

**From:** (b)(6)  
**Sent:** Mon, 3 Jun 2019 20:22:43 +0000  
**To:** PREDICTMGT  
**Cc:** Predict inbox; (b)(6)  
**Subject:** PREDICT International Travel Requests  
**Attachments:** Laos TDY (b)(6) June 28 - July 6, 2019.docx

*Please find below international travel requests for your review and approval; a TDY form is attached for (b)(6) Laos travel. Please let me know if you have any questions. Thanks!*

1. Daszak (CIV): \$14,800 airfare (b)(6) / \$344 (Abidjan) max daily per diem
2. (b)(6) Daszak (China): \$1900 (Economy) / \$5208 (b)(6) Dr. Daszak (b)(6) / \$346 (Beijing), \$288 (Harbin) max daily per diems
3. (b)(6) (Laos): \$1500 airfare / \$212 (Vientiane) max daily per diem

Travel Requests –

1. EcoHealth Alliance would like to request travel approval for Peter Daszak to travel from Newark, NJ to Abidjan, Cote d'Ivoire from June 19 to 22, 2019 to meet with country coordinators and the USAID Mission in Abidjan.

**Trip purpose:** In Abidjan, Dr. Daszak will meet with all of the PREDICT stakeholders including PREDICT partners, community leaders, and USAID (b)(6).

2. EcoHealth Alliance would like to request travel approval for Peter Daszak and (b)(6) to travel from Newark, New Jersey, USA to Beijing and Harbin, China from July 22 – 30, 2019 for meetings with PREDICT in-country partners and to attend the 13<sup>th</sup> China National Meeting of Virology.

**Trip purpose:** Dr. Daszak and (b)(6) will meet with in-country partners and stakeholders, and local leaders from PREDICT surveillance sites from Yunnan, Guangxi, and Guangdong provinces to present PREDICT work results in Beijing, China. In Harbin, Dr. Daszak will attend a side meeting with Chinese scientists to launch the China Virome Project. Dr. Daszak will give talk on PREDICT and GVP.

3. Metabiota would like to request travel approval for (b)(6) to travel from Nanaimo, Canada to Vientiane, Laos from June 28 to July 6, 2019 to hold PREDICT2 wrap up meetings with in-country partners.

**Trip purpose:** In Vientiane, (b)(6) will coordinate and participate in national-level meetings with PREDICT2 partners including the Ministry of Health, the Ministry of Livestock and Fisheries, as well as USAID members from the embassy. Following these meetings, (b)(6) will travel to Champasack province for similar meetings with provincial and district governments, as well as partner hospitals and

communities. These meetings are intended to be a part of the final, program close-out activities for the PREDICT2 program. Results from the global and local programs will be presented to all partners and local results will be shared as appropriate with hospitals and communities. In Vientiane, (b)(6) will also arrange to meet with mission representatives at the US embassy to debrief on PREDICT2 as the EPT2 program comes to a close.

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(b)(6)

One Health Institute

(b)(6)

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**Lao PDR Temporary Duty Information Form (Last update: August 2017)**

(send completed form to (b)(6))

**Submitted by:** (b)(6) Metabiota Inc.

<b>Dates of travel:</b>	From: 6/28/2019 To: 7/6/2019
<b>TDY objective:</b>	To hold PREDICT2 wrap up meetings with the national, provincial, and district governments, as well as partner hospitals and communities.
<b>USAID activity</b>	To hold PREDICT2 wrap up meetings with in-country partners as well as partner hospitals and communities.
<b>Individuals visiting Laos (from RDMA, Washington, Implementing Partner):</b>	(b)(6) Metabiota, Inc.
<b>Required meetings to be arranged:</b>	Meet with USAID mission if possible and available.
<b>Site visits required:</b>	Champasak province to meet with partner hospitals and communities.
<b>Data to be collected:</b>	N/A
<b>Is a DIP note or letter of introduction requested:</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <i>Note: DIP notes are required for site visits and meetings with high-level GOL officials. Names of GOL officials must also be provided.</i>
<b>Is motor pool requested:</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Is Embassy access requested:</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Have the visitors met with the AMB/DCM before:</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Is Laos staff recommended to accompany all meetings:</b>	<input type="checkbox"/> Strongly recommended <input checked="" type="checkbox"/> Optional, but at the Laos Office discretion
<b>Additional Comments:</b>	

\*Only a limited number of hotels meet Embassy Lao security and safety requirements for eCC travelers. As of August 2017 these are: (1) Lao Plaza Vientiane, (2) Landmark Mekong Riverside, (3) Settha Palace, (4) Dhavara Vientiane, and (5) Crowne Plaza.

**From:** (b)(6)  
**Sent:** Fri, 26 Apr 2019 17:57:27 +0000  
**To:** (b)(6) Emerging Threats Division (b)(6) PREDICTMGT (b)(6)  
(b)(6)  
**Cc:** (b)(6) predict@ucdavis.edu  
**Subject:** Re: Response needed by 2 pm ET today: [predict] Predict innovation  
**Attachments:** DRAFT P2 2019 Semi-annual Report.pdf

Hi there,

The best we can do on short notice is an early preview of our **draft 2019 semi-annual report**. This showcases our One Health approach, which is entirely innovative, cost saving, and transformative. The report draft does include success stories and innovations and overviews of all progress and achievements, though it it still a working version as we are still finalizing a few things, validating data, and preparing for final submission early next week.

Let us know if you have any questions!

(b)(6)

On Fri, Apr 26, 2019 at 9:20 AM (b)(6)@ucdavis.edu> wrote:

From: predict-request@ucdavis.edu <predict-request@ucdavis.edu> On Behalf Of (b)(6)  
(b)(6)  
Sent: Friday, April 26, 2019 8:09 AM  
To: (b)(6)@usaid.gov>  
Cc: predict Sympa List <predict@ucdavis.edu>; PREDICTMGT <predictmgt@usaid.gov>;  
(b)(6)@usaid.gov>  
Subject: [predict] Re: Predict innovation

Hi P2 Colleagues,

In case helpful, below is some additional information on what is being requested.

Best,

(b)(6)

- Examples of the most impactful innovations in which your office is involved
  - o Noting USAID defines innovation as the pursuit of a novel business or organizational model, operational or production process, or product or service that leads to substantial improvements in addressing development challenges.
  - o It would also be helpful to think of innovations broadly across:
    - ☐ Offering (i.e. product or service),

- ☐ Delivery (how we get offerings to end-users),
- ☐ Finance/Business Model (how products/services are bought sold or new financing tools),
- ☐ Process (how we operate internally and/or create and add value. e.g. para-skilling)
- The top innovation partnerships from your office involving the private sector or other USG agencies
- Links to externally available information about each example (if available) that might be included should the reader wish to dive deeper into your examples
- We suggests most examples be from FY2017+ but feel free to include any 'penultimate' achievements from earlier

(b)(6)

U.S. Agency for International Development (USAID) (b)(6)  
Bureau for Global Health, Office of Infectious Disease, Emerging Threats Division

(b)(6)

Desk: (b)(6)  
Cell: (b)(6)  
E-mail: (b)(6)@usaid.gov

(b)(6)

(b)(6)

One Health Institute  
(b)(6) (cell)  
(b)(6) (office)  
Skype: (b)(6)

-----Original Message-----

From: (b)(6)  
Sent: Friday, April 26, 2019 9:20 AM  
To: (b)(6)@ucdavis.edu; (b)(6)@ucdavis.edu;  
(b)(6)@UCDAVIS.EDU; (b)(6)  
<(b)(6)@ucdavis.edu>; (b)(6)@ucdavis.edu>  
Subject: Response needed by 2 pm ET today: [predict] Predict innovation  
Importance: High

See email from (b)(6) below.

(b)(6)

One Health Institute  
(b)(6) (cell)

(b)(6) (office)

Skype: (b)(6)

-----Original Message-----

From: [predict-request@ucdavis.edu](mailto:predict-request@ucdavis.edu) <[predict-request@ucdavis.edu](mailto:predict-request@ucdavis.edu)> On Behalf Of (b)(6)

Sent: Friday, April 26, 2019 6:50 AM

To: predict Sympa List <[predict@ucdavis.edu](mailto:predict@ucdavis.edu)>; [predictmgt@usaid.gov](mailto:predictmgt@usaid.gov)

Cc: (b)(6)@usaid.gov

Subject: [predict] Predict innovation

Dear Predict team,

We have a very short fuse tasker for the Hill on "innovation." Pls let us know if there is anything you would like us to highlight? We need this by 2pm today so let me know if you have anything to add.

Thanks

(b)(6)

Sent from my iPhone

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# USAID | PREDICT

FROM THE AMERICAN PEOPLE

SEMI-ANNUAL REPORT

2019



**REDUCING PANDEMIC RISK,  
PROMOTING GLOBAL HEALTH**

# ACKNOWLEDGEMENTS

This publication was prepared by the PREDICT Consortium headquartered at the One Health Institute (OHI), School of Veterinary Medicine, University of California, Davis.

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University of California, Davis

Jonna AK Mazet, DVM, MPVM, PhD  
Professor and Executive Director, OHI  
University of California, Davis

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## **Design:**

Eunah Cho, OHI  
University of California, Davis

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Special thanks to the governments of and partners in Bangladesh, Cambodia, Cameroon, China, Cote d'Ivoire, Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Guinea, India, Indonesia, Jordan, Kenya, Laos, Liberia, Malaysia, Mongolia, Myanmar, Nepal, Republic of Congo, Rwanda, Senegal, Sierra Leone, Tanzania, Thailand, Uganda, and Vietnam. The success realized by the PREDICT project, documented herein, would not have been possible without the valuable contributions of Andrew Clements, Alisa Pereira, Cara Chrisman, and Amalhin Shek.

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Photo: Ebola Host Project's Mohamed Turay untangles a bat from a mist net in Sierra Leone. PREDICT's Ebola Host Project, a regional effort across West Africa, is working to identify the animal host species of ebolaviruses.

Credit: Simon Townsley



Photo: (L-R) Jonna Mazet with  
PREDICT/Mongolia Country  
Coordinator Enkee Shiilegdamba

# DIRECTOR'S LETTER

## **Introduction**

The PREDICT Project, led by its in-country teams, has contributed to amazing advancements in local and global health security over the life of the project. Because of the dedication and smart surveillance work of the diligent participants countries and communities are more aware than ever of zoonotic disease threats and what can be done to reduce risks. Despite these efforts and the giant steps forward, spillovers of viral pathogens do happen, and we must be vigilant in order to recognize them and respond rapidly for the best control outcomes possible. It has been eight months since the Democratic Republic of Congo declared a new outbreak of Ebola virus disease in North Kivu Province. In that time, over 1,200 individuals have been infected, and the disease has claimed over 800 lives. Response teams continue to battle the outbreak in a complex social and political environment, and while the number of cases continues to rise, there have been promising developments in our ability to prevent and contain the spread of this disease. Preliminary assessments in the efficacy of the candidate vaccine and ring vaccination strategy provide needed hope, though other assessments of the social challenges reaching affected communities for response and prevention efforts, including vaccine delivery, are a sober reminder that science and evidence-based interventions can fall short without investments in understanding the human social and behavioral elements critical for their success.

Over the past six months, the PREDICT Ebola Host Project teams in West Africa continued to build an evidence base supporting Ebola and other filovirus prevention efforts by investigating the underlying drivers of viral spillover and spread and the wildlife host species that may pose greatest risk. Building on our earlier discovery of a new ebolavirus in Sierra Leone (*Bombali ebolavirus* in bats), our team, together with the US



Centers of Disease Control and Prevention, detected Marburg virus in Egyptian rousette bats in that country, the first time the virus has been detected west of Gabon. Meanwhile in Liberia, our PREDICT team detected *Zaire ebolavirus* in a greater long-fingered bat, with further genetic investigations showing it was either the same or a close relative of the virus that caused the West Africa outbreak. Recently, in early April, a team of European researchers and partners in Kenya (not affiliated with PREDICT) detected *Bombali ebolavirus*, also in *Mops condylurus* bats in the Taita Hills near the border with Tanzania, validating our assumptions that this new ebolavirus is geographically widespread and may pose a risk for spillover across the continent, as these bats favor roosting sites near villages and dwellings.

PREDICT has been designed using the One Health approach, recognizing that to prevent spillover of these viruses from wildlife, you must invest in understanding social and behavioral factors that put people and their domestic animals at risk. Since 2014, our teams in over 28 countries have been working with communities using the social science toolkit to build relationships and trust; raise awareness of zoonoses and risks of transmission and spread; and understand the cultural systems, behaviors, and practices that could facilitate viral spillover and spread. In addition, our teams have been working to strengthen the workforce and systems for improved disease surveillance, detection, and health security. In DR Congo, PREDICT led a workshop on Ebola preparedness in Goma, highlighting risks to human communities and the critically endangered mountain gorilla population which is also susceptible to the disease. In Kenya, PREDICT teams brought the Smithsonian's National Museum of Natural History Outbreak exhibit to communities in Lakipia, using an innovative educational approach featuring the immersive experience

in outbreak and zoonotic disease education combined with a workshop on biosecurity and prevention. In Tanzania, we launched a month-long One Health workshop for professionals in the Lake Zone, which borders DR Congo, along with Burundi, Rwanda, and Uganda and is the designated hot zone for implementation of Tanzania's Ebola Contingency Plan.

We are proud to highlight these successes in our 2019 Semi-annual Report, another round of amazing contributions to global health and security. Our project, which is building to a crescendo at the end of a second 5-year investment phase from USAID, is shifting focus now towards data analysis and characterization of zoonotic disease risk, an exciting phase that promises to yield even more evidence and insights to improve our understanding of pandemic threats, their origins, and, we hope, their eventual demise.

Best regards,



Jonna AK Mazet, DVM, MPVM, PhD  
Professor and Global Director  
One Health Institute & USAID PREDICT Project  
University of California, Davis





# PREFACE

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The PREDICT consortium: putting One Health in practice



## Global Health Security Agenda PREDICT-2 Countries



**USAID**  
FROM THE AMERICAN PEOPLE

**PREDICT**

PREDICT, a project of USAID's Emerging Pandemic Threats (EPT) program, was initiated in 2009 to strengthen global capacity for detection and discovery of viruses with pandemic potential that can move between animals and people. Those include filoviruses, such as the ebolavirus and Marburg virus; influenza viruses; coronaviruses, the family to which SARS and MERS belong; and paramyxoviruses, like Nipah virus. PREDICT has made significant contributions to strengthening global health security by improving surveillance and laboratory diagnostic capabilities for new and known viruses.

Now working with partners in 30 countries, PREDICT is continuing to build platforms for priority viral surveillance and for identifying and monitoring zoonotic pathogens or those that can be shared between animals and people. Using the One Health approach, the project is investigating the behaviors, practices, and ecological and biological factors driving disease emergence, transmission, and spread. Through these efforts, PREDICT is improving global disease recognition and beginning to develop

strategies and policy recommendations to minimize pandemic risk.

PREDICT is working to strengthen global capacity for detection and discovery of zoonotic viruses with epidemic and pandemic potential, including the Ebola, influenza, and Zika viruses that have been recent causes of devastating disease and necessary impetuses of dramatic and resource-intensive responses. The project is actively and diligently implementing GHSA activities in target countries aimed at developing and operationalizing strategies to improve disease management efficiencies in the short term and reduce zoonotic pathogen spillover, amplification, and spread in the long term, through improved public health policies and risk-reducing mitigation efforts. In every country of engagement, we work hand-in-hand with governmental and non-governmental stakeholders to develop and implement activities that are tailored to country and regional priorities and specifically designed to strengthen capabilities and ensure lasting positive effects from our engagements.

# PREDICT Consortium & Management

The USAID/PREDICT Consortium is a functionally collaborative working team that implements the project through in-country partners and benefits from the experience of world leaders in zoonotic disease detection and surveillance, epidemiology, disease ecology, and risk characterization. PREDICT's consortium includes partnerships with ministries of health, agriculture, and environment and implementing university and NGO partners in 30 countries.

## PERSONNEL

PREDICT's international consortium of partners consists of

**232** in-country staff

**99%** of whom are citizens of the host countries where they serve

## PARTNERSHIPS

PREDICT has executed 22 subaward agreements since the start of the project, of which 90% are with foreign government entities and laboratories in Asia and Africa. These partnerships enable PREDICT to further advance capabilities for zoonotic disease surveillance, detection, and response.

## COMMUNICATIONS

Follow PREDICT teams around the world on Twitter

**@PREDICTproject**



Join ResearchGate to connect with PREDICT Consortium scientists and to access publications and presentations.

Committed to open data, our host country government-approved findings are available online through the PREDICT BioProject on GenBank and through the HealthMap-hosted data portal at [www.data.predict.global](http://www.data.predict.global).

### USAID/PREDICT global-level consortium institutions

- **UC Davis' One Health Institute**, based in the most highly-rated veterinary school in the world, is active all over the globe, working at the interface of animals, people, and the environment to solve complex problems that impact health and conservation.
- **EcoHealth Alliance** is the first group to identify bats as the reservoir of SARS-like coronaviruses, to define hotspots of emerging diseases, and identify drivers of disease emergence.
- **Metabiota, Inc.** has made seminal discoveries regarding the role of hunting of nonhuman primates and food handling in moving animal pathogens to humans.
- **Smithsonian Institution and the National Zoo** are among the founders of the field of conservation biology.
- **Wildlife Conservation Society** was the first conservation organization with a dedicated team of wildlife veterinarians deployed around the world, with programs focused on environmental stewardship and health problem-solving.
- Other global partners include **Columbia University; Epidemico (HealthMap);** and the **International Society for Infectious Disease.**

Photo: PREDICT/Bangladesh team sampling crows



# SUCCESS STORIES

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Highlights and milestones for our teams around the world



# SUCCESS STORY

## Strengthening National Capacity for Outbreak Response in Bangladesh

**L**ive bird markets are very common in many parts of Southeast Asia, including Bangladesh, where they serve as the economic networks for selling and trading poultry. Beyond buyers and sellers, these markets draw the attention of wild birds like crows, foraging for food. This interface of wild birds, humans, and domestic avian species presents a possible avian influenza biosecurity hazard. PREDICT/Bangladesh has been working with government partners to strengthen outbreak response capabilities since 2016, when the team played a lead role in crow mortality outbreak response, collecting samples from dead and live birds at the live bird markets and testing them at partner laboratories for zoonotic diseases.

More recently, on December 21, 2018, dead crows in Jessore were reported to the Institute of Epidemiology, Disease Control and Research (IEDCR). IEDCR contacted the PREDICT/Bangladesh team, and its members attended meetings in Dhaka to support the Government of Bangladesh's leadership and to help develop a plan for outbreak response. As part of the plan, PREDICT provided training to a multidisciplinary government team that included officials from both IEDCR and the Department of Livestock Services (DLS). PREDICT also provided hands-on training in avian sampling methods, proper personal protective equipment (PPE) and biosafety, and proper disposal of biohazardous waste/carcasses to the DLS team and members of the Field Epidemiology Training Program—Bangladesh (FETPB) Veterinary Fellowship.

The Government of Bangladesh outbreak team led the response and collected samples from crows that were sent to the Bangladesh Livestock Research Institute (BLRI) laboratory for testing. During the outbreak, the rapid mobilization and response demonstrates that the Government has improved national health security capacity for outbreak response, especially for diseases emerging in wildlife—often a gap in national surveillance and detection systems. Over time, PREDICT support helped advance this capability, and Bangladesh is now increasingly self-reliant in zoonotic disease prevention and control.

PREDICT assists government in outbreak response to crow die-off, presenting confirmed results of: avian influenza (H5N1)

PREDICT assists government in two crow die-off events, presenting confirmed results of: avian influenza (H5N1 & H5), as well as a human encephalitis outbreak (suspected Nipah virus)

Government of Bangladesh independently mobilizes & responds to a crow die-off, suspected to be an outbreak of avian influenza

2016

2017

2018

**R**ecent PREDICT discoveries have identified bats a the host species for multiple zoonotic viruses. But identification does not equal a call for eradication. In fact, PREDICT strives to underscore the ecological importance of bats and the need to conserve their populations and the habitats on which they depend. Community engagement and feedback is essential to PREDICT's strategy for zoonotic disease risk reduction, which includes raising awareness of ecosystem health and conservation in conjunction with public health.

#### **KENYA: Outbreak exhibit, "bat book" leads to action, interventions**

In Kenya, PREDICT held several events with communities in Laikipia County (Leikiji, Mpala, Ol Jogi, and Ilmotiok). The team brought a mobile "Outbreak" exhibit (developed in collaboration with Smithsonian's National Museum of Natural History) to catalyze dialogue on the disease risks posed by exposure to wildlife, and help illustrate best practices for disease prevention and control.

Some community leaders expressed concern about the role of bats in disease transmission, as bats are common around their homes and public buildings. In response, *Living Safely with Bats*—a behavior change and risk communication book created by PREDICT—was distributed to community leaders, teachers,

and health liaisons as a resource. The book helps identify practical ways to reduce the risk of disease, such as basic home improvement options that prevent bats from roosting in homes and community spaces.

During visits, our team observed that community members in Ol Jogi were putting these best practices into action through the renovation of a community center. The center's roof had multiple holes, allowing bats to freely enter and roost inside, close to people. Following PREDICT/Kenya's engagement, Ol Jogi residents reinforced the center's roof to fill the holes and gaps, making the building unusable as a roosting site. This basic intervention is now being considered for implementation in homes and other public structures in Ol Jogi.

#### **GUINEA: Bat book & podcast reach at-risk groups at heart of West Africa Ebola outbreak**

Over 3,000 miles away in Guinea, PREDICT has been working to reduce the risk of disease transmission in the Forest Region, which has an estimated population of 1,335,274 and is considered to be the origin for the West Africa Ebola outbreak. Over the past six months (October 2018–March 2019) our team used the *Living Safely with Bats* book to target at-risk groups such as hunters and farmers, engaging over 4,000 individuals.



## **SUCCESS STORY**

### **From East to West Africa: Reducing Risks of Zoonotic Disease Transmission**





L-R: presenting the mobile “Outbreak” exhibit, radio interview on “Health for All”

PREDICT also worked with a local radio station to record an interactive episode of the Guinea podcast series “Health for All.” Broadcast throughout the Forest Region in French and four other national dialects (Kissi, Toma, Guerze, and Malinke), the episode focused specifically on the *Living Safely with Bats*

book. As evidence of the podcast’s impact, the Government of Guinea specifically requested that PREDICT intensify risk communication activities upon notice of a confirmed death from Lassa Fever. The Health for All podcast was broadcast daily in the affected region for one month.

## Empowering Youth to be One Health Leaders

In Kenya, our team has found that primary school students are highly attuned to the risks of living in close proximity with bats. They were the most receptive group to messaging regarding biosafety measures.



PREDICT visited primary schools in three communities in Kenya (Leikiji, Ol Jogi, and Ilmotiok) to discuss zoonotic diseases of bat origin, such as Ebola and Nipah virus, as well as risk mitigation techniques to protect their health and keep their communities safe. Students first watched a documentary film about zoonotic diseases meant to stimulate conversation.

Following a Question-and-Answer session, students viewed the mobile Outbreak Exhibit and talked about the importance of conserving bat populations while preventing disease transmission from wildlife to people.

In Guinea, PREDICT’s community engagement and risk communication team worked closely with 27 primary schools to bring the *Living Safely with Bats* book and risk reduction messages to over 2,700 children. At the schools, PREDICT distributed 250 of the books to school directors. These books are being used in reading exercises and as a tool for child-to-child communication, along with their intended purpose for increasing awareness of zoonotic diseases, conservation, and the role of wildlife in health ecosystems.

# SUCCESS STORY

## Strengthening National Capacity to Detect & Prevent Priority Zoonotic Diseases

### SIERRA LEONE

#### *Finding viruses before they find us*

**F**or the first time in West Africa, scientists discovered the deadly Marburg virus in five Egyptian rousette fruit bats in Sierra Leone. Marburg virus was co-discovered by scientists from two separate projects—the USAID PREDICT project and the US Centers for Disease Control and Prevention project with Njala University.

The multiple diverse strains of the highly pathogenic Marburg virus were found in its natural fruit eating bat reservoir in several locations across the country, suggesting Marburg virus has been present in these bat colonies in Sierra Leone for many years. The Marburg virus was found in Egyptian rousette fruit bats who primarily feed on fruit—if infected, they can shed the virus in their saliva, urine, and feces. In light of the potential threat from this virus, PREDICT/Sierra Leone continues to emphasize how to reduce the risk of exposure and live safely with bats throughout communities in Sierra Leone, stressing the importance of bats as a keystone species for healthy ecosystems.

