals)</th>
<th>Number of specimens collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bac Giang</td>
<td>Human Community</td>
<td>30</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Wildlife (Bat)</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Hanoi (Thach That District)</td>
<td>Human Hospital Syndromic</td>
<td>300</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Human Community</td>
<td>300</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Wildlife (Rodents)</td>
<td>300</td>
<td>1480</td>
</tr>
<tr>
<td>Dong Nai</td>
<td>Human Hospital Syndromic</td>
<td>300</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Human Community</td>
<td>300</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Wildlife (Rodents)</td>
<td>685</td>
<td>1516</td>
</tr>
<tr>
<td></td>
<td>Wildlife (NHP)</td>
<td>158</td>
<td>268</td>
</tr>
<tr>
<td></td>
<td>Wildlife (Carnivores)</td>
<td>300</td>
<td>600</td>
</tr>
</tbody>
</table>
### Independent Surveillance

<table>
<thead>
<tr>
<th>Province</th>
<th>Targets of sample collection</th>
<th>Sampling Complete (Individuals)</th>
<th>Number of specimens collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ninh Binh</td>
<td>Wildlife (confiscated from illegal wildlife trade)</td>
<td>373</td>
<td>1742</td>
</tr>
<tr>
<td>Highland area</td>
<td>Wildlife (confiscated from illegal wildlife trade)</td>
<td>41</td>
<td>93</td>
</tr>
<tr>
<td>Dong Thap</td>
<td>Wildlife (Rodents)</td>
<td>399</td>
<td>1632</td>
</tr>
<tr>
<td></td>
<td>Wildlife (Bat guano collection)</td>
<td>435</td>
<td>880</td>
</tr>
</tbody>
</table>
- PREDICT organized training course for local staffs on how to collect samples and interview participants following IRB.

- Samples has been kept in cold chain before transferring to laboratories for viral testing
PREDICT 2 Viral Testing Strategy

- Virus detection will be performed using consensus PCR (cPCR) and supplemented with high through-put sequencing (HTS)
  - Degenerate or consensus primers that allow to detect both known and novel viruses
  - Low cost diagnostic approach by using conventional PCR machines
  - Universal control – synthetic construct: no risk of infectious transmission

- Five priority viral families will be tested on all samples from all host taxa (humans, wildlife, livestock) and include the following:
  - Corona, Filo, Paramyxovirus, Influenza, Flavi viruses
Sample (field)
Keep in nitrogen liquid

Storage at -80 freezer in labs:
NIHE; VNUA; RAHO

Direct-zol RNA extraction (Zymo kits)

First strand cDNA synthesis (Invitrogen kits)

5 priority viral families will be tested

Negative PCR

Positive PCR

Sequencing

Analysis

Emerging Pandemic Threats Program 2 (EPT-2)
PREDICT 2: Diagnostic

1,372 completed viral PCR tests
190 on-going confirmatory tests
Viet Nam National University of Agriculture

7,490 completed viral PCR tests
474 on-going confirmatory tests
Regional Animal Health Office No.6

3,438 completed viral PCR tests
116 on-going confirmatory tests
National Institute of Hygiene and Epidemiology

Testing all target viral families: Paramyxovirus, Coronavirus, Influenza, Flavivirus and Filovirus
Emerging Pandemic Threats Program 2 (EPT-2)

**Behavioral Risk Surveillance**

- Qualitative & Quantitative Data
  - Questionnaires on risk behaviors administered to community members and hospital patients
  - Ethnographic interview and focus groups conducted
  - A mixed analysis is used to assess behaviors associated with risk of zoonotic disease transmission

A “snapshot” of data collected through behavioral risk questionnaires.
PREDICT 2: Results

Preliminary Results & Next Steps

- All surveillance (biological sample collection and behavioral risk data) completed
- Viral family testing, cloning and sequencing on-going
- Interpretation of results >> submission to government for approval >> public release

PREDICT Surveillance Summary

Data of samples and test results:
https://www.healthmap.org/predict/