### LIBERIA

#### *Liberia reaches a healthy security milestone*

**I**n Liberia, the PREDICT team reached a major milestone this year with the successful identification of *Zaire ebolavirus* in an insectivorous bat. This discovery is momentous because it is the first detection of *Zaire ebolavirus* in a bat in West Africa, providing important evidence that these bats may be a natural host for Ebola. Our findings and insights are helping target national surveillance and risk communication strategies and empowering local communities with the knowledge to prevent zoonotic disease spillover and spread.

In follow-up to the *Zaire ebolavirus* finding and in order to reinforce national laboratory capacity for detection of ebolaviruses, a Liberian scientist received training in advanced disease detection techniques at PREDICT's partner laboratory (Columbia University Mailman School of Public Health). As a result of PREDICT's engagement, Liberia has a trained and equipped wildlife surveillance team and a national laboratory with the capability to detect ebolaviruses and emerging viral threats, yielding tremendous value for strengthening national health security.



## Ebola Host Project

PREDICT's Ebola Host Project, a regional effort across West Africa, is working to identify the animal host species of ebolaviruses. Recent discoveries in bats, which include a new ebolavirus (*Bombali ebolavirus*), *Zaire ebolavirus*, and Marburg virus exemplify the mission of USAID's PREDICT Project, which aims to find viruses before they spillover into humans and cause economic catastrophes and devastating loss of life.



# SUCCESS STORY

## Strengthening Disease Surveillance & Detection Networks in North Africa & the Middle East

### ***Building the evidence base through new viral discoveries***

Global disease surveillance initiatives for novel, emerging viruses are an essential component of pandemic prevention efforts. PREDICT's surveillance strategy is focused on high-risk transmission interfaces, where people and wildlife come into contact and where viruses have the potential to spillover from wild animals into people or their domestic animals. In Egypt, PREDICT collected samples from *Rousettus aegyptiacus* bats from an abandoned mudbrick house in a village in the Nile Delta region, then tested the samples for multiple viral families, including that of influenza viruses. As a result, the team not only discovered a new influenza virus, but the first and only characterization of this wild type bat influenza isolate. Interestingly, the virus was distinct from any previously discovered influenza A virus, suggesting that it is a novel H19N12 subtype.

This exciting finding was recently published in the January 2019 issue of the *Journal of Virology*: "Isolation and Characterization of a Distinct Influenza A Virus from Egyptian Bats."



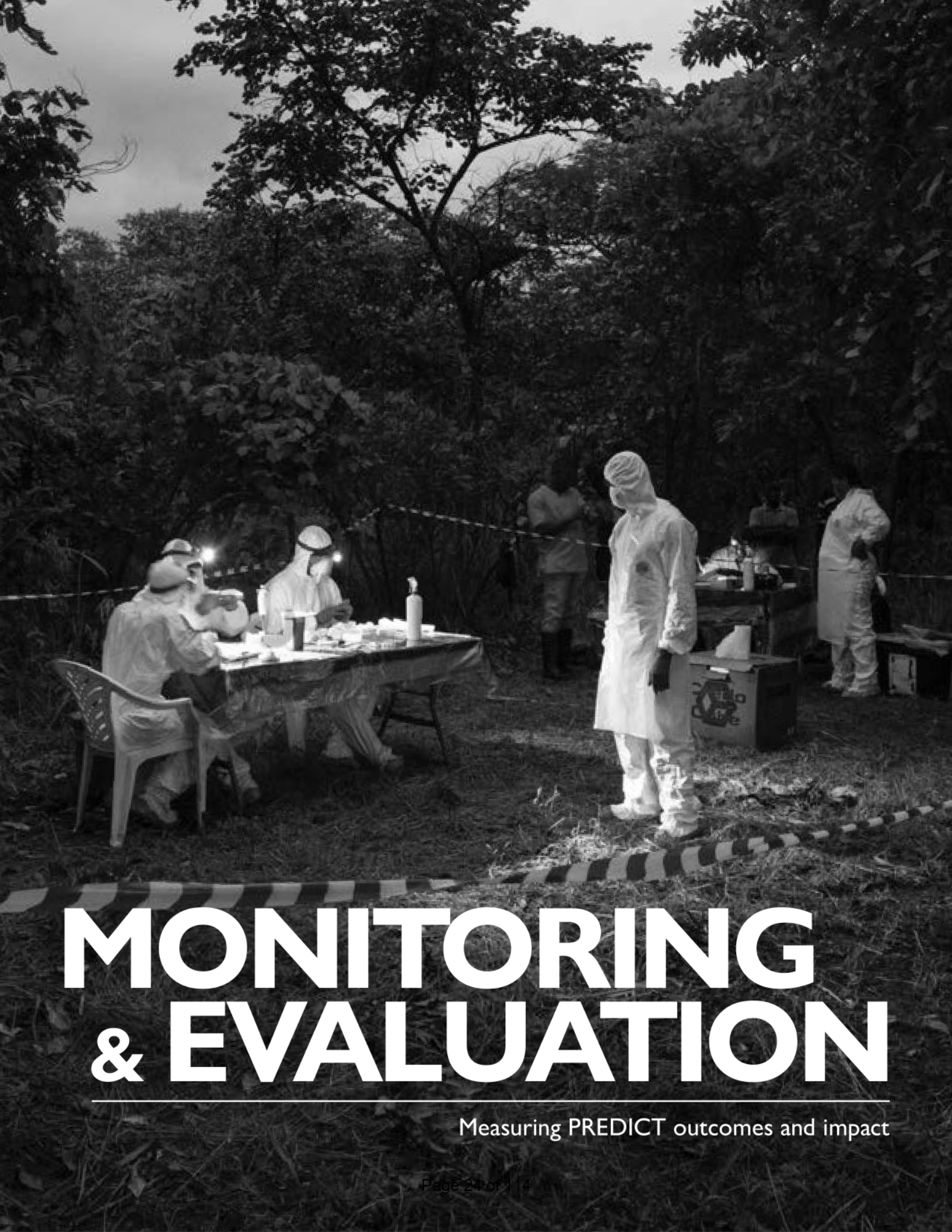


### **Improving regional health security**

PREDICT works to optimize surveillance and detection protocols and strengthen capacities in national laboratory systems, and to enhance multi-sectoral and regional collaboration between labs for improved global health security. PREDICT continued to encourage collaboration between Egypt's National Research Centre's Center of Scientific Excellence for Influenza Viruses (our project lab in Egypt) and the Jordan University of Science and Technology (JUST – our lab in Jordan) through trainings, sample sharing, and testing of human samples. In 2017, the PREDICT/Egypt team traveled to Jordan for hands-on trainings in safe bat capture and sampling. In turn, the PREDICT/Jordan team assisted with safe and effective implementation of One Health surveillance in at-risk Jordanian communities. In addition, PREDICT lab teams worked together to better understand

exposure to Middle East Respiratory Syndrome Coronavirus (MERS-CoV). In Egypt, 1,084 human samples were screened using serological assays for MERS-CoV-neutralizing antibodies via a serum microneutralization test. This allowed all of the serology tests from PREDICT/Egypt and Jordan teams to be directly compared, yielding regional insights on MERS exposure in the North Africa and Middle East regions.

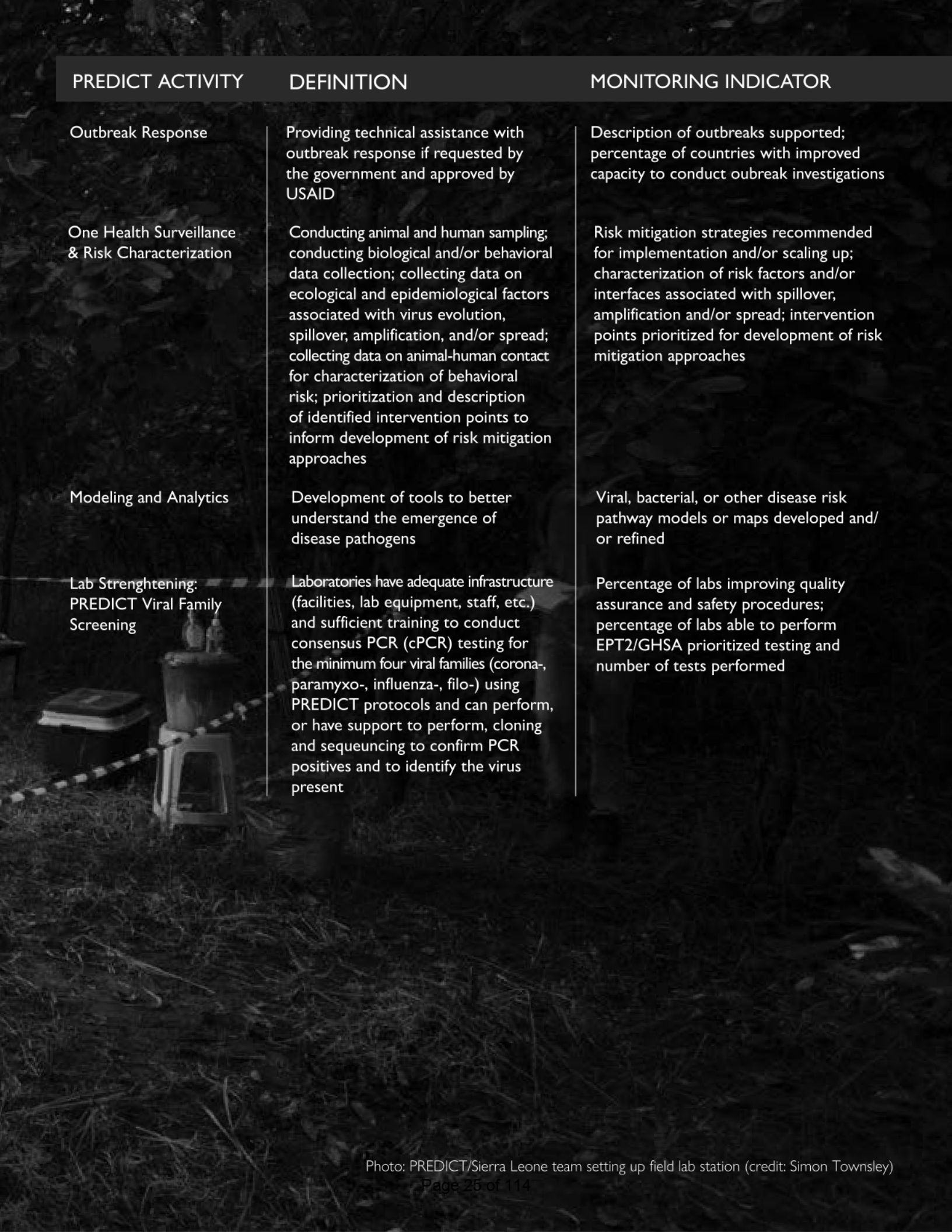




# MONITORING & EVALUATION

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Measuring PREDICT outcomes and impact



PREDICT ACTIVITY	DEFINITION	MONITORING INDICATOR
Outbreak Response	Providing technical assistance with outbreak response if requested by the government and approved by USAID	Description of outbreaks supported; percentage of countries with improved capacity to conduct outbreak investigations
One Health Surveillance & Risk Characterization	Conducting animal and human sampling; conducting biological and/or behavioral data collection; collecting data on ecological and epidemiological factors associated with virus evolution, spillover, amplification, and/or spread; collecting data on animal-human contact for characterization of behavioral risk; prioritization and description of identified intervention points to inform development of risk mitigation approaches	Risk mitigation strategies recommended for implementation and/or scaling up; characterization of risk factors and/or interfaces associated with spillover, amplification and/or spread; intervention points prioritized for development of risk mitigation approaches
Modeling and Analytics	Development of tools to better understand the emergence of disease pathogens	Viral, bacterial, or other disease risk pathway models or maps developed and/or refined
Lab Strengthening: PREDICT Viral Family Screening	Laboratories have adequate infrastructure (facilities, lab equipment, staff, etc.) and sufficient training to conduct consensus PCR (cPCR) testing for the minimum four viral families (corona-, paramyxo-, influenza-, filo-) using PREDICT protocols and can perform, or have support to perform, cloning and sequencing to confirm PCR positives and to identify the virus present	Percentage of labs improving quality assurance and safety procedures; percentage of labs able to perform EPT2/GHSA prioritized testing and number of tests performed

**PREDICT ACTIVITY****DEFINITION****MONITORING INDICATOR**

Workforce Development  
Training and Materials  
Developed

Personnel and/or students participating in the following types of trainings; Field Sampling, Information Management, Laboratory Techniques and Assay Development, and Risk Characterization

Number of faculty members that received One Health training or professional development; number of future professionals trained; number of One Health fellows placed; number of current professionals trained

Workforce Development:  
Local Capacity

PREDICT training and employment of local or regional staff members in host countries

Total number of in-country staff who are from the host country or region

Advancement &  
Improvement of One  
Health practices & policy

Development of One Health resources (including guidelines, technical protocols, standard operating procedures, standardized data collection instruments and protocols, and instructional tools and manuals for implementing risk mitigation recommendations) to provide evidence-based guidance on the operationalization and/or implementation of One Health principles and approaches; inform policy change through evidence based solutions

Description of application of One Health approaches in the workforce; description of national/regional coordination mechanisms showing improved capacity; description of global, regional or country strategies under implementation; list of educational materials developed; tools developed for implementation and operationalization; evidence-based informational resources developed including policy briefs, research papers, situational analysis/risk assessment, and zoonotic prioritization resources





Photo: Children in Kenya learning about *Living Safely with Bats* (credit: PREDICT/Kenya)

# 2018-2019

## ONE HEALTH TOOLS & RESOURCES

# 78

Educational & evidence-based materials developed

## ONE HEALTH STRENGTHENING

# 15

Countries coordinating community One Health events

## LAB STRENGTHENING

# 790K

Tests performed

# 47

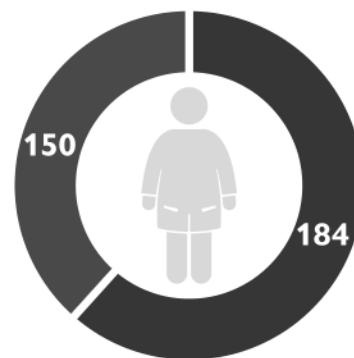
Labs testing able to perform PREDICT viral family testing

## RISK MODELS & MAPS

# 34

Models or maps developed, re-fined, analyzed & described

## ONE HEALTH WORKFORCE CAPACITY



#s trained

Female

Male

## RISK FACTORS & RISK INTERFACES

# 49

Risk factors & risk interfaces characterized since the beginning of PREDICT-2 in 2014

## INTERVENTIONS

# 24

Intervention points prioritized to inform the development of risk mitigation approaches





# GLOBAL REPORT

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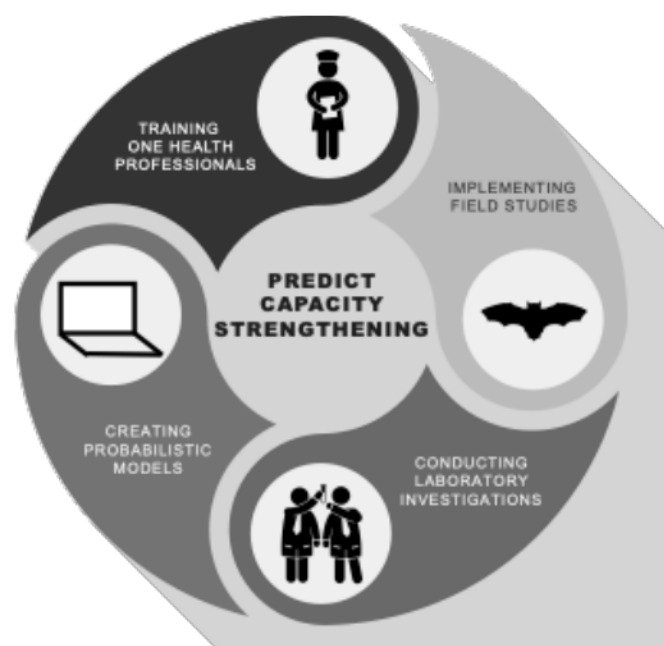
One Health framework for global health security

## CAPACITY STRENGTHENING

**Since 2009, PREDICT has trained over 5,000 One Health Professionals in Africa, Asia and Latin America**

PREDICT-2 uses an integrated approach to train personnel in One Health skills necessary for field surveillance activities, laboratory testing, outbreak preparedness, and development of risk reduction strategies and interventions. Emerging viruses have the potential to spillover and cross borders; therefore, it is also essential to build a network of international health professionals that can detect, respond to, and prevent health threats.

Since October 2014, PREDICT-2 has engaged in over 28 countries in Asia and Africa to foster leadership and transdisciplinary thinking in the next generation of One Health professionals, strengthening skills and capacities of more than 3,500 people through 20,000 individual training events in topics such as biosafety, cold chain management, emergency preparedness, field sampling, behavioral risk investigations, and disease detection. To enhance global health security, PREDICT-2 continued to train future and current One Health professionals through 'on the job' trainings and workshops. Among these professionals, PREDICT has trained over 300 university students and 1,000 project staff in zoonotic disease surveillance and disease detection skills, a major contribution to the long-term capabilities of national health systems.



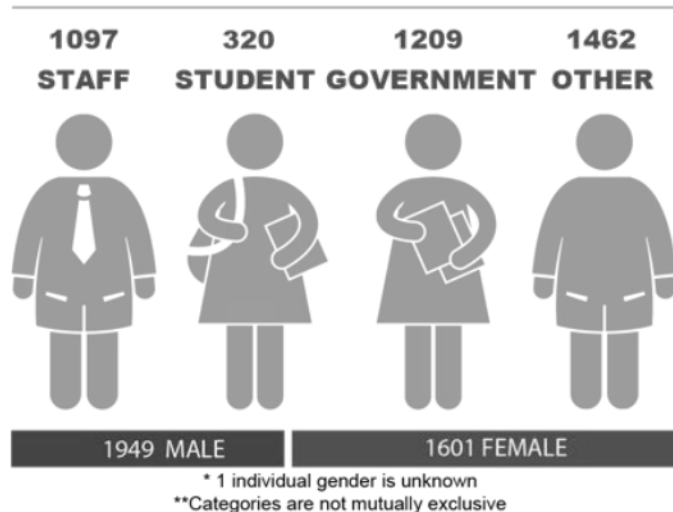
*FIGURE 2. PREDICT-2 uses an integrated approach to train personnel in One Health competencies that enable field surveillance activities, laboratory testing for priority zoonotic diseases and other emerging threats, outbreak assistance, and informed behavior change that improves our understanding of zoonotic disease risks at key wildlife-livestock-human interfaces where spillover events may occur.*

### Building national capacity for zoonotic disease surveillance

Since the inception of PREDICT, the project has focused on enhancing One Health surveillance and laboratory diagnostic capacity in hot spot regions in Asia and Africa, training over 1,200 government officials in the core skills required to detect, respond to, and prevent zoonotic disease threats. In Bangladesh, PREDICT has been providing support and training for the multidisciplinary government outbreak response team, who independently led a wildlife outbreak response in December 2018 (see Success Stories for details).

We continued to build key partnerships within and across active countries, as exemplified through collaborations with universities, ministries, and international organizations in Asia and Africa. This year, PREDICT/Senegal organized an innovative two-day outbreak simulation exercise on detection and response to an Ebola Virus Outbreak for government officials, which resulted in discussions among human, animal, and environmental health sectors emphasizing the importance of collaboration among ministries to prevent and respond to emerging pandemic threats.

## WORKFORCE DEVELOPMENT



*FIGURE 1. Since 2014, PREDICT-2 has trained over 3,500 individuals in One Health surveillance and disease detection in over 28 countries. Trained individuals include PREDICT staff, university students, government officials and others.*





*FIGURE 3. PREDICT/Senegal hosted a two-day simulation exercise on detection and response to an Ebola Virus Outbreak. Simulation hosted over 40 participants from seven different ministries.*

In Jordan, our PREDICT team played a critical role in the development of the molecular and virology laboratory at Jordan University of Science and Technology helping enhance JUST capabilities in molecular diagnostics. For example, in November 2018, there was a die-off and millions of dead fish were found along nearby rivers. Samples were sent to the JUST laboratory, and the team detected an emerging herpes virus called koi herpes.



*FIGURE 4. PREDICT/Jordan strengthens capacity in laboratory techniques by training graduate students who work as part-time research assistants. Master's student, Ola Abeneh, demonstrates laboratory techniques at the JUST Molecular and Virology Lab.*

## **Developing innovative training & outreach strategies**

Capacity building activities often take place in a traditional classroom, but technical skills for health professionals are best learned in the field or lab through instruction and hands-on training. Through PREDICT-2, a variety of training approaches have been utilized, from online trainings to face-to-face workshops.

In Cambodia and beyond, PREDICT performs aligned surveillance with the participation of government partners, university students, and local authorities including district and village veterinarians and nurses. Our team in Cambodia also provides experiential training to university students, who serve as interns in the field and project lab to practice and perfect their skills.



*FIGURE 5. PREDICT/Cambodia is strengthening wildlife surveillance by working with university students and interns in the classroom and in the field. These hands-on experiences with professional mentors are valuable opportunities for students to apply knowledge and help strengthen the workforce for zoonotic disease surveillance.*

Similarly, in Kenya, PREDICT launched an innovative strategy for raising community awareness of the One Health approach and risks of zoonotic diseases through the use of the Smithsonian Institute's National Museum of Natural History's Outbreak panels. The panels were showcased in the communities and provided a platform for community members to engage in dialogue and role-play to learn and explore ways to prevent, detect, and control diseases at high-risk human-animal-environment interfaces.



*Figure 6. PREDICT/Kenya showcases "Outbreak" panels at a One Health training, an innovative approach to increasing community awareness of zoonotic diseases and for learning about zoonotic disease prevention, detection, and control.*

## **A One Health learning library for students & professionals**

To encourage sharing of the knowledge and skills essential for safe and effective One Health surveillance, detection, and characterization of zoonotic disease threats, PREDICT's training materials, protocols, and e-book resources are freely available to the public (in English and French) at:

**[www.publications.predict.global](http://www.publications.predict.global)**

### **Publicly available guides & protocols**

#### **Biosafety, Cold Chain and Emergency Preparedness Resources**

- Basic Laboratory Safety
- Biosafety & PPE Use
- Emergency Preparedness
- Implementing Cold Chain for Safe Sample Transport & Storage
- Packing & Shipping Biological Samples

#### **One Health Surveillance & Field Sampling Guides**

- Avian Sampling Methods
- Bat Sampling Methods
- Bushmeat Sampling Methods
- Livestock Sampling Methods
- Non-Human Primate Sampling Methods
- Rodent Sampling Methods
- Safe Animal Capture & Sampling
- Small Carnivore Sampling Methods

#### **Behavioral Risk & Qualitative Research Guides**

- Qualitative Research: Introduction & Observational Research Methods
- Qualitative Research: Focus Groups, Ethnographic Interviews & Data Analysis



Photo: *Macaca mulatta* in Nepal (credit: Pranav Pandit)

# ONE HEALTH SURVEILLANCE:

## Characterizing Biological & Ecological Risk

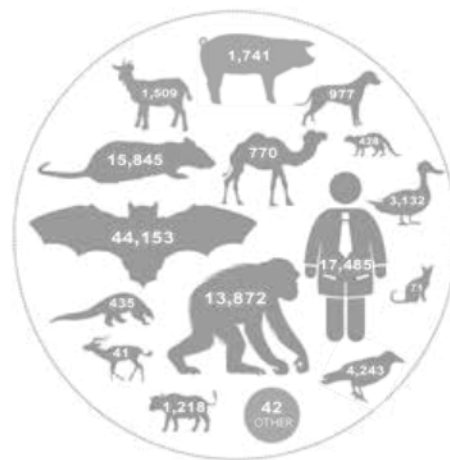
### Overview

We completed implementation of our overall One Health surveillance strategy for animals and humans, in coordination with USAID and Emerging Pandemic Threats-2 (EPT-2) partners, to detect viruses in animals and humans and to characterize biological and ecological risk. Surveillance activities focused on a concurrent surveillance strategy for detection of viral sharing and spillover as a result of close proximity interactions, or effective contact, between wildlife shedding viruses and susceptible people (and domestic species where relevant). For human surveillance, sampling targeted people with high-risk occupations at concurrent sampling sites for animals, as well as sampling acutely ill patients year-round at clinic and hospitals within the catchment area of concurrent sites.

At the PREDICT Semi-annual Meeting in November 2018, we reviewed surveillance progress and accomplishments to date and strategized successful completion of sampling and field activities with USAID and global and regional leads. We outlined the transition to post-sampling activities, including supporting data cleaning at the country and cross-partner level, preparation of data for analyses, and discussion of risk characterization. Additionally, we finalized how serology testing will be utilized to complement PCR testing already underway to provide a more complete surveillance assessment.

### Targeted monitoring for zoonotic viruses with pandemic potential at specific high-risk interfaces

PREDICT-2 has sampled over 88,000 animals and 17,000 people since the start of project activities in October 2014. Years 1-2 involved coordination of a multitude of required activities before sampling began in each country, including engagement of local partners and stakeholders, obtaining local and institutional permits for animal and human sampling, and staff training. Over the past year, field activities substantially ramped up with respect to sampling efficiency across wildlife, domestic animals, and humans (Figure 1). Sampling activities were completed in the majority of participating countries by the end of Year 4 (September 30, 2018), and remaining sample collection events were completed by the end of January 2019. As sample collection wrapped up, efforts were transitioned to reviewing data, standardizing key data fields that accepted write-in responses, and preparing data for analyses.



### Wildlife

PREDICT made a substantial effort towards sampling targeted wildlife species, primarily bats, rodents, and non-human primates, at high-risk interfaces for zoonotic spillover and spread. Wildlife sampling activities at high-risk interfaces were completed in all **28** PREDICT-engagement countries, which include: Bangladesh, Cambodia, Cameroon, China, Cote d'Ivoire, Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Guinea, India, Indonesia, Jordan, Kenya, Lao PDR, Liberia, Malaysia, Mongolia, Myanmar, Nepal, Republic of Congo, Rwanda, Senegal, Sierra Leone, Tanzania, Thailand, Uganda, and Viet Nam.

### Livestock

PREDICT coordinated with FAO on planning and sampling livestock at sites designated for concurrent and triangulated surveillance wherever possible.

Concurrent livestock sampling activities have been directly supported by FAO in Bangladesh, Cambodia, Indonesia, Lao PDR, Myanmar, Thailand, and Viet Nam. Together with PREDICT teams, FAO sampled livestock in the same locations as wildlife (and humans where possible) in Egypt, Jordan, Nepal, and Tanzania. To date, PREDICT has completed additional livestock sampling in the Democratic Republic of Congo, Guinea, Kenya, Malaysia, Sierra Leone, and Uganda. Due to FAO priorities, livestock sampling was not conducted in Cameroon, China, Côte d'Ivoire, Ethiopia, Ghana, India, Liberia, Mongolia, Republic of Congo, Rwanda, and Senegal.

### Humans

Human biological sampling and risk characterization surveys using PREDICT's human questionnaire were completed in high-risk communities in 23 targeted countries: Bangladesh, Cambodia, Cameroon, China, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Ethiopia, Ghana, India, Indonesia, Jordan, Kenya, Lao PDR, Malaysia, Myanmar, Nepal, Rwanda, Senegal, Tanzania, Thailand, Uganda, and Viet Nam.

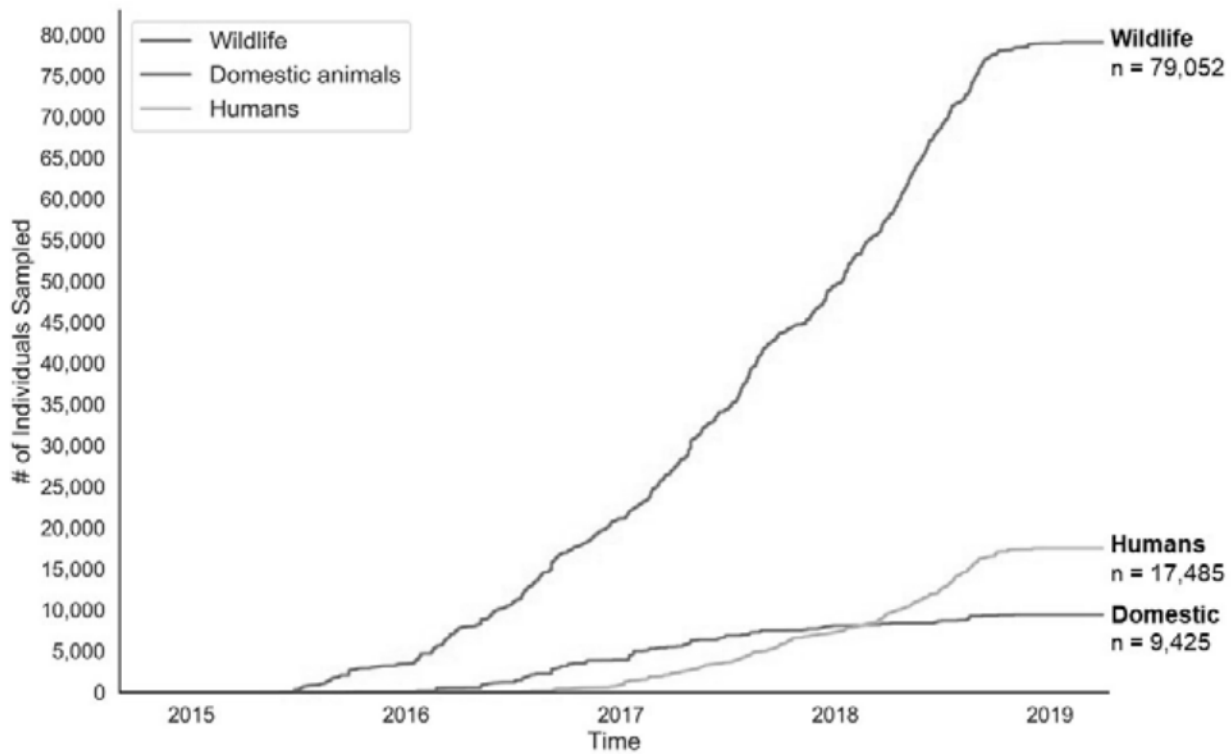


FIGURE 1. Number of Individual Wildlife, Domestic Animals and Humans Sampled

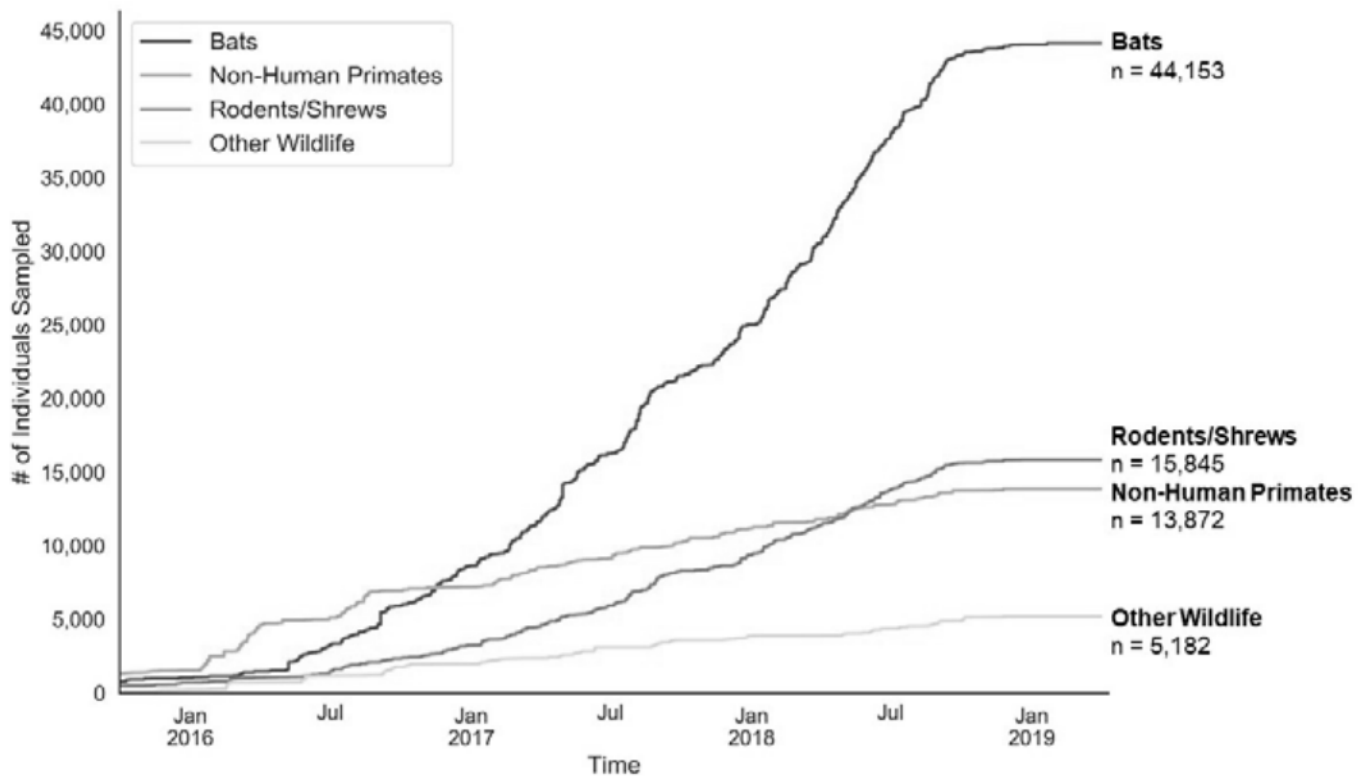


FIGURE 2. Number of individual wild animals\* sampled overall, by taxonomic group.

\*Depicts animals with data entered into the Emerging Infectious Disease Information Technology Hub (EIDITH), PREDICT's information and data management system.



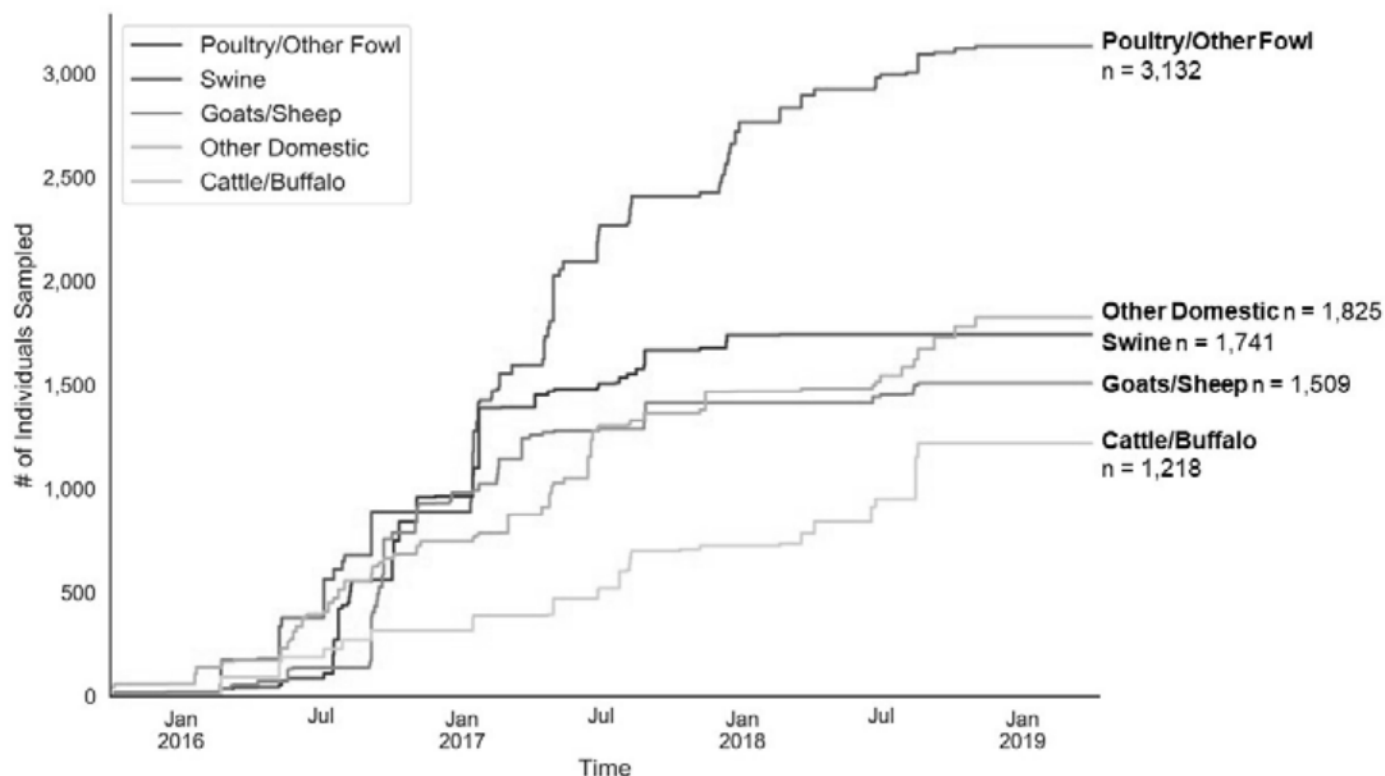


FIGURE 3. Number of individual domestic animals\* sampled overall, by taxonomic group.  
\*Depicts animals with data in EIDITH.

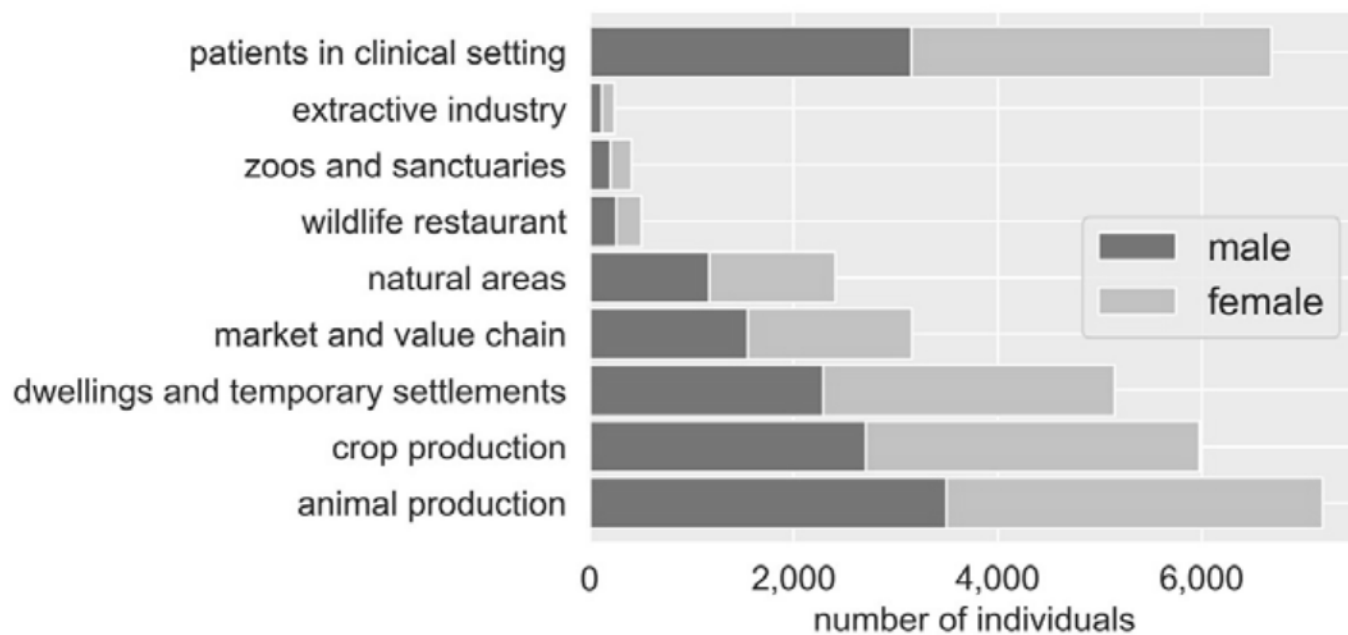


FIGURE 4. High risk interface modules completed by individuals sampled\* in the community or patient clinical setting, is aggregated by gender.

\*Many individuals sampled were identified with more than one disease transmission interface.

## CHARACTERIZING BEHAVIORAL RISK

PREDICT's behavioral risk activities aim to 1) collect data to better understand the human drivers of viral emergence, transmission, and spread, and 2) use evidence to inform the development of potential population or policy-level intervention strategies to reduce the spillover, amplification, and spread of zoonotic viruses and other emerging threats.

### Highlights

- 739 professionals (46% women) in 29 countries trained on a variety of topics relevant to behavioral risk investigations.
- 9 tools established or refined to enhance the rigor of mixed-method behavioral risk characterization and the development of intervention recommendations.
- Over 1,000 ethnographic interviews and 100 focus groups (inclusive of over 900 participants) conducted.
- More than 19,000 quantitative behavioral questionnaires completed with community members and patients.
- More than 100 downloads of the *Living Safely with Bats* behavior change and risk communication picture book by community leaders, members, students, and individuals who work in academia or research, public health, animal health, NGOs, elementary schools, US government agencies, development, communications, museum libraries, and bat conservation. Successful endorsement of the behavior change book during its initial rollout in West Africa along with interest from the broader PREDICT consortium led to a broader adaptation and development for use in Asia partner countries (Figure 1).



FIGURE 1. PREDICT's *Living Safely with Bats* behavior change and risk communication picture book, adapted for the South and Southeast Asia region.

## Successes

### Strengthening capacity for behavioral risk investigations in 28 countries



FIGURE 2. *Strengthening Capacity for Behavioral Risk Investigations*. Trainings include both remote and in-person events, as well as cross-team trainings to build regional capacity.

### Standardizing approaches for investigating human behavioral risks

PREDICT continued to standardize and refine behavioral risk protocols, frameworks, and data investigation tools to improve scientific rigor within data analyses and interpretation.

- A Data Analysis Report was prepared that provides a visually engaging way to digest the information from the ecological, biological, and behavioral risk surveillance questionnaires. This report allows the data to be rapidly compared across each site for each country. With this new tool, country team members and technical team members are able to quickly conceptualize the differences between reported behaviors and contacts in country sites. The Data Analysis Report uses heatmaps to represent varied animal contacts by priority taxa overall and by key demographic characteristics. User-friendly heatmaps, such as the one featured from Malaysia (Figure 3), will assist country teams in exploring the data by visualizing trends as they work to develop evidence-based intervention recommendations.
- Data analysis planning resources were developed—including a framework and prototype to support analysis planning across all country-level behavioral risk teams and across consortium technical teams. In addition, an inventory of analysis themes of interest to country teams was established, helping coordinate data analysis for development of holistic, multidisciplinary One Health intervention recommendations.



FIGURE 3. Strengthening Capacity for Behavioral Risk Investigations. Trainings include both remote and in-person events, as well as cross-team trainings to build regional capacity.

## Identifying Potential Intervention Points

The **Intervention Development Tool**—created to assemble the risk and protective factors relevant to knowledge/beliefs, attitudes, skills, and behaviors—has been implemented. The tool is used to capture both protective and risky factors as they relate to behavior and incorporates relevant summaries with supporting data sourced from ethnographic interviews and focus group discussions. The end-goal logic model for behavioral change, which will incorporate these findings, can be seen in Figure 4.



FIGURE 4. PREDICT's logic model for behavior change

**Deep Dive Investigations.** Preliminary analyses of project data revealed that bat-related interfaces warrant particular attention, given the connection between bats and epidemics (such as in the case of SARS and Ebola). PREDICT has detected numerous viruses in bats at high-risk interfaces, including filoviruses, coronaviruses, paramyxoviruses, and influenza viruses, further supporting the need to conduct in-depth behavioral investigations at human-animal contact interfaces.

Our work exploring zoonotic disease risk and behaviors at human-animal interfaces, such as animal markets and value chains, also warrants extensive examination. PREDICT continued to explore several priority deep dive topics (Figure 5) that we identified as particularly critical for in-depth investigation. Early insights into intervention recommendations have been drafted across six countries (nine deep dive topics).



FIGURE 5. Behavioral risk deep dive topics under investigation by PREDICT technical teams.

**Collaboration across Objective Teams.** The PREDICT Modeling and Analytics (M&A) technical team is leading the implementation of modeling efforts referred to as 'IMPACTs' (Intervention Modeling Projects Across Teams). The IMPACTs, some of which are focused on behavioral questions around human-bat interactions, are designed to output modeling results that can be integrated into the development of intervention recommendations for each of PREDICT's deep dive topics.

Working with the Surveillance and M&A technical teams has allowed for visually engaging analyses of the quantitative behavioral data (Figure 6).

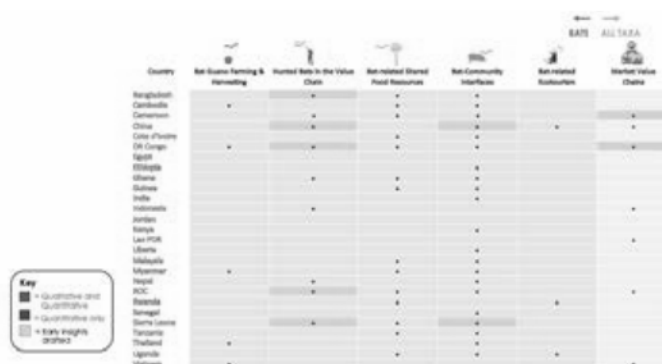


FIGURE 6. The multitude of ways that PREDICT-enrolled participants that completed the questionnaire experience contact with animals.

## Select PREDICT Behavioral Risk Products

- 11 training decks to support capacity-building sustainability
- Data analysis planning resources
- Questionnaire Analysis Report
- Coding Clarification Log
- Questionnaire Analysis Matrix
- Real-time Interim Data Review (IDR) report
- Maps of behavioral data
- Intervention Development Tool
- Behavior change and risk communication resource *Living Safely with Bats* adapted to multiple contexts and translated in several languages

# STRENGTHENING ONE HEALTH DATA PLATFORMS



# EIDITH

The Emerging Infectious Disease Information and Technology Hub (EIDITH) is the centerpiece of PREDICT's One Health data and knowledge management platform. Through EIDITH, One Health surveillance and lab data are captured by from the field by apps and pushed to our secured servers for data cleaning and validation.

Specimen ID	Animal ID	Biorep Species Name	Collection Name
New Recording Form			
Sample Information	Test Date	Animal ID	Host Species ID
DIAGNOSTIC ON 2	2019-09-10	2019	Adenovirus (H5N1)
DIAGNOSTIC ON 2	2019-09-10	2019	Adenovirus (H5N1)
DIAGNOSTIC ON 2	2019-09-10	2019	Adenovirus (H5N1)
DIAGNOSTIC ON 2	2019-09-10	2019	Adenovirus (H5N1)

An EIDITH application for host species identification and DNA barcode results.



EIDITH's new menu system for improved site navigation.

Multiple Person Training Event

Site:  Training Date:

Location of Training:

Trainer Name:

Was the training conducted by PREDICT staff? ☐ Yes ☐ No

Were PREDICT products used in the training? ☐ Yes ☐ No

Did participants use PREDICT species after the training? ☐ Yes ☐ No

Estimated number of livestock participants who attended:

Training Information

Type of Training:

Training Topic:

What was the topic of the training session? (Select all that apply)

Species: ☐ ACU/101 ☐ BSE ☐ Emergency Preparedness ☐ Information Literacy ☐ Planning and Policy

Trainer Participant Information

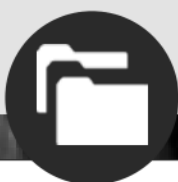
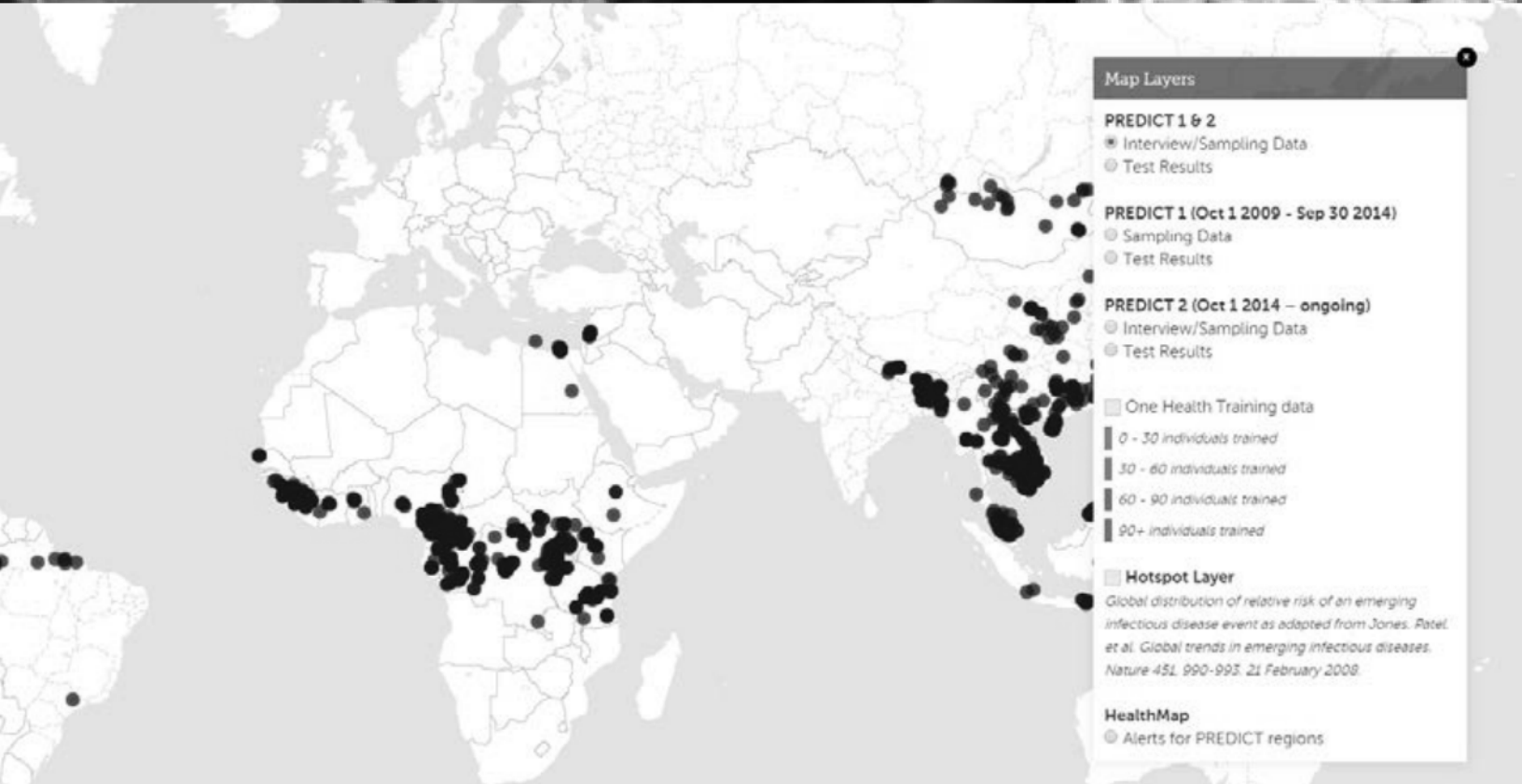
Trainer Name:

What was the gender makeup of the participants? (Select all that apply)

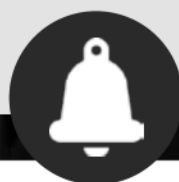
EIDITH training application form for multiple-person training data.



EIDITH has upgraded the animal identification (barcoding) test results module, improving the accuracy of species data, which is critical for the conservation community.



EIDITH enables reporting to PREDICT partners, USAID, and host country governments, pulling data from our servers into customized data and information summaries that include reports on viral findings for government review and approval for public release.



EIDITH is home to PREDICT's training tracking system, where our teams can monitor trainee status, receive notifications on expired or refresher trainings, and view One Health competencies gained through our capacity strengthening program.



EIDITH also exports data that are approved for public release to HealthMap, PREDICT's home for interactive training, surveillance, and test result data. The site, **[www.data.predict.global](http://www.data.predict.global)** is updated every 24 hours and powers visualization and analysis of data for the entire life of the project.

## VIRAL DETECTION & LABORATORY IMPLEMENTATION

### Laboratory capacity building

PREDICT continued to improve disease detection capabilities in 63 laboratories, targeted for training and testing across five priority viral families (corona, paramyxo, filo, influenza, and flaviviruses) known to cause zoonotic disease in humans and that are considered pandemic threats. There are now 47 labs testing for one or more priority viral families across Asia and Africa.

During this period, 19 labs gained step-wise increases in detection capacity (Figure 1): 10 gained a one-step increase, 8 gained a two-step increase, and one advanced three-steps. As a result, one lab began testing for the first time, an additional lab produced preliminary results for the first time, and 17 labs submitted sequence results for interpretation.

Results-reporting also improved, and viral findings have been approved for public release by host country governments in 22 countries (see major milestones in laboratory testing). Results reports were prepared for 13 countries and shared with government partners (or will be shared soon). All government-approved results are available on our public site: [www.data.predict.global](http://www.data.predict.global)

### CRITICAL CAPACITY

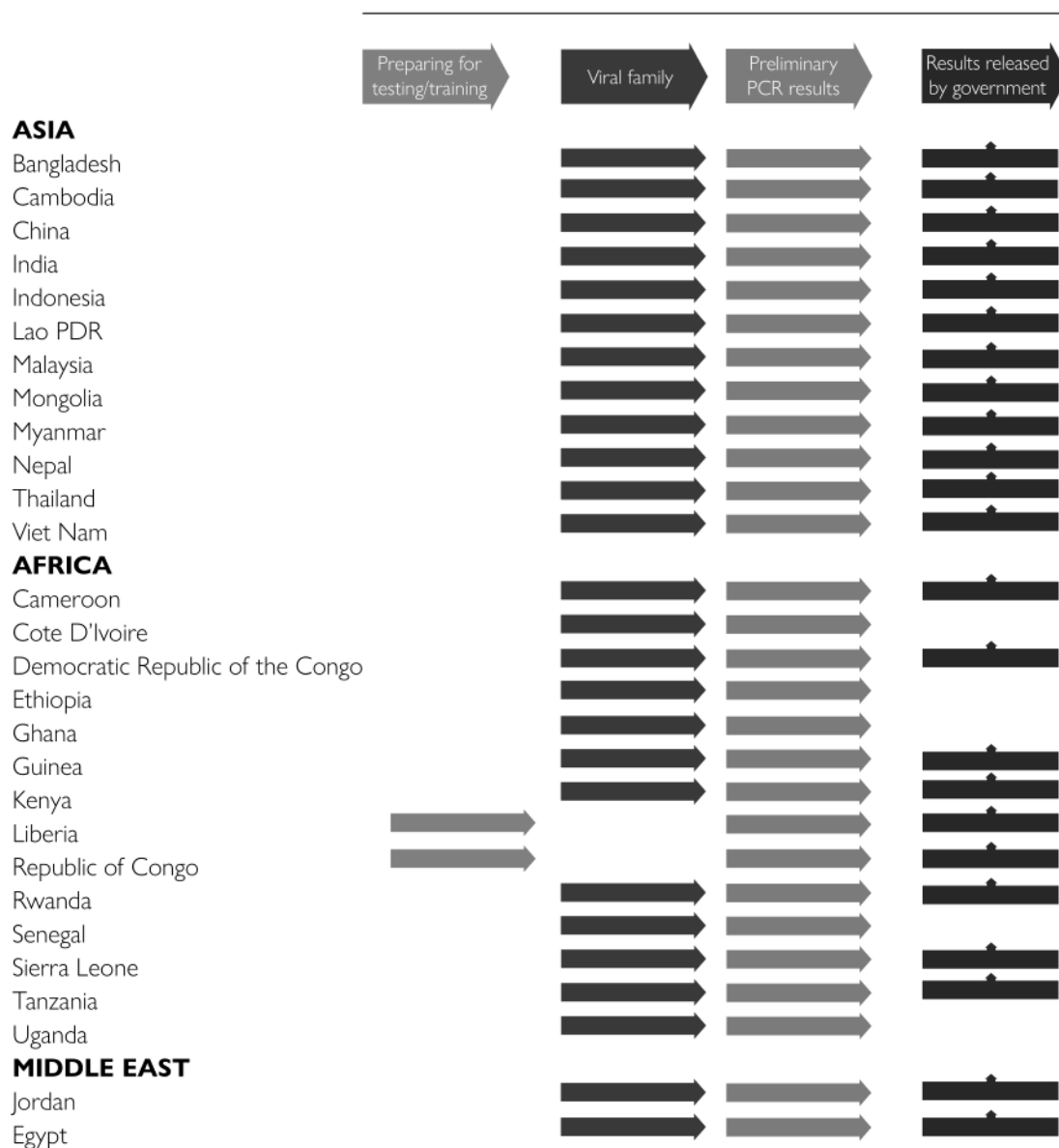


FIGURE 1. Major milestones and laboratory capacity gains toward viral detection





FIGURE 2. Bode Shobayo, deputy director for research at the National Public Health Institute of Liberia, visits the Center for Infection and Immunity (CII) at Columbia University. He was there to help with screening of Ebola Host Project samples collected from bats in Liberia and for training in advanced diagnostic platforms including VirCapSeq and Serochip. While at the CII, Mr. Shobayo also participated in several capacity strengthening academic programs, including the weekly journal club in which he presented a study on filoviruses in China.

## Testing progress

We are in the final stages of testing and data entry for the current five-year period. A side-by-side comparison shows that we tested more individuals in PREDICT-2 than in PREDICT-1, surpassing PREDICT-1 numbers in Year 2 (Figure 3). The majority of samples tested were from bats, humans, and rodents (Figure 4).

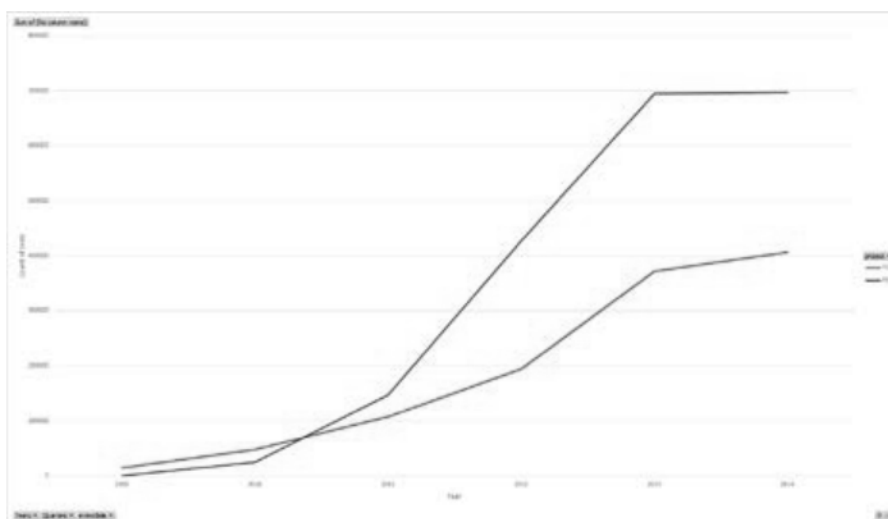


FIGURE 3. Total number of individuals tested in PREDICT-1 (blue line) and PREDICT-2 (orange line)

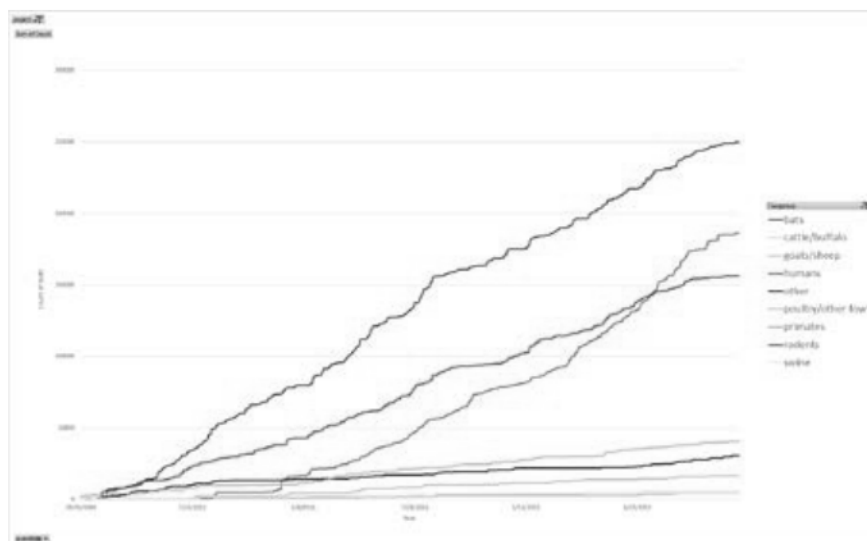


FIGURE 4. Total number of individuals tested to date broken out by taxa

## PREDICT viral interpretation results

Viral family	# of known viruses found in P1	# of novel* viruses found in P1	# of additional known viruses found in P2	# of additional novel* viruses found in P2	Total
Coronavirus	31	69	18	Coronavirus	149
Paramyxovirus	12	74	8	Paramyxovirus	172
Filovirus	0	0	2	Filovirus	3
Influenza virus	8	0	1	Influenza virus	9
Flavivirus	3	5	3	Flavivirus	12
Hantavirus	4	3	1	Hantavirus	8
Rhabdovirus	0	31	0	Rhabdovirus	36

Some findings not yet approved for release; data for other viral families detected during PREDICT-1 but not targeted in PREDICT-2 are not shown.

\*Definition of a novel virus: A virus is considered to be new or novel if it has equal or greater genetic variation than the difference between the two closest known virus species within a family/genus and if it represents a distinct (monophyletic) lineage. Our data are strongly suggestive of a new virus, but such classification can only be conferred by the International Committee on Taxonomy of Viruses (ICTV).

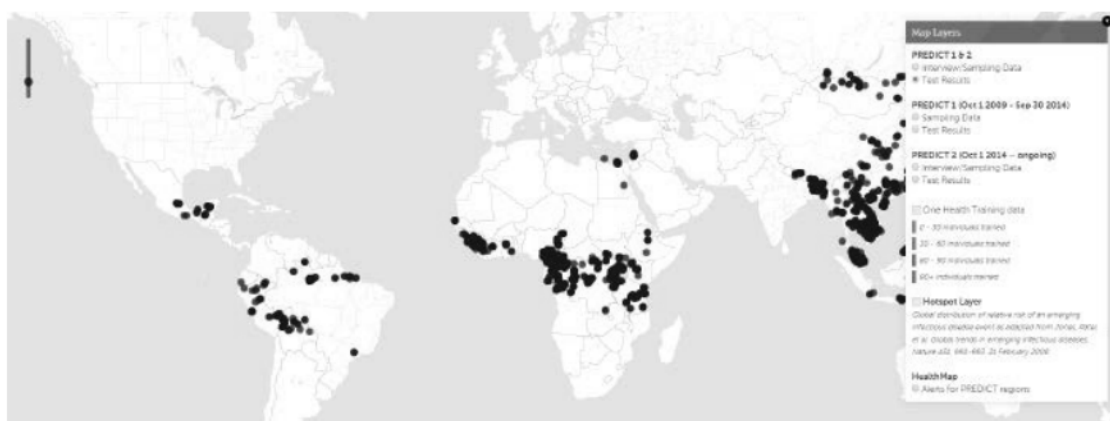


Figure 5. Viral map.

A table of comprehensive viral findings approved by host government partners for public release is provided below. All approved viral findings are also available on PREDICT's public site, [www.data.predict.global](http://www.data.predict.global).

## Highlight of viral findings

- **Coronaviruses:** Completed 27 full genome sequences collected from Cambodia, ROC, Rwanda, Malaysia, and Bangladesh to facilitate phylogenetic analyses to better classify the viruses and understand their evolutionary history, as well as to evaluate their zoonotic potential
- **Evaluated the ability of Bombali virus to antagonize human interferon:** Preliminary evidence suggests that Bombali virus is a poor antagonist of human interferon. This finding suggests that the virus may not induce a severe pathogenic response in people. Additional work is ongoing to fully characterize this response.
- **Generated additional NPC1 sequences for ebolavirus host susceptibility project:** An additional 25 NPC1 sequences were generated from bats and rodents. NPC1 is the host receptor used by filoviruses to enter cells. These sequences are now being used to assess species susceptibility to different ebolaviruses.
- **Detection of Marburg virus in West African rousette bats:** Marburg virus was detected in five Egyptian rousette bats (*Rousettus aegyptiacus*) in Sierra Leone. These infected bats were identified in caves near Moyamba, Koinadugu/Falaba, and Kono districts. Multiple strains of Marburg virus were found, including the Angola strain, a lineage of virus that emerged at a Marburg virus outbreak in 2005 in Angola. This is the first time that the Angola stain has been detected in bats (Figure 5) and also has provided further, productive impetus for collaborations with the CDC Special Pathogens Branch.
- **Detection of Ebola virus (species Zaire ebolavirus) in a greater long-fingered bat (*Miniopterus inflatus*) in Liberia:** An oral swab tested positive for Ebola virus (EBOV) by real-time PCR and was confirmed positive by sequencing. Approximately 20% of the genome was recovered. Preliminary analysis suggests the virus is the same or a close relative of the West African outbreak strain. Serum collected from this bat neutralized recombinant Vesicular Stomatitis Virus (VSV)-expressing EBOV glycoprotein (Figure 6).



Figure 6. Marburg virus was detected in Egyptian rousette bats (*Rousettus aegyptiacus*) in Sierra Leone. This is the first time the virus has been found in West Africa and is more than 2700 km from the closest reported detection

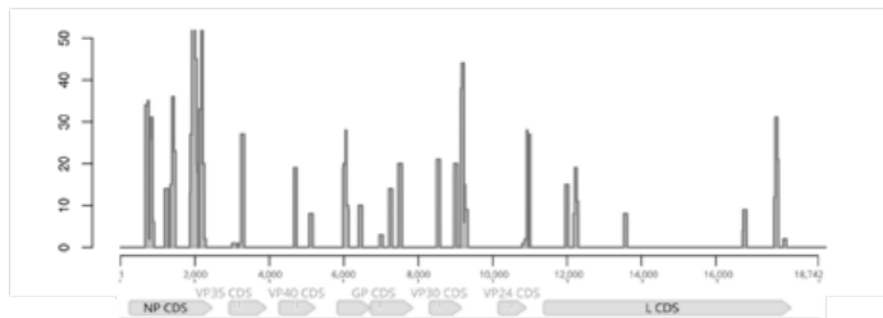


Figure 7. Ebola virus (species *Zaire ebolavirus*) was detected in a greater long-fingered bat (*Miniopterus inflatus*) in Liberia. Plot shows that approximately 20% of the genome has been sequenced.

## Tools in development

- **Paramyxoviruses:** Vesicular Stomatitis Virus (VSV) pseudotype particles have been developed that incorporate different genes from paramyxoviruses, including a PREDICT virus found in bats. The goal is to assess the ability of these genes to mediate entry and replication in human and animal cells.
- **Ebola Serologic Assay:** Optimization of the PREDICT ebolavirus ELISA and western blot assays for testing human sera has been completed with samples from eastern DRC, and the assays are now being used to test a second batch of human samples from Uganda. Bat samples for further testing have now been shipped from Sierra Leone, Guinea, and Liberia to the US.
- **Refining our deep-sequencing approach:** We continued data collection and ongoing analyses to compare results of high throughput sequencing using unbiased sequencing with VircapSeq-VERT and to evaluate factors that affect sequencing.
- **Development of ebolavirus reagents:** Antibodies against proteins of the new Bombali virus have been produced (GP, NP, VP24, VP35). Recombinant VSV expressing the Bombali glycoprotein has also been developed. These reagents are now being used to understand Bombali virus infection in human cells and look for evidence of exposure in human populations.

COUNTRY	VIRUS	TAXA	2015		2016		2017		2018	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Bangladesh	Influenza A	Birds			1		3			
		Poultry/other fowl			10		45			
	Strains of Newcastle Disease Virus	Poultry/other fowl					22			
	Peste des petits ruminants (PPR)	Goats/sheep	2				2			
	Strain of Alphacoronavirus 1	Dogs					2			
	Strain of Avian Paramyxovirus 6	Poultry/other fowl					7			
	Strain of Duck Coronavirus	Poultry/other fowl					37			
	Strain of Infectious bronchitis virus (IBV)	Birds					3			
		Poultry/other fowl					29			
	Strain of Murine coronavirus	Rodents/shrews			1					
	Strain of Pigeon-Dominant Coronavirus	Poultry/other fowl					9			
	PREDICT_CoV-17	Bats							4	
	PREDICT_CoV-52	Bats				1		2		
	PREDICT_CoV-56	Bats				5				
	PREDICT_CoV-86	Bats				1				
	PREDICT_CoV-88	Bats				4				
	PREDICT_CoV-89	Bats				1				
	PREDICT_CoV-90	Bats				3				
	PREDICT_PMV-103	Bats				1				
	PREDICT_PMV-104	Bats				1				
	PREDICT_PMV-109	Bats				1				
	PREDICT_PMV-20	Rodents/shrews				5				
Cambodia	Strain of Bat coronavirus 512/2005	Bats	2		26					
	Strain of Infectious bronchitis virus (IBV)	Poultry/other fowl						6		
	Strain of Lonquan Aa mouse coronavirus	Rodents/shrews	37	22	4	7				
	Strain of Murine coronavirus	Rodents/shrews	70	62	29	12				
	Strain of Tembusu virus	Poultry/other fowl						2		
	Thottapalayam virus	Rodents/shrews	2							
	PREDICT_CoV-100	Poultry/other fowl					1	1		
	PREDICT_CoV-102	Poultry/other fowl						3		
	PREDICT_CoV-24	Bats								
	PREDICT_CoV-25	Bats	1							
	PREDICT_CoV-35	Bats				2				
	PREDICT_CoV-56	Bats				1				
	PREDICT_PMV-13	Bats	6		18					
	PREDICT_PMV-63	Bats	1							
	PREDICT_PMV-66	Bats	3		6					
	PREDICT_PMV-67	Bats	9		1					
	PREDICT_RbdV-21	Bats	1							
	PREDICT_RbdV-28	Bats	1							
	PREDICT_RbdV-31	Bats	2							
	PREDICT_RbdV-32	Bats	1							
	PREDICT_RbdV-33	Bats	1							
Cameroon	Human Parainfluenzavirus 2	Humans					1			
	Influenza A	Humans					4	3		
	Monkey pox	Environment sample			7					
		Non-human primates			5					
	Strain of Bat coronavirus Hipposideros	Bats							1	
	Strain of Bat-related Human Coronavirus 229E	Bats			16	4	15	3		
	Strain of Zaria Bat Coronavirus	Bats				2	8			
	PREDICT_CoV-30	Bats	1							
	PREDICT_CoV-35	Bats	2							
	PREDICT_CoV-44	Bats			1	2	1	3		
	PREDICT_CoV-54	Bats				10	3			
	PREDICT_CoV-66	Bats	2							
	PREDICT_CoV-75	carnivores			1					
	PREDICT_CoV-81	Bats			11	3	3	1		
	PREDICT_PMV-101	Rodents/shrews				3	1			

	PREDICT_PMV-127	Bats	1	
	PREDICT_PMV-131	Rodents/shrews		1
	PREDICT_PMV-133	Bats		1
	PREDICT_PMV-79	Bats	2	
	PREDICT_PMV-80	Bats	1	1
	PREDICT_PMV-82	Bats	1	
	PREDICT_PMV-91	Rodents/shrews	1	
	PREDICT_PMV-97	Bats	1	
China	Influenza A	Humans	3	
	Strain of Bat Coronavirus 1	Bats	32	
	Strain of Bat Coronavirus HKU10	Bats	6	
	Strain of Bat coronavirus HKU2	Bats	3	28
	Strain of Bat coronavirus HKU6	Bats		44
	Strain of Bat coronavirus HKU8	Bats	3	
	Strain of Bat coronavirus HKU9	Bats		6
	Strain of Bat paramyxovirus isolate BtHp-ParaV/GD2012	Bats		2
	Strain of Hipposideros_Bat_Alphacoronavirus MJ/67C	Bats		2
	Strain of Rhinolophus/Hipposideros Alpha-coronavirus	Bats	1	
	Strain of SARS-related betacoronavirus Rp3/2004	Bats		14
	Strain of SARS-related betacoronavirus RsSHC014	Bats	1	
	PREDICT_CoV-22	Bats	11	32
	PREDICT_CoV-23	Bats		1
	PREDICT_CoV-79	Bats	8	29
	PREDICT_CoV-95	Bats		2
	PREDICT_PMV-123	Bats		1
	PREDICT_PMV-129	Bats		1
	PREDICT_PMV-130	Bats		1
	PREDICT_PMV-134	Bats		1
	PREDICT_PMV-135	Bats		1
	PREDICT_PMV-136	Bats		1
	PREDICT_PMV-47	Bats		3
	PREDICT_PMV-49	Bats	1	1
	PREDICT_PMV-88	Bats	1	
	PREDICT_PMV-89	Bats	1	
	PREDICT_PMV-90	Bats	1	
Democratic Republic of the Congo	Zaire Ebolavirus (EBOV) - Équateur province outbreak	Humans		1
	Strain of Bat coronavirus Hipposideros	Bats	1	
	Strain of Eidolon bat corona-virus/Kenya/ KY24/2006	Bats	8	
	Strain of Kenya bat corona-virus/BtKY56/ BtKY55	Bats	1	2 1
	Strain of Pan paniscus lymphocryptovirus 1	Non-human primates	2	2
Egypt	Strain of Bat coronavirus HKU9	Bats		6
	Strain of Rousettus Bat Coronavirus/NRC-1	Bats		4
	Strain of Rousettus Bat Coronavirus/NRC-2	Bats		8
	PREDICT_PMV-113	Bats	1	
	PREDICT_PMV-114	Bats		1
	PREDICT_PMV-115	Bats		1

Egypt	PREDICT_PMV-116	Bats							1
	PREDICT_PMV-118	Bats				12			
	PREDICT_PMV-119	Bats				1			
Jordan	Strain of Bat Alphacoronavirus/GS2013/HuB2013	Bats							5
	Strain of Bat Coronavirus BM48-31/BGR/2008	Bats							28
	Strain of Bat coronavirus HKU9	Bats							2
	Strain of Betacoronavirus 1 (OC43)	Bats							1
	Strain of Bat-related Human Coronavirus 229E	Bats							17
	PREDICT_CoV-65	Bats							5
	PREDICT_CoV-91	Bats							1
Kenya	PREDICT_CoV-90	Bats							5
	Strain of Chaerephon bat corona-virus/Kenya/KY22/2006	Bats							1
Lao PDR	Strain of Lonquan Aa mouse coronavirus	Rodents/shrews				2			
Liberia	Zaire Ebolavirus (EBOV)	Bats						1	
Malaysia	Strain of Infectious bronchitis virus (IBV)	Poultry/other fowl						1	
	Strain of Murine coronavirus	Rodents/shrews	1			1			1
	Strain of Philippines/Diliman1525G2/2008	Bats						1	
	PREDICT_CoV-52	Bats	1			5			
	PREDICT_CoV-76	Bats	3						
		Rodents/shrews	1						
	PREDICT_CoV-78	Bats	2	7	1	1			4 1
		Rodents/shrews	1			1			1 9
	PREDICT_CoV-80	Bats	3						
	PREDICT_CoV-84	Bats	1			1			1
	PREDICT_CoV-87	Bats							4
	PREDICT_Flavi-6	Bats				2			
	PREDICT_PMV-105	Bats	1						
	PREDICT_PMV-106	Bats				2			
	PREDICT_PMV-107	Bats				2			
	PREDICT_PMV-108	Bats				1			
	PREDICT_PMV-110	Bats				1			
	PREDICT_PMV-120	other				1			
	PREDICT_PMV-137	Bats							1
	PREDICT_PMV-72	Bats	2						
	PREDICT_PMV-74	Bats				1	1		
	PREDICT_PMV-81	Bats	4						
	PREDICT_PMV-98	Bats				1			
	PREDICT_PMV-99	Bats				1			
Mongolia	Influenza A	Birds				31	15		
Myanmar	PREDICT_CoV-35	Bats						1	3
	PREDICT_CoV-47	Bats				2			
	PREDICT_CoV-82	Bats				3			
	PREDICT_CoV-90	Bats							1
	PREDICT_CoV-92	Bats						36	
	PREDICT_CoV-93	Bats						3	
	PREDICT_CoV-96	Bats						5	
	PREDICT_PMV-132	Rodents/shrews						2	
	PREDICT_PMV-48	Bats						4	



Nepal	Influenza A	Birds	12		
		Humans		10	
	Strain of Duck Coronavirus	Birds	25		
	Strain of Infectious bronchitis virus (IBV)	Birds	3		
	Strain of Murine coronavirus	Rodents/shrews	4		
	Strain of Newcastle Disease Virus	Birds	8		
Republic of Congo	PREDICT_PMV-83	Rodents/shrews	1		
	Strain of Kenya bat coronavirus/BtKY56/BtKY55	Bats	11		
Rwanda	PREDICT_CoV-30	Bats		2	
	Strain of Chaerephon bat coronavirus/Kenya/KY22/2006	Bats	1		
Sierra Leone	Strain of Eidolon bat coronavirus/Kenya/KY24/2006	Bats		19	1
	Strain of bat-related Human Coronavirus 229E	Bats	2		
	Strain of Kenya bat coronavirus BtKY33/2006	Bats	1		
	PREDICT_CoV-44	Bats	7		
	PREDICT_CoV-77	Bats	1		
	PREDICT_CoV-94	Rodents/shrews			2
	PREDICT_PMV-56	Bats		1	
Tanzania	Bombali Ebolavirus (BOMV)	Bats		3	
	Marburg virus (MARV)	Bats			2
Thailand	Strain of Bat coronavirus HKU9	Bats	3		7
	Strains of Betacoronavirus 1 (OC43)	Humans		3	
	Strain of Chaerephon bat coronavirus/Kenya/KY22/2006	Bats			1
	Strain of Eidolon bat coronavirus/Kenya/KY24/2006	Bats	1		4
	PREDICT_CoV-97	Bats	1		
	PREDICT_PMV-141	Bats	1		
	PREDICT_PMV-143	Rodents/shrews			1
	PREDICT_PMV-144	Rodents/shrews	1		1
	PREDICT_PMV-146	Rodents/shrews	1		
	PREDICT_PMV-150	Rodents/shrews	1		
Viet Nam	Nipah Virus	Bats		2	
	Strain of Bat Coronavirus 1	Bats	1		
	Strain of Murine coronavirus	Rodents/shrews		9	2
	PREDICT_CoV-17	Bats		13	
	PREDICT_CoV-22	Bats	7		
	PREDICT_CoV-27	Bats	3		
	PREDICT_CoV-47	Bats	5		6
	PREDICT_CoV-68	Bats		9	
	PREDICT_PMV-2	Bats		4	
	PREDICT_PMV-20	Rodents/shrews			2
	PREDICT_PMV-85	Bats		1	
	PREDICT_PMV-86	Rodents/shrews		2	
Viet Nam	Influenza A	Swine		26	
	Strain of Porcine Parainfluenzavirus 1	Swine	1	2	

# MODELING & ANALYTICS (M&A)

## Major highlights & successes

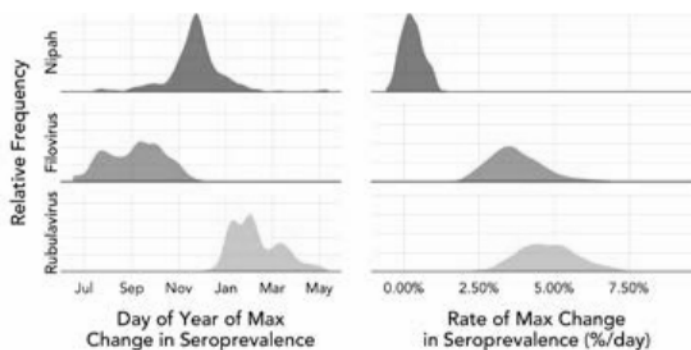
This period, PREDICT's M&A team focused on four major themes:

- 1) Demonstrating how we can analyze PREDICT data to increase the efficiency of surveillance programs and predictive power of our models
- 2) Intervention Modeling Projects ACross Teams (IMPACT) that help test proposed broad-based intervention strategies that derive from PREDICT results
- 3) Working with EPT partners to produce maps, models, and other products that help them design their programs, test hypotheses, and hone their One Health strategic plans
- 4) Designing new analytical strategies and open-source tools to analyze risk of disease emergence.

### 1) Analyzing PREDICT data to increase efficiency of surveillance programs

Analyses were conducted to examine whether surveillance can be targeted seasonally to a period when the risk of disease emergence is greatest. We used longitudinal serological data from Bangladesh to identify co-circulation dynamics of Nipah, filovirus, and Rubulavirus in a bat population of the species *Pteropus medius*. We show that each virus has different periods/months when seroprevalence is significantly increasing or decreasing, and the calculated risk of viral shedding is greatest. We also analyzed these data to show that individual bats can be co-infected with multiple viruses.

Therefore, interventions to mitigate the spillover of viruses from this one fruit bat species will need to consider different periods of viral shedding, and a single intervention to mitigate human exposure may have the benefit of reducing spillover risk for multiple viruses.

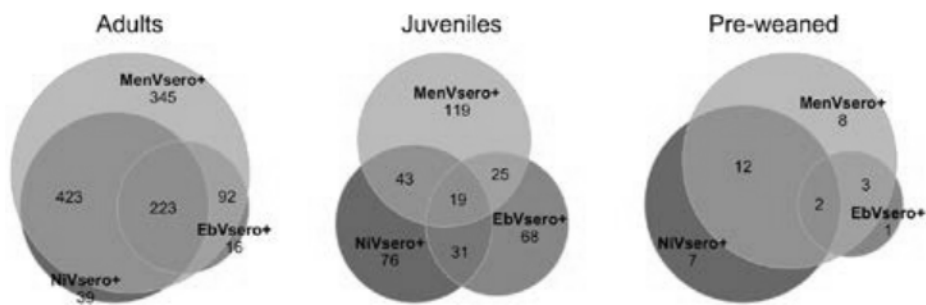


Analysis of serological data for three viruses to determine the timing and strength of viral circulation in juvenile bats from a longitudinal dataset from Bangladesh. Plots show periods of the year when the increase in seroprevalence is greatest (left), and the rate of change for each virus (right). Plots display the relative frequency from 1,000 generalized additive model runs.

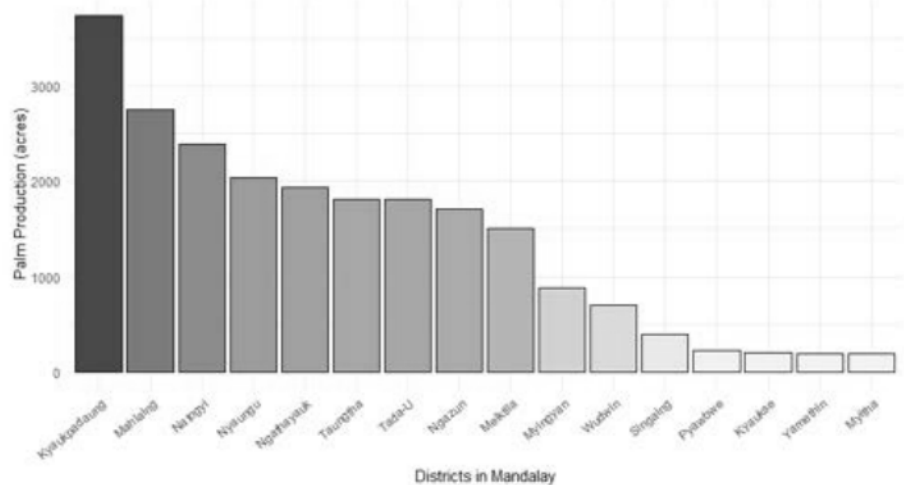
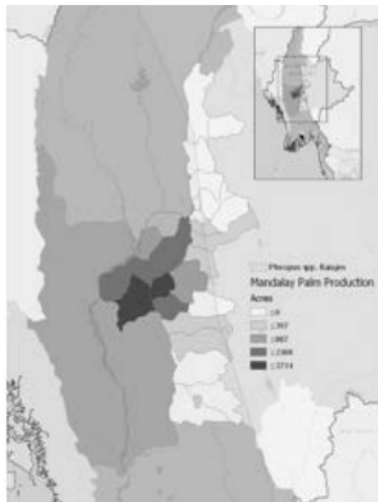
PREDICT is analyzing the specific risk of viral emergence across the wildlife market value chain. Using data from bushmeat market surveys in North Sulawesi, Indonesia, models are being developed to quantify the areas of greatest risk for bat- and rodent-borne zoonotic virus emergence. We identified markets that sell fresh and frozen bats, rats, wild pigs, and snakes. Daily observational data are being used to calculate the volume of wildlife sold monthly/annually and will feed in to IMPACT projects to assess the specific risk that these markets play in disease spillover and spread.



Map of the wildlife trade/value chain in North Sulawesi, Indonesia. Green markers indicate bushmeat markets surveyed by PREDICT, and red denotes markets where daily observational data were recently collected. Supermarkets where bushmeat is also available are marked in orange.



Patterns of seropositivity to multiple viruses in fruit bats from Bangladesh. Venn diagrams for adult, juvenile, and pre-weaned (dependent) *Pteropus medius* bats testing positive for antibodies against of Nipah virus, filovirus, and rubulavirus. Numbers under labels are counts of bats with only seroreactivity to those viruses, numbers in overlapping areas represent number of bats detected with multiple viruses or evidence of co-immunity.



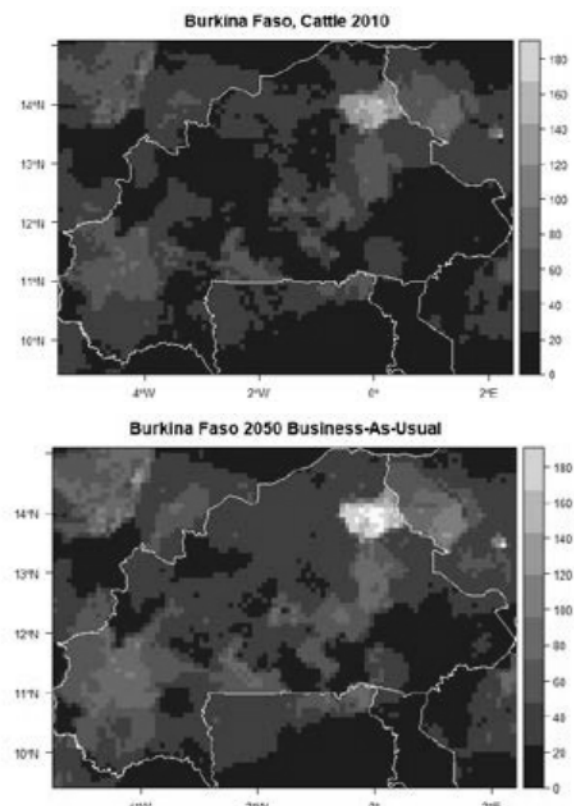
Date palm sap harvesting data from Myanmar by district in Mandalay being used to map the risk of bat-borne virus spillover risk.

## 2) Analyses to test proposed broad-based intervention strategies

The PREDICT M&A, Surveillance, and Behavioral Risk teams continue to develop analyses to assess potential evidence-based risk interventions and define the boundaries within which interventions might prove successful. Over the last six months, significant progress has been made on 15 **IMPACT** projects (**I**ntervention **M**odeling **P**rojects **A**cross **T**eams) focused on different risk factors or specific interfaces of disease emergence. Over the remaining six months of the project, the M&A team will continue to coordinate across PREDICT, USAID EPT, and our in-country teams in modeling, capacity-building, and scientific communication efforts. Outputs from all analyses will be developed as short, policy-relevant Emerging Disease Insight documents for distribution to key stakeholders and the public.

## 3) Working with EPT partners to produce maps, models and other products of value for their programs

PREDICT continued to collaborate with FAO on the Africa Sustainable Livestock 2050 (ASL2050) project to model the risk of disease in the face of expanding livestock production in Africa. We produced geospatial maps of cattle density under three future scenarios of agricultural development: 1) Stratified societies, 2) Business as usual, and 3) Toward sustainability. Countries included in these forecasts: Burkina Faso, Uganda, Kenya, Nigeria, Egypt, and Ethiopia.



Forecasted changes in cattle density for Burkina Faso from 2010 to 2050 under a business-as-usual scenario. Maps produced by PREDICT as part of the Africa Sustainable Livestock 2050 (ASL2050) project in collaboration with FAO.

PREDICT's M&A team supported the development and strategic design of the Global Virome Project (GVP). We designed a spatial modeling approach to identify priority sites for targeted wildlife sampling at a 10 x 10 km resolution in countries of relevance to the GVP. PREDICT developed specific maps for the Thai National Virome Project (TNVP) and the China Virome Project and presented these at the TNVP launch, as well as in high-level meetings with Chinese Government and US Embassy leaders in Beijing. These analyses will form the basis for the design of specific workplans in both countries during the rollout of their virome projects in 2019-20.



### Legend

% of Model Iterations Selecting Site

0%

25%

50%

75%

100%

Protected Areas

*Optimizing sites for the China Virome Project, part of the GVP. Darker shaded areas on the map (red and dark red) are sites that were consistently identified by the model as the optimal areas to discover the greatest number of viruses using the fewest resources. Protected areas in China shown in green.*

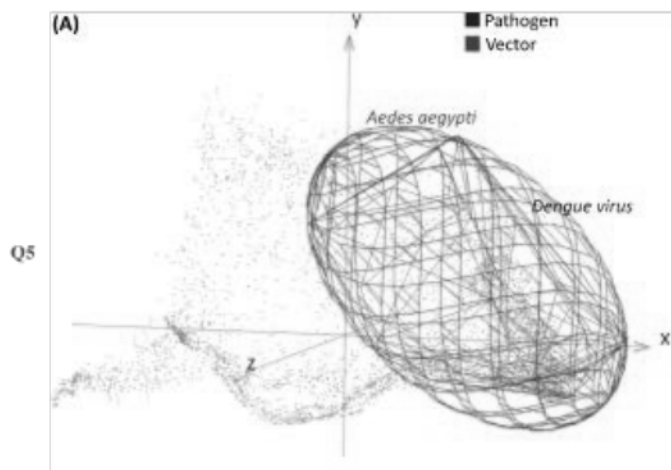
## 4) New analytical strategies and open-source tools to analyze risk of disease emergence

We continued developing new tools within the EIDITH R package to facilitate the cleaning and analysis of project data. These open-source tools allow country and global teams to download their country-level PREDICT-2 data, clean datasets by automatically identifying outliers and fields with missing or incorrect data, and analyze patterns in the data using the statistical analysis program, R. Site characteristics, behavioral risk, animal, or testing data can then be manipulated in R to explore and visualize data from the project in near real-time, as it's entered into the database.

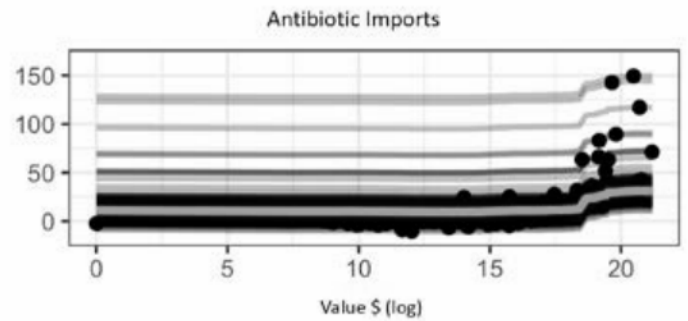
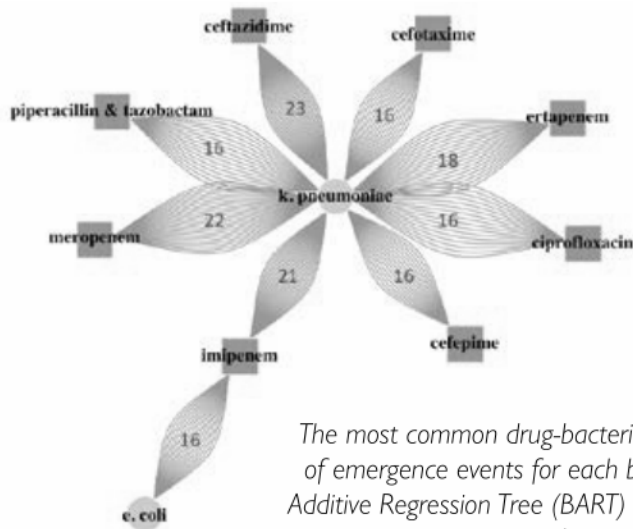
*PREDICT developed a new theoretical model of disease distribution using ecological niche models. Examples above shows how dengue virus (blue polyhedron) distribution coincides with that of its vector, the mosquito *Aedes aegypti* (red ellipsoid).*

*In Press, Trends in Ecology and Evolution.*

PREDICT developed a new theoretical framework for modeling the geography of disease transmission using biological properties of both hosts and parasites to produce reliable outputs of disease distributions. These analyses can be used to better map and help guide the surveillance and discovery of pathogens across the landscape.



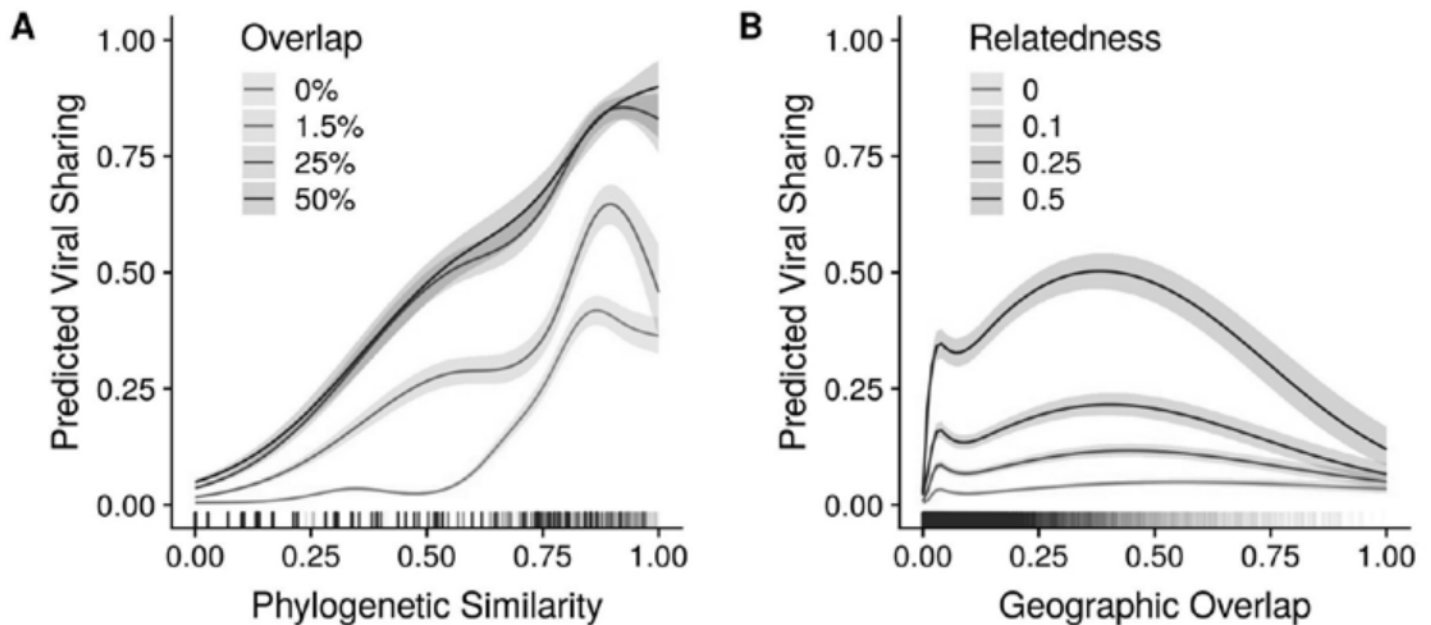
PREDICT completed the most comprehensive database to date to analyze the drivers of antimicrobial resistance (AMR) disease emergence in people. This effort involved data extraction and data cleaning from over 24,000 scientific papers published from 2006-2017. PREDICT is currently using this database to develop an AMR "hotspots" map to show areas around the world where future AMR emergence is most likely. Preliminary analysis using Bayesian Additive Regression Tree (BART) models are underway to identify potential risk factors that explain the number of AMR events within a country. Variables include: research bias, percentage of agricultural land cover, livestock index, GDP, and % of GDP spent on healthcare, population, antibiotic imports, and antibiotic exports.



The most common drug-bacteria combinations in PREDICT's AMR database are displayed, the number of emergence events for each bacteria-drug combination are shown in red (left). Example of Bayesian Additive Regression Tree (BART) model output showing an increase in the per-country risk of a new AMR emergence event with increasing levels of antimicrobial drug imports for a given country (right).

Building off previously published PREDICT analyses to identify host and viral traits that predict zoonotic potential, we developed new models to explain viral sharing between all mammal species. Specifically, phylogenetic similarity and geographic overlap were used to predict a viral sharing network across all known mammals (~5000 species). These analyses found that more

closely related species and those that overlap the most in space, are much more likely to share viruses. The relationship of these factors was non-linear, and the two variables interact so that phylogenetic similarity has a stronger effect on species that overlap more, and conversely overlap matters more when species are more closely related.



New PREDICT model to examine factors that determine viral sharing among all known mammal species. These plots show the interacting, non-linear effect of host species relatedness (left) and geographic overlap (right).

## For more information

Emerging Disease Insights are available online: [livescience.ecohealthalliance.org](https://livescience.ecohealthalliance.org)

# ONE HEALTH PARTNERSHIPS

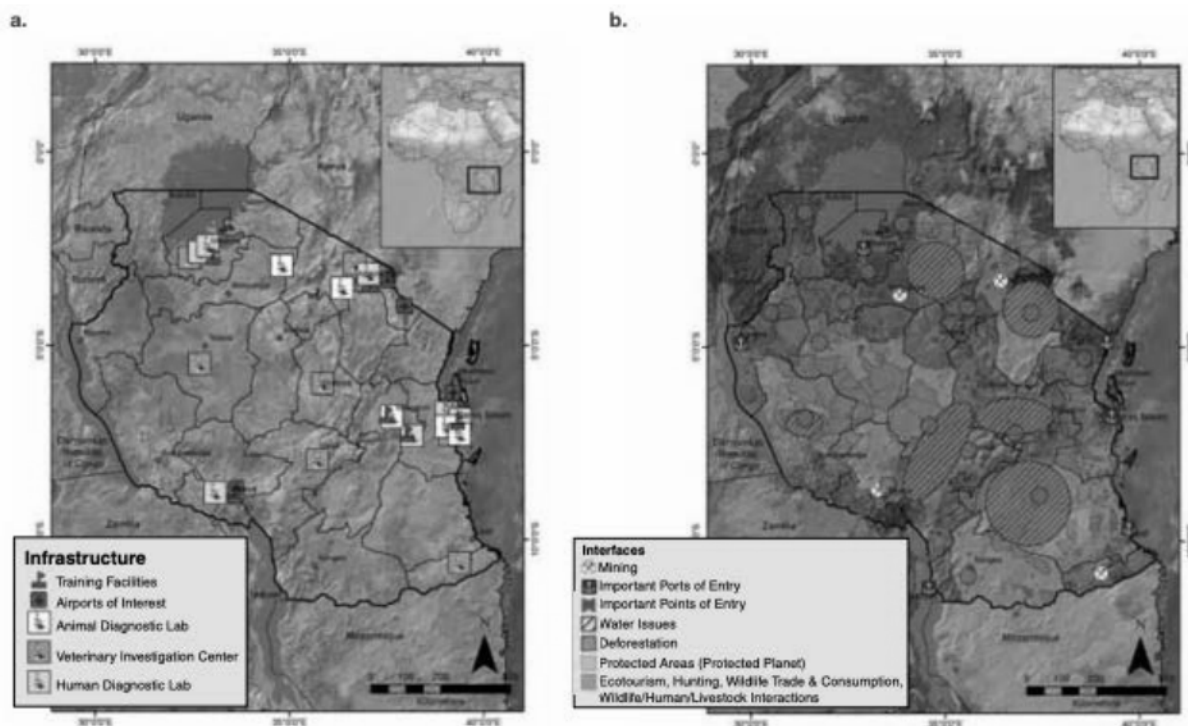
## One Health policy advocacy

To set the path for success under the second phase of the Global Health Security Agenda (GHSA), PREDICT-2 had a direct role in shaping the GHSA Roadmap 2024, which sets out annual implementation and outcome objectives, enhancing attention to multisectoral coordination and inclusion of the environment sector. As part of our engagement, PREDICT led the delegation representing non-governmental stakeholders (the Global Health Security Agenda Consortium) at the GHSA Steering Group meeting at the Hague in February 2019. PREDICT has also been appointed as a focal point for the PREVENT 2 – Zoonotic Disease Action Package working group under the Steering Committee and helped to develop the work plan for the GHSA Advocacy and Communications Task Force that will oversee compilation of information toward awareness of the GHSA 2024 outcomes, action plan, and implementation and will show the value of continued prioritization of health security.

Following publication of the World Bank's Operational Framework for Strengthening Human, Animal and Environmental Public

Health Systems at their Interface ("One Health Operational Framework") in 2018, to which PREDICT contributed significant technical expertise, we had a key role in circulation of the Framework's key messages and practical guidance to donors, intergovernmental agencies, and countries through a wide variety of fora, providing opportunities to reach additional stakeholders.

Examples include the United Nations Rio Conventions Pavilion event "Harnessing biodiversity for a healthy and resilient future" convened by the UN Convention on Biological Diversity (CBD) and World Health Organization (WHO) at the CBD 14th Conference of the Parties (COP), the 2nd Wildlife Forum on "Sustainable Use for Conservation and Livelihoods" hosted by the Collaborative Partnership on Wildlife Management, "One Health in the 21st Century" hosted at the Woodrow Wilson Center, a high-level roundtable on "Leveraging global polio eradication assets to support global health security and sustainable universal health coverage" convened by Chatham House with Rotary International, InterAction Council, other partners (non-PREDICT), and the Gates Global Grand Challenges meeting.



Inter-sectoral drivers and capabilities mapping approach (illustrative example; produced by USAID Emerging Pandemic Threats PREDICT in 2012-14). (a) Distribution of human and animal diagnostic resources. (b) Relative risk of an emerging infectious disease from wildlife, based on mammalian diversity and human population density, from bright green (lowest risk) to red (highest risk). Risk interfaces are marked. Airports or border crossings in both indicate possible pathways for international spread of diseases. Source: World Bank One Health Operational Framework for Strengthening Human, Animal, and Environmental Public Health Systems at their Interface 2018.



PREDICT continued collaboration with a range of entities to improve animal and environmental dimensions of health security. Through the International Panel of Experts for the Global Health Security Index under development by the Nuclear Threat Initiative, the Economist Intelligence Unit, and the Johns Hopkins School of Public Health we helped to integrate One Health-relevant indicators on prevention and detection of epidemic and pandemic threats, including zoonoses and antimicrobial resistance. We also participated in the OIE ad hoc group on MERS-CoV, presenting PREDICT findings in the review of criteria for OIE disease listing.

At country level, PREDICT conducted training in Liberia on One Health policy and evaluation, leading to a draft intervention ultimately presented at the plenary at the UN CBD COP14. This intervention helped inform the decision on Health and Biodiversity accepted by Parties, which includes a recommendation for governments and other stakeholders to “review, adjust and improve biodiversity-health linkages in the environmental assessment of relevant projects”.

### **Other highlights & success stories**

PREDICT collaborated on the forthcoming WHO Guide for Multisectoral Partnership Coordination for Preparedness, IHR (2005), and Health Security, providing examples from PREDICT and moderating a panel on “Public Health Institutions and Non-State Actors’ Engagement for IHR (2005) and health security” at an expert roundtable convened by WHO to collect examples of country-level coordination. This document complements the FAO/OIE/WHO Tripartite Zoonoses Guide on “Taking One Health Approaches to Address Zoonotic Diseases in Countries” published in March 2019, which features approaches shared by PREDICT and refers to several policy and evaluation guidance resources produced by PREDICT.

PREDICT continued to engage technical institutions to promote simplified procedures to promote timely movement of emergency diagnostic specimens, including to address regulations that inadvertently delay investigation of wildlife disease emergencies. Recommendations from the working group convened by countries under the Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES), which PREDICT served on, will advance for final vote at the Conference of the Parties in May 2019. Our team also participated in the development of OIE Guidance on Transport of Biological Specimens.

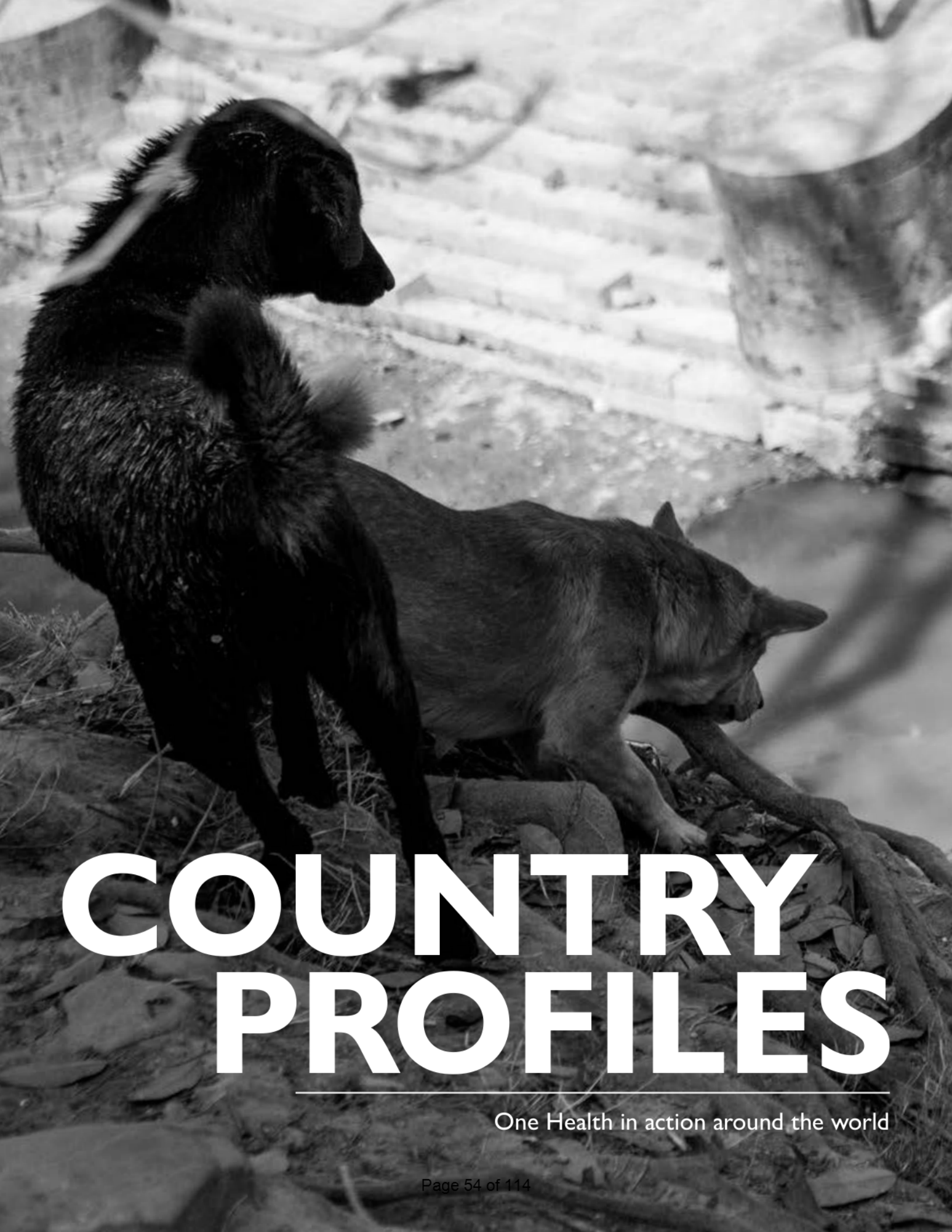
### **New publications, products and policy briefs**

Key outputs highlighted practical pathways and benefits of multi-sectoral approaches to global health security and included:

- “Institutionalizing One Health: from Assessment to Action” in Health Security, which PREDICT led in collaboration with partners from the World Bank, WHO, CDC, FAO, OIE, Toward a Safer World Network, and the EPT OHW and P&R projects to show opportunities for alignment of assessment and planning tools.
- “Infectious disease and economics: The case for considering multi-sectoral impacts” in One Health, on the economic imperative for a wide range of private sector stakeholders to mitigate risks and impacts of emerging infectious diseases.

### **Selected presentations on PREDICT, One Health, zoonotic diseases and global health security**

- Chaired the OIE Working Group on Wildlife Meeting, highlighting new and emerging wildlife disease events and reinforcing the importance of country reporting for wildlife diseases to OIE delegates.
- Presented to a subcommittee of the National Science and Technology Council on the outcomes of a Pandemic Prediction and Forecasting Science and Technology working group workshop on behavioral risk modeling for pandemics.
- Presented on “Digital Disease Detection for Health Security” at the 2018 American Public Health Association meeting, showing tools from PREDICT and its partners that can be used by public health agencies to help monitor and detect disease threats.
- Presented on risk reduction strategies for emerging infectious disease risks linked to ecosystem degradation on a webinar on migration hosted by the World Federation of Public Health Associations working group on health in emergencies and disasters.
- Highlighted PREDICT’s work at an expert Symposium on Biosecurity and Transnational Environmental Crime hosted by the Canadian Institute for Advanced Research. Attendees were representatives of law enforcement and intergovernmental agencies.



# COUNTRY PROFILES

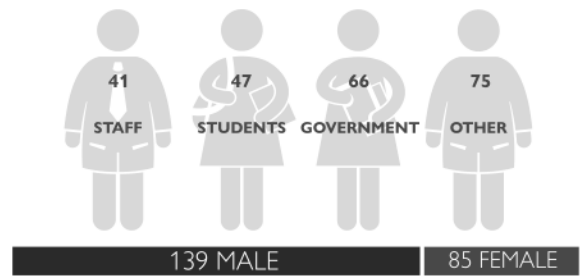
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One Health in action around the world

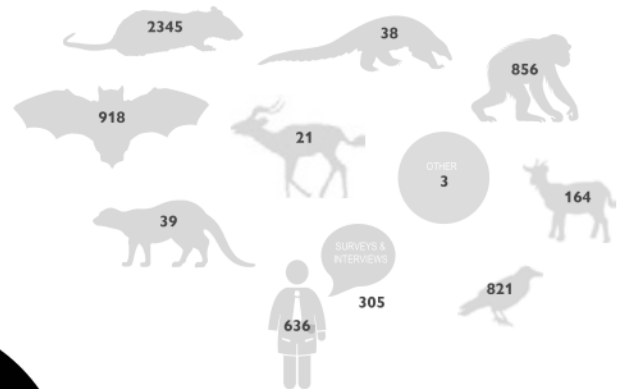




## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

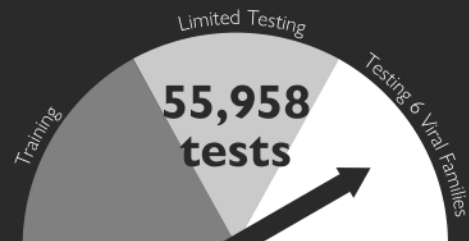


## IMPACT

**224 trained** in One Health skills  
**4,856 individuals sampled** (animals & humans)  
**941 individuals interviewed**  
**35 unique viruses detected**

## LAB STRENGTHENING

· Military Health Research Center



## VIRAL FINDINGS

P1

**217** new viruses  
**20** known viruses

P2

**11** new viruses  
**8** PREDICT-1 viruses  
**18** known viruses



Global Health Security Agenda

# CAMEROON

..... **MOHAMED MOCTAR MOUICHE  
MOULIOM, DVM, MPH**

Country Coordinator, PREDICT/Cameroon

**PARTNERS**

- Metabiota, Inc.
- Global Viral
- Mosaic
- Military Health Research Center (CRESAR)

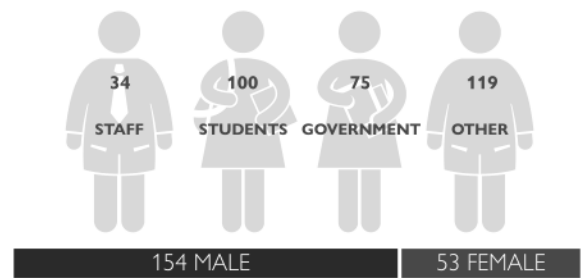


***“PREDICT has effectively contributed to Cameroon’s increased capacities for zoonotic disease surveillance and the detection of priority zoonotic diseases and unknown threats. The opportunity to work with specialists from various professional backgrounds and to share their experience has helped me to build my own capacity more efficiently than ever before in the One Health approach and project management. ”***

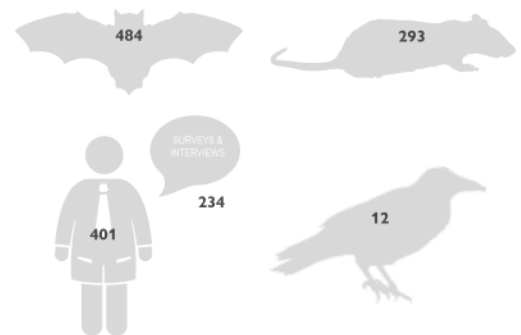




## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

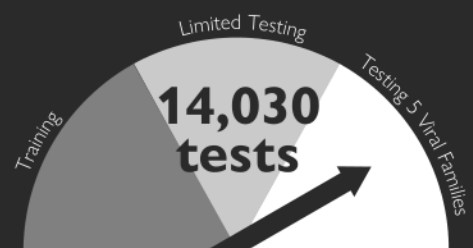


### IMPACT

**207 trained** in One Health skills  
**1,190 individuals sampled**  
**635 individuals interviewed**

## LAB STRENGTHENING

- Institut Pasteur du Cote d'Ivoire
- Laboratoire National d'Appui au Développement Agricole



Global Health Security Agenda

# CÔTE D'IVOIRE



..... **EUGENE KOFFI KOUASSI, DVM, MSc**

PREDICT/Côte d'Ivoire, Research Associate

*Institut Pasteur Côte d'Ivoire*

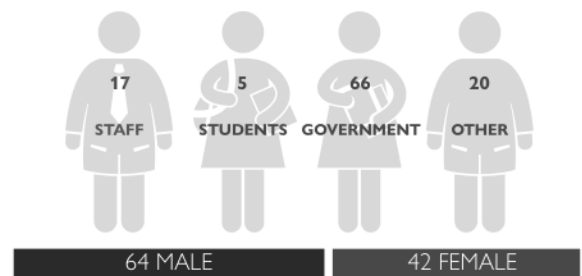
**PARTNERS**

- EcoHealth Alliance
- Institut Pasteur de Côte d'Ivoire
- Laboratoire National d'Appui au Développement Agricole

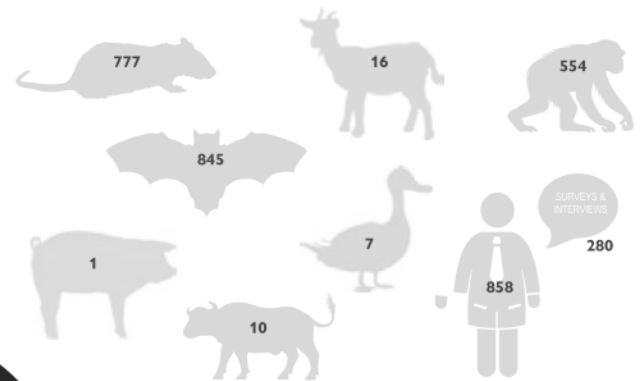


***“I have acquired the capacity to develop collaborations with several ministerial sectors: water and forest, animal and human health, administrative authorities, and village authorities in the surveillance of emerging diseases”***

## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

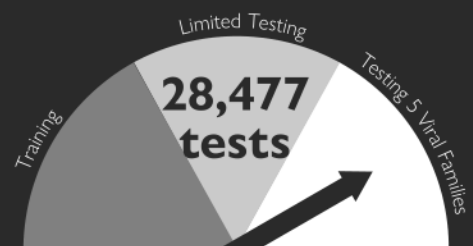


## IMPACT

**106 trained** in One Health skills  
**3,068 individuals sampled**  
**1,138 individuals interviewed**  
**8 unique viruses detected**

## LAB STRENGTHENING

· Institut National de Recherche Biomédicale



## VIRAL FINDINGS

**P1**

**49 new viruses**  
**22 known viruses**

**P2**

**1 PREDICT-1 viruses**  
**7 known viruses**

# DEMOCRATIC REPUBLIC OF THE CONGO



Global Health Security Agenda

## ..... **PLACIDE MBALA, MPH, PhD**

PREDICT/DRC, Former Laboratory Manager, INRB  
Current Director of Viral Hemorrhagic Fevers  
Diagnostics Units, INRB

*Institut National de Recherche Biomedicale*

### PARTNERS

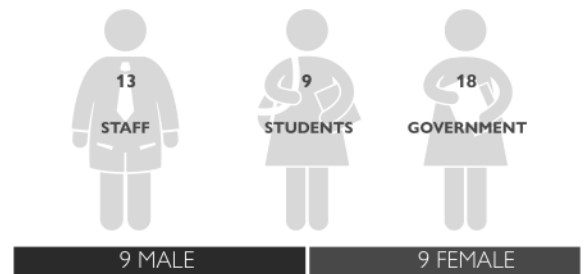
- Metabiota, Inc.
- Institut National de Recherche Biomédicale
- Kinshasha School of Public Health
- Mountain Gorilla Veterinary Project
- University of California, Davis



**Dr. Mbala now directs the Viral Hemorrhagic Fevers Diagnosis Unit at INRB, and is a key player in the training of physicians, biologists, and laboratory technicians, as well as in the establishment of field laboratories integral to Ebola outbreak response in his country. PREDICT provided Dr. Mbala the opportunity to gain and refine his skills in laboratory management, molecular biology techniques, and field investigations, and through his tireless work and ongoing contributions, Dr. Mbala and those he mentors, improve the capacity of DRC to respond to outbreaks with a One Health approach, and bring a greater understanding of zoonotic diseases in this high-risk area of the world.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

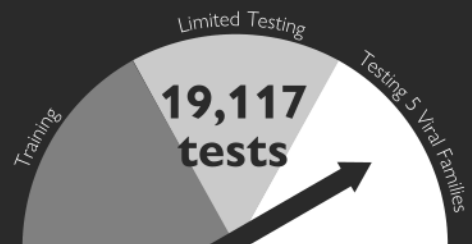


### IMPACT

**18 trained** in One Health skills  
**2,100 individuals sampled**  
**1,097 individuals interviewed**  
**9 unique viruses detected**

## LAB STRENGTHENING

· Center of Scientific Excellence for Influenza Viruses



## VIRAL FINDINGS

**P2**

**6 PREDICT-1 viruses**

**3 known viruses**

# EGYPT

## PREDICT/EGYPT TEAM

PREDICT-2 Interdisciplinary Teamwork

*Egypt National Research Centre's Center of Scientific  
Excellence for Influenza Viruses*

## PARTNERS

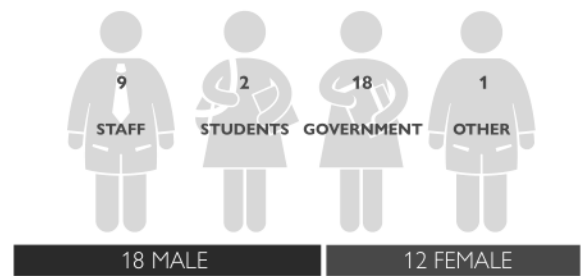
- EcoHealth Alliance
- Egypt National Research Centre



**The Egypt team demonstrated how interdisciplinary backgrounds can work together toward a common goal: promoting One Health activities to better understand and respond to viral zoonotic threats in Egypt.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

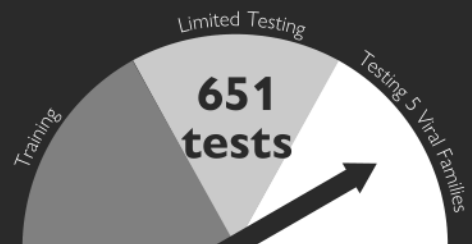


### IMPACT

**30 trained** in One Health skills  
**1,355 individuals sampled**  
**313 individuals interviewed**

## LAB STRENGTHENING

· Addis Ababa University Aklilu Lemma Institute of Pathobiology



# ETHIOPIA



Global Health Security Agenda



## ..... **DESALEGN BELAY TAKELE**

PREDICT/Ethiopia, Associate Researcher

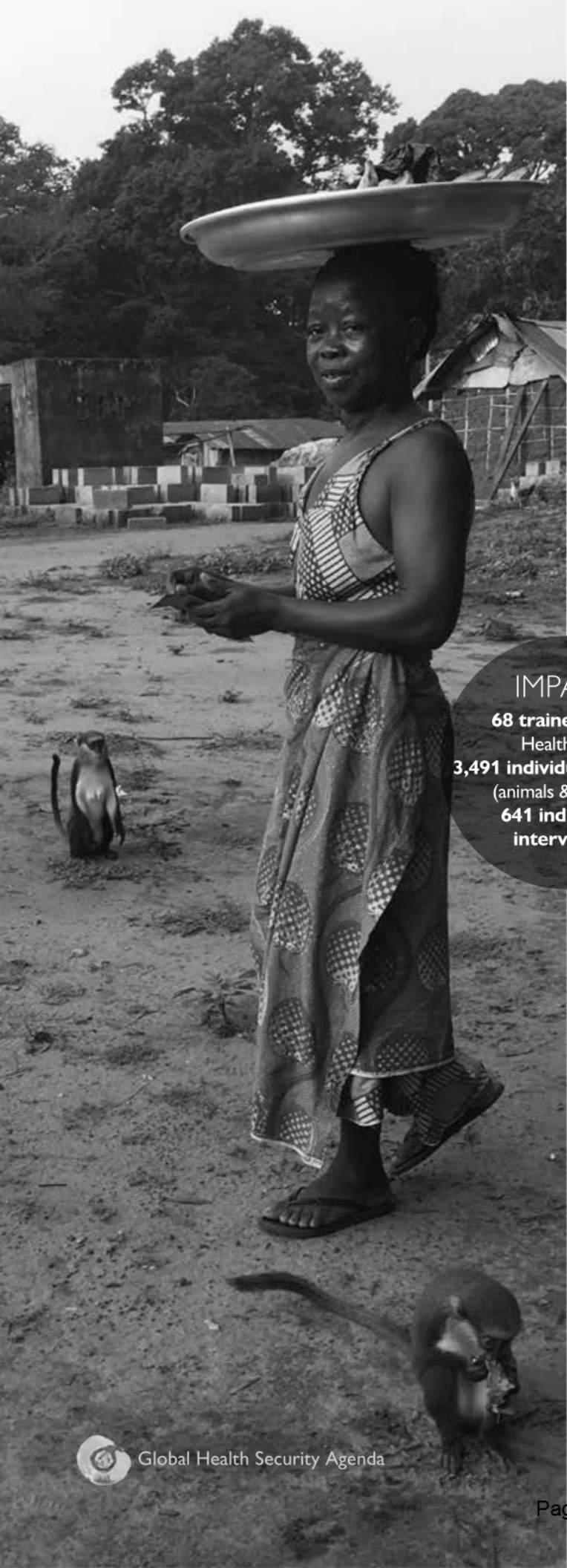
*National Influenza Laboratory, Ethiopian Public  
Health Institute*

### PARTNERS

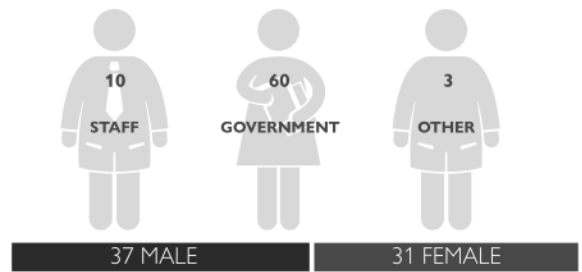
- University of California, Davis
- Addis Ababa University
- Aklilu Lemma Institute of Pathobiology
- Ethiopian Public Health Institute



***“It is a special experience to work on different viral families, with other colleagues from different disciplines, and inter-national collaboration—UC Davis is a practical power of house of One Health.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

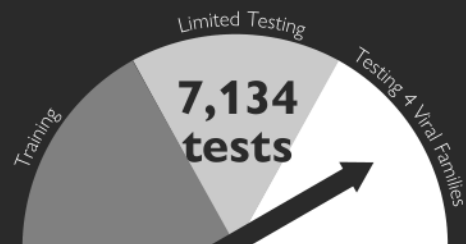


### IMPACT

**68 trained** in One Health skills  
**3,491 individuals sampled** (animals & humans)  
**641 individuals interviewed**

## LAB STRENGTHENING

- Accra Veterinary Laboratory
- Noguchi Memorial Institute for Medical Research



**RICHARD SUU-IRE, DVM, PhD**

PREDICT/Ghana, Wildlife Disease Surveillance Lead

*Wildlife Division of the Forestry Commission,  
Ministry of Land and Natural Resources*

**PARTNERS**

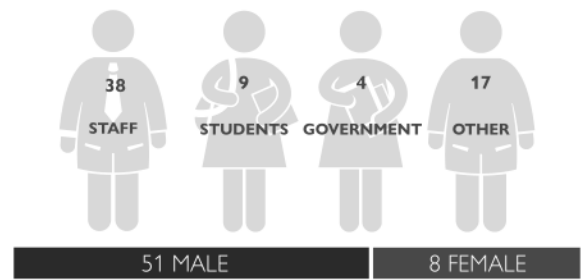
- University of California, Davis
- Wildlife Division of the Forestry Commission, Ministry of Land & Natural Resources
- Veterinary Services Directorate, Ministry of Food & Agriculture
- Noguchi Memorial Institute for Medical Research, University of Ghana
- Ghana Health Services
- Military Hospital of the Ghana Armed Forces



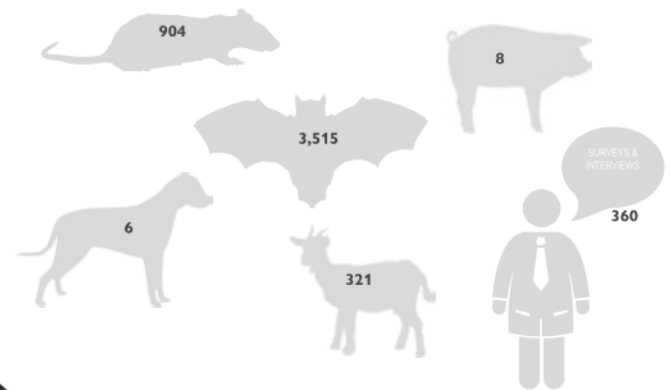
***“I look back at my life back to the village where I had to herd cattle and make time for schooling in the face of serious want and feel that I must share the little I have with those who do not have at all.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

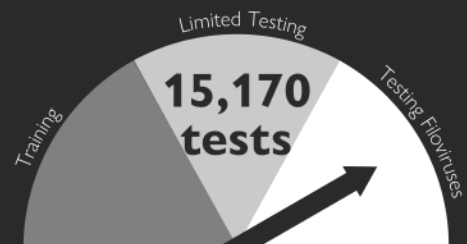


### IMPACT

**59 trained** in One Health skills  
**4,754 individuals sampled** (animals & humans)  
**213 individuals interviewed**

## LAB STRENGTHENING

- Laboratoire de Fievres Hemorrhagiques
- UC Davis One Health Institute\*



\*As part of the Ebola Host Project, samples are being tested at UC Davis to accelerate release of viral findings for use for decision-making and risk-mitigation efforts.



Global Health Security Agenda

# GUINEA

## POKPA SAKOUVOGUI

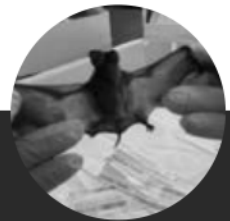
PREDICT/Guinea, Student & Community Liaison

## PARTNERS

- University of California, Davis
- Guinea Viral Hemorrhagic Fever Laboratory

## SAYON YOMBOUNO

PREDICT/Guinea, Veterinarian



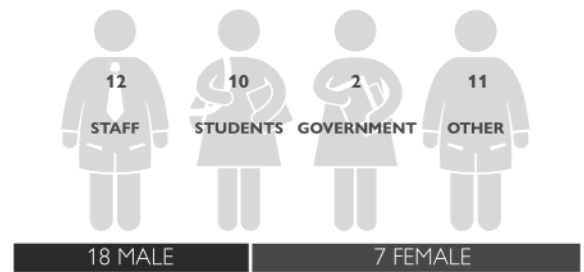
*“Experiences that I acquired with PREDICT helped me become more professional in my work in general. Also, taking part of research projects that aims to improve the health situation in my country made me proud. This is why I plan to go back to university once the project ends. PREDICT inspired me to become an epidemiologist!”*



*“This year, when you came to visit my class, you had a book full of pictures with bats and you gave us advice on how to interact with them. I realized that it was not good to play or even touch bats. Since then, I tried to explain to my parents that bats are important for the environment but they could carry dangerous diseases.”*



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

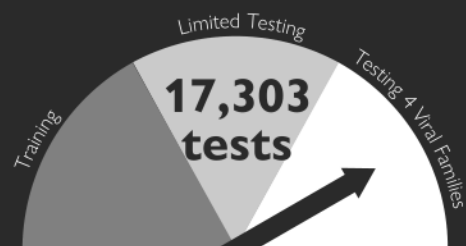


### IMPACT

**25 trained** in One Health skills  
**2,164 individuals sampled**  
**1,085 individuals interviewed**

## LAB STRENGTHENING

Jordan University of Science and Technology



## VIRAL FINDINGS

P2

- 1 new virus
- 1 PREDICT-1 viruses
- 5 known viruses



Global Health Security Agenda



## MUSTAFA ABABNEH

PREDICT/Jordan, Technical Laboratory Lead

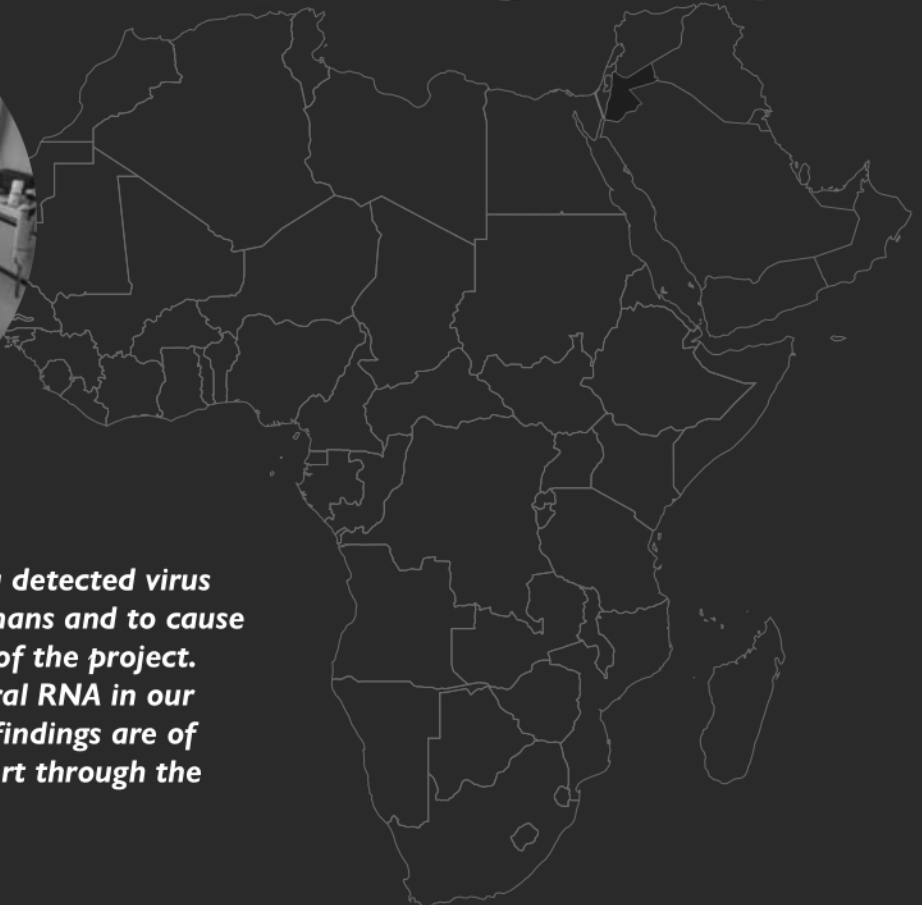
*Jordan University of Science & Technology*

## PARTNERS

- EcoHealth Alliance
- Jordan University of Science and Technology

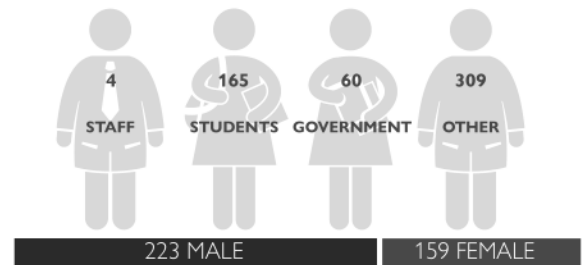


***“We are discovering whether a detected virus has the potential to infect humans and to cause illness, which is a central part of the project. We may find a multitude of viral RNA in our samples, so prioritizing which findings are of greater importance helps us sort through the data.”***

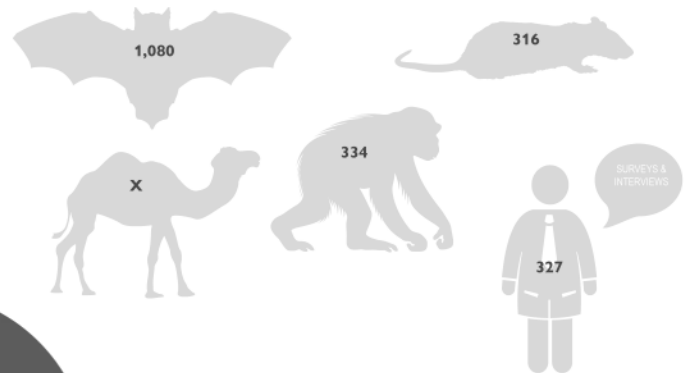




## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

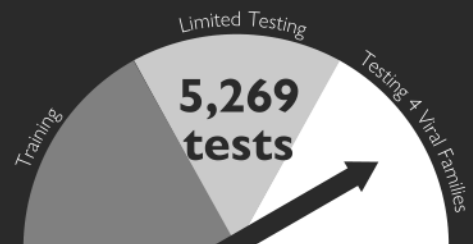


### IMPACT

**382 trained** in One Health skills  
**1,861 individuals sampled**  
**327 individuals interviewed**

## LAB STRENGTHENING

- Kenya Medical Research Institute
- Institute of Primate Research



## VIRAL FINDINGS

**P2**

- 1 new virus**
- 1 known viruses**



Global Health Security Agenda

# KENYA

## AMOS RIMFA

PREDICT/Kenya, MS Candidate

*Institute of Primate Research*

*University of Nairobi*

## PARTNERS

- Smithsonian Institution
- Institute of Primate Research
- Kenya Medical Research Institute

## PERIS AUMA AMBALA

PREDICT/Kenya, PhD Candidate

*Institute of Primate Research*

*Kenyatta University*



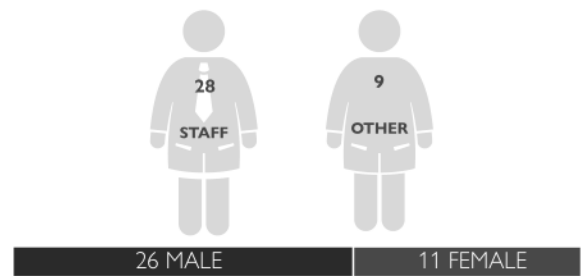
***“[Female scientists] are not put on the map [in Kenya], so there are very few of us...Female scientists should be encouraged, motivated, and mentored.”***



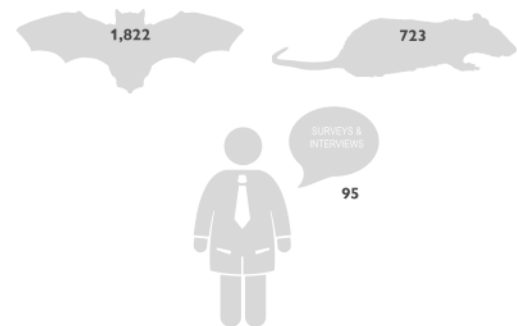
***“The work [that PREDICT does] is very proactive in terms of disease management, not only on control but also on prevention. PREDICT actually is trying to prevent before an occurrence happens...We may not understand now, until a recent outbreak, then we will know the value of what PREDICT has done.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

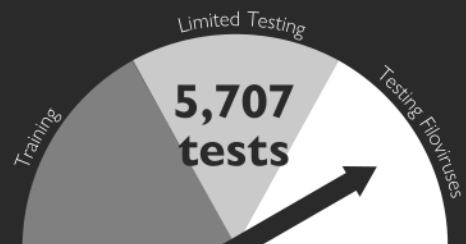


### IMPACT

**37 trained** in One Health skills  
**5,386 individuals sampled**  
**95 individuals interviewed**  
**27 unique viruses detected**

## LAB STRENGTHENING

- National Public Health Institute of Liberia
- Columbia University Center for Infection & Immunity



## VIRAL FINDINGS

**P2**  
*Zaire ebolavirus*

\*As part of the Ebola Host Project, samples are being tested at Columbia University to accelerate release of viral findings for use for decision-making and risk-mitigation efforts.

# LIBERIA

## JACKSON PULTOLNOR

PREDICT/Liberia, Team Lead

*Society for the Conservation of Nature, Liberia*

### PARTNERS

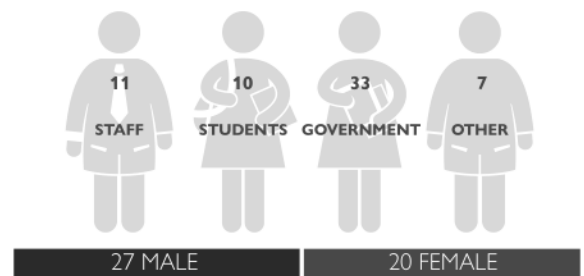
- EcoHealth Alliance
- National Public Health Institute of Liberia



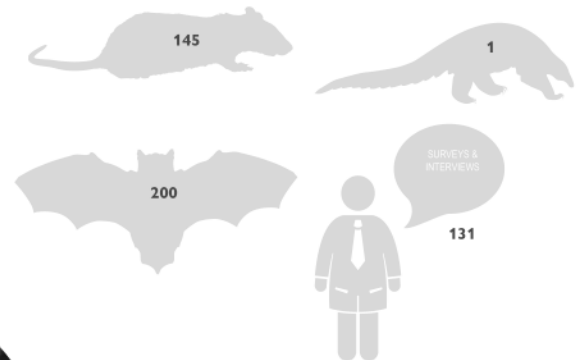
**With Jackson's experience on the PREDICT project, he hopes to continue working in the conservation and One Health fields and combine that with his previous interest in sustainable farming and forestry. Jackson is poised to become one of the future Liberian leaders in these fields.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE



## IMPACT

**47 trained** in One Health skills  
**346 individuals sampled** (animals & humans)  
**131 individuals interviewed**  
**2 unique viruses detected**



## VIRAL FINDINGS

**P1**

**55 new viruses**  
**13 known viruses**

**P2**

**1 PREDICT-1 viruses**  
**1 known viruses**

# REPUBLIC OF CONGO



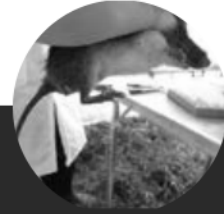
## CYNTHIA GOMA-NKOUA

PREDICT/RoC, Country Coordinator

*National Public Health Laboratory*

### PARTNERS

- EcoHealth Alliance
- Laboratoire National de Sante Publique (LNSP)



***“I am currently the head of the Molecular Epidemiology Service laboratory of the National Public Health Laboratory (LNSP) in Brazzaville. My passion for infectious diseases began in 1995 when she saw the movie “Outbreak!” about the spread of Ebola.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

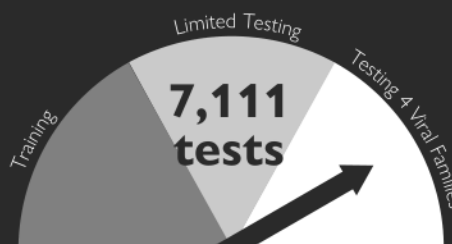


### IMPACT

**20 trained** in One Health skills  
**1,544 individuals sampled** (animals & humans)  
**11 unique viruses detected**

## LAB STRENGTHENING

- Rwanda Agricultural Board Wildlife Virology Laboratory
- National Reference Lab/Rwanda Biomedical Center



## VIRAL FINDINGS

**P1**

**16 new viruses**  
**11 known viruses**

**P2**

**2 new viruses**  
**2 PREDICT-1 viruses**  
**7 known viruses**

# RWANDA



Global Health Security Agenda

## ADRIEN EMILE NTWALI

PREDICT/Rwanda, Field Veterinarian

*Gorilla Doctors*

### PARTNERS

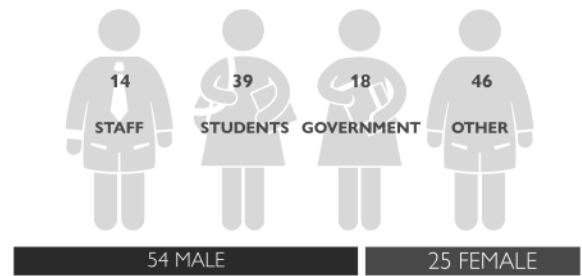
- Mountain Gorilla Veterinary Project/Gorilla Doctors
- University of California, Davis
- Rwanda Agriculture Board
- Rwanda Biomedical Center/  
National Reference Laboratory



***“Gorilla Doctors (PREDICT implementing partner) are always ready to save the lives of gorillas anytime, no matter how the weather is looking, no matter what time of the day or week, no matter how far the gorillas are in the forest, no matter what circumstances.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

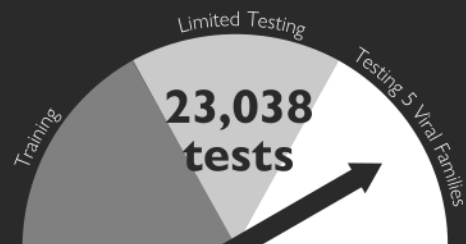


### IMPACT

**79 trained** in One Health skills  
**1,671 individuals sampled** (animals & humans)  
**795 individuals interviewed**

## LAB STRENGTHENING

- L'Institut Senegalais de Recherches Agricoles
- Cheikh Anta Diop University



Global Health Security Agenda

# SENEGAL

..... **AMINATA BA**

PREDICT/Senegal, Laboratory Technician

*National Veterinary Laboratory*

**PARTNERS**

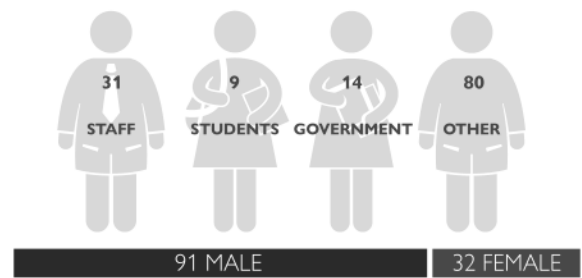
- University of California, Davis
- Inter State School of Veterinary Science & Medicine of Dakar
- Cheikh Anta Diop University/ Dantec University Hospital
- Senegalese Institute of Agricultural Research/National Livestock & Veterinary Research Laboratory



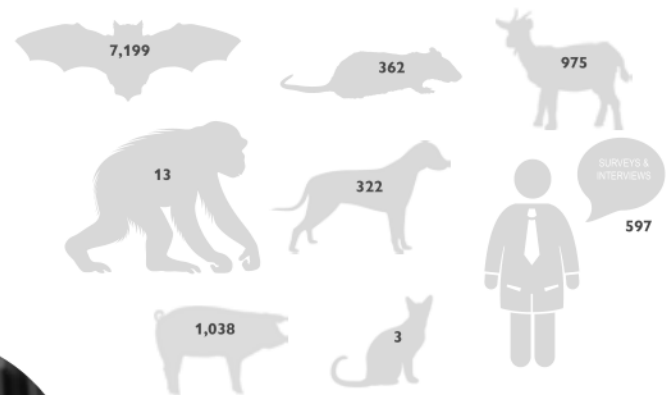
***“For me, the USAID/PREDICT project is a great experience, fitting perfectly into the One Health concept. This project has allowed me to broaden my skills in molecular diagnostics of highly pathogenic and critically important viral families.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

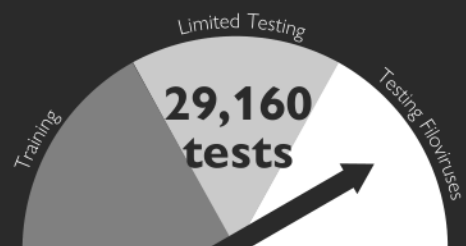


### IMPACT

**123 trained** in One Health skills  
**10,509 individuals interviewed**  
**2 unique viruses detected**

## LAB STRENGTHENING

- University of Makeni
- UC Davis One Health Institute



## VIRAL FINDINGS

**P2**

- 1 new virus** (*Bombali ebolavirus*)
- 1 known virus** (*Marburg virus*)

\*As part of the Ebola Host Project, samples are being tested at UC Davis to accelerate release of viral findings for use for decision-making and risk-mitigation efforts.



## EDWIN LAVALIE

PREDICT/Sierra Leone, Field Ecologist

*University of Makeni*

## PARTNERS

- University of California, Davis
- University of Makeni

## ABDULAI BANGURA

PREDICT/Sierra Leone, Field Ecologist

*University of Makeni*

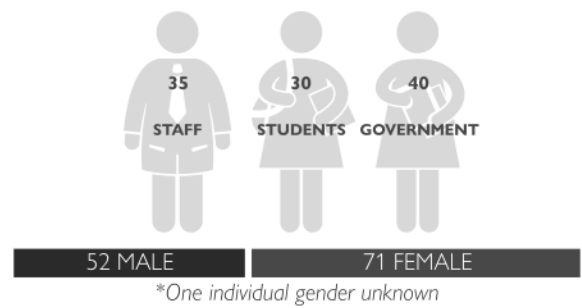


*"I am most proud of being able work in a community that do not have knowledge of my job, using my skills for community to trust our ideas and allow us to capture animals, safely process them. Most importantly, I am most proud of working as a Sierra Leonean scientist that discovered the BOMBALI Ebola virus and the Marburg virus."*



*"I personally enjoy making trips to remote villages, forests and caves to trap and sample animals. It gives me the opportunity to interact with nature and see the rich biodiversity of our land, which is always hard to resist even when taken into consideration how risky our work is. It gives that pride, confidence and respect about the work we do for each sampling trip as a team. In addition, I am really proud of the work we do sensitizing people on how to safely live with animals, stimulating huge behavioral change in the lives of locals"*

## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

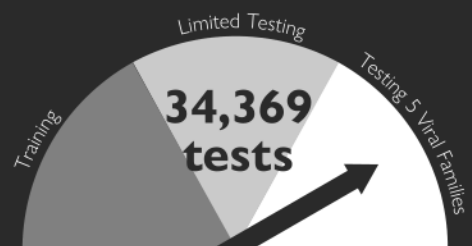


### IMPACT

**124 trained** in One Health skills\*  
**4,039 individuals sampled** (animals & humans)  
**1,574 individuals interviewed**

## LAB STRENGTHENING

- Ifakara Health Institute
- Sokoine University of Agriculture



## VIRAL FINDINGS

P1	P2
15 new viruses	6 new viruses
12 known viruses	4 known viruses



..... **HAPPY RAPHAEL MKALI**

PREDICT/Tanzania, Laboratory Lead

*Ifakara Health Institute*

**PARTNERS**

- University of California, Davis
- Sokoine University of Agriculture
- Ifakara Health Institute

..... **WALTER SIMON MAGESA**

PREDICT/Tanzania, Laboratory Scientist

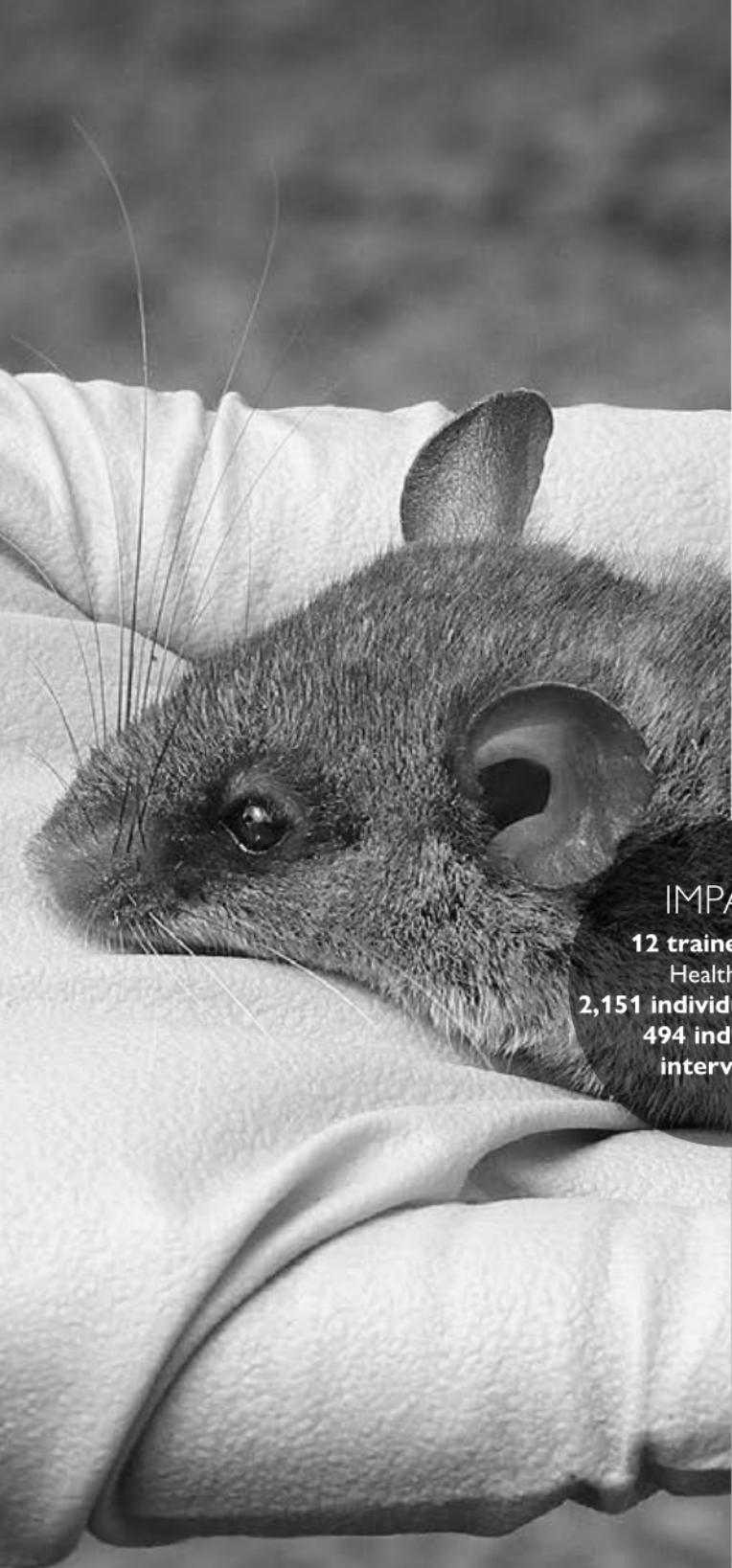
*Sokoine University of Agriculture*



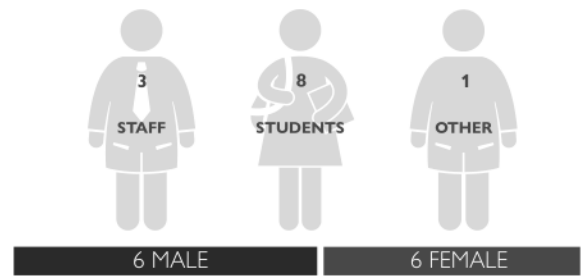
***“The capacity building of local experts on surveillance and detection of known and unknown pathogens of pandemic potential and the One Health Approach makes me really enjoy working with PREDICT, interacting with people from different disciplines (including; veterinary, public health and social science professionals), who all work together and share experiences on solving community health issues.”***



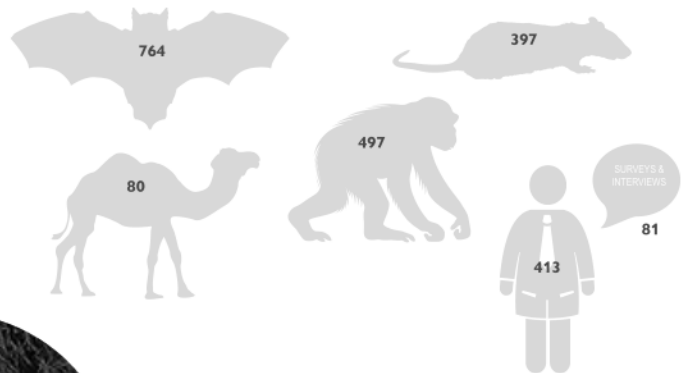
***“What I really enjoy about working with PREDICT is the beauty of interacting with teams of different disciplines -from veterinarians to social scientists to the public health professionals, who all together have brought different experiences on how to approach zoonoses and other One Health issues around our communities.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

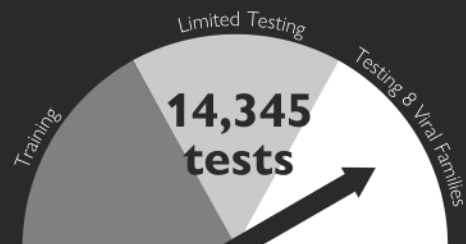


### IMPACT

**12 trained** in One Health skills  
**2,151 individuals sampled**  
**494 individuals interviewed**

## LAB STRENGTHENING

- Uganda Viral Research Institute
- Makerere Uganda Walter Reed Project



## VIRAL FINDINGS

**P1**  
**39 new viruses**  
**17 known viruses**

**P2**



Global Health Security Agenda

# UGANDA

..... **RICKY OKELLO OKWIR**

PREDICT/Uganda, Field Veterinarian

*Gorilla Doctors*

**PARTNERS**

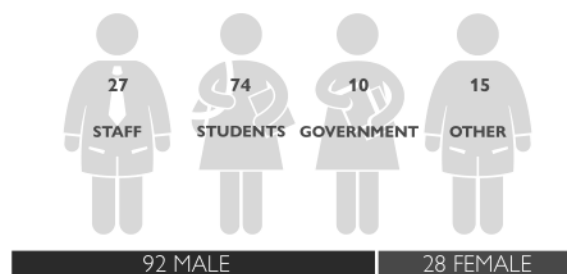
- Mountain Gorilla Veterinary Project
- University of California, Davis
- Uganda Viral Research Institute



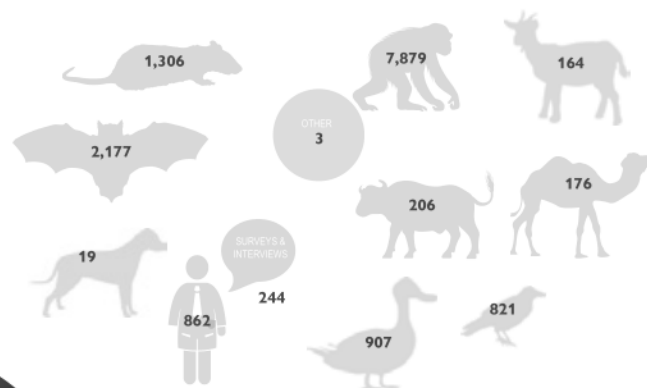
***“I was compelled to enter the veterinary profession at an early age of just 10 years after suffering a traumatic incident in our remote village. I watched a mother squirrel and her baby speared by a group of hunters. I rescued the squirrels, and as a young school-going child, took care of the two squirrels from just my basic knowledge of simple wound treatment that I had learned in school.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

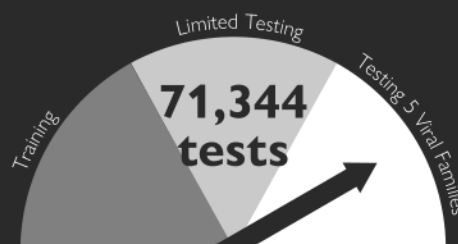


### IMPACT

**120 trained** in One Health skills  
**14,284 individuals sampled** (animals & humans)  
**972 individuals interviewed**  
**37 unique viruses detected**

## LAB STRENGTHENING

- Institute of Epidemiology Disease Control & Research
- icddr,b



## VIRAL FINDINGS

**P1**

**217** new viruses  
**20** known viruses

**P2**

**11** new viruses  
**8** PREDICT-1 viruses  
**18** known viruses



Global Health Security Agenda

# BANGLADESH



## .....**SHARIFUL ISLAM**

PREDICT/Bangladesh, Field Coordinator-Epidemiology

*Institute of Epidemiology Disease Control & Research*

### PARTNERS

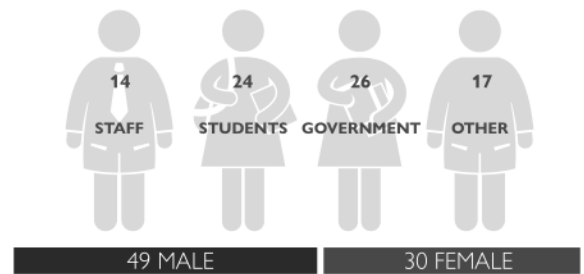
- EcoHealth Alliance
- icddr,b
- Institute of Epidemiology,  
Disease Control & Research
- Bangladesh Forest Department



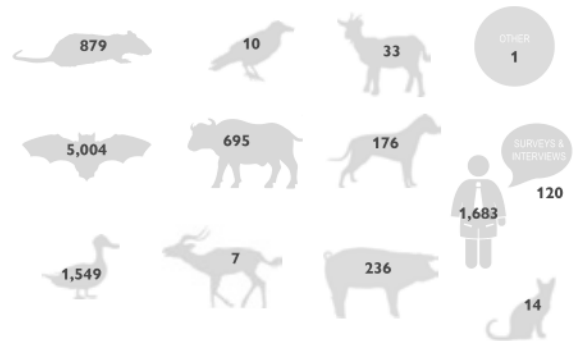
**Dr. Islam has been leading field teams with multi-sectoral representation to conduct ecological and epidemiological studies of zoonotic viruses in wildlife. While in the field, Dr. Islam collects biological samples from various wildlife species, including bats, macaques, rodents, shrews and wild birds.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

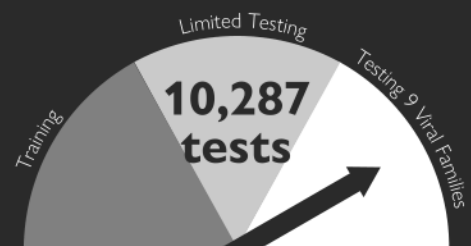


## IMPACT

**79 trained** in One Health skills  
**10,177 individuals sampled**  
**120 individuals interviewed**  
**31 unique viruses detected**

## LAB STRENGTHENING

· Institut Pasteur du Cambodge



## VIRAL FINDINGS

P1	P2
29 new viruses	7 new viruses
18 known viruses	11 PREDICT-1 viruses
	13 known viruses



Global Health Security Agenda

# CAMBODIA

## VEASNA DUONG

PREDICT/Cambodia, Country Coordinator

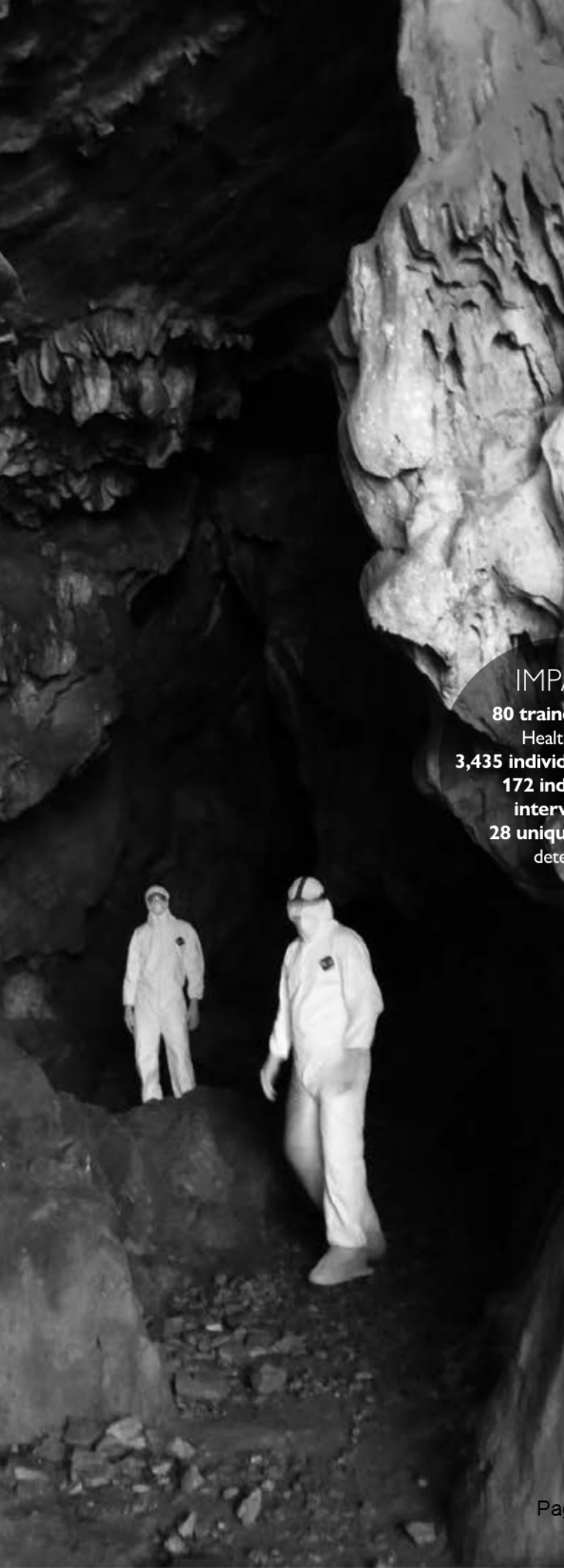
*Institut Pasteur du Cambodge*

## PARTNERS

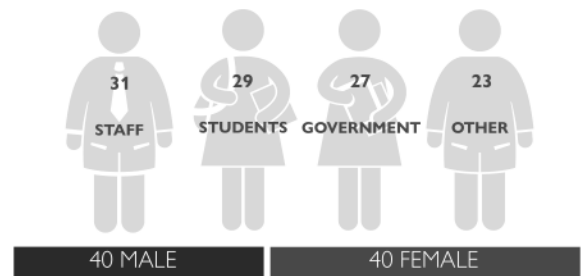
- University of California, Davis
- Institut Pasteur du Cambodge



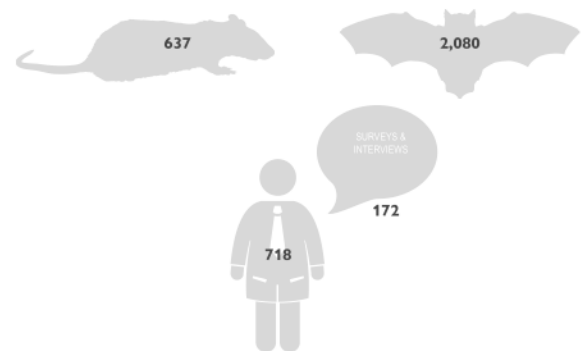
***“PREDICT has introduced and built capacity here for effective One Health approach to tackle emerging zoonotic viruses with potential threat to Cambodia and the world.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

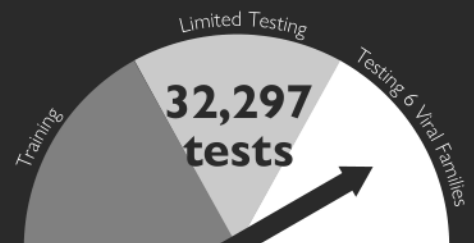


## IMPACT

**80 trained** in One Health skills  
**3,435 individuals samples**  
**172 individuals interviewed**  
**28 unique viruses detected**

## LAB STRENGTHENING

- Wuhan Institute of Virology of Chinese Academy of Sciences
- Institute of Microbiology of Chinese Academy of Sciences



## VIRAL FINDINGS

### P1

**46 new viruses**  
**22 known viruses**

### P2

**11 new viruses**  
**5 PREDICT-1 viruses**  
**12 known viruses**

# CHINA

## .....**GUANGJIAN ZHU, PhD**

PREDICT/China, Field Coordinator

*EcoHealth Alliance*

### PARTNERS

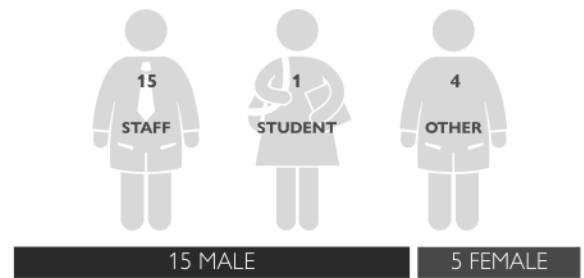
- EcoHealth Alliance
- Wuhan Institute of Virology of Chinese Academy of Sciences
- Institute of Microbiology of Chinese Academy of Sciences
- Chinese Center for Disease Control & Prevention



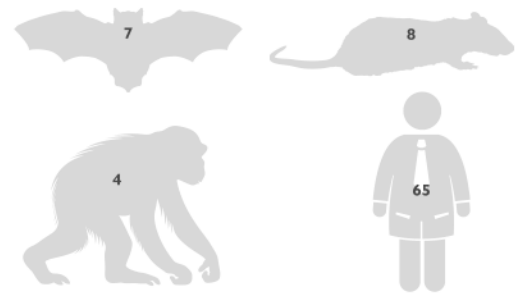
***“I believe every individual who works with PREDICT is the key of its success. The greater success of PREDICT in China lies in the sharing and collaborating with the world.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

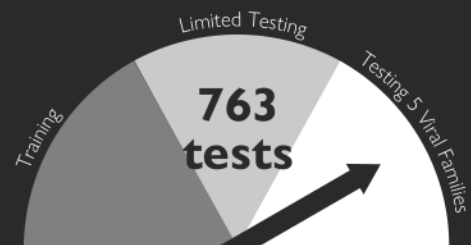


### IMPACT

**20 trained** in One Health skills  
**84 individuals sampled** (animals & humans)

## LAB STRENGTHENING

· Sanjay Gandhi Postgraduate Institute of Medical Science



# INDIA



Global Health Security Agenda

## **HARJEET SINGH MAAN**

PREDICT/India, Laboratory Lead

*Sanjay Gandhi Post Graduate Institute of Medical Sciences*

### **PARTNERS**

- EcoHealth Alliance
- Sanjay Gandhi Postgraduate Institute of Medical Sciences

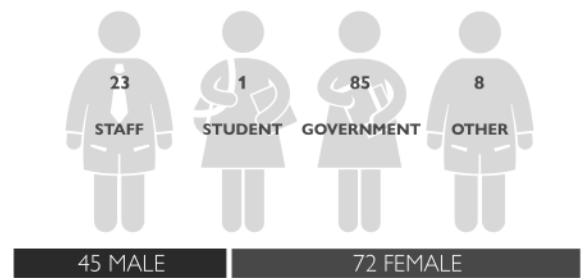


***“I have since taken my expertise in microbiology to work as a Senior Scientist at the State Virology laboratory, at Gandhi Medical College in Bhopal Madhya Pradesh, India, where I am now in charge of a virology lab.”***

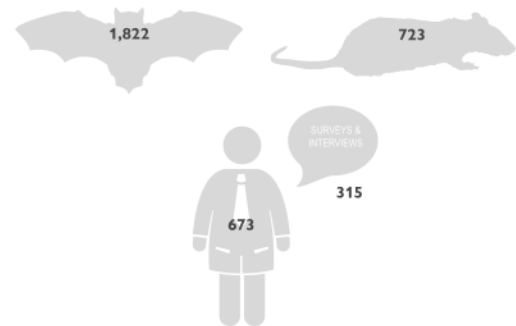




## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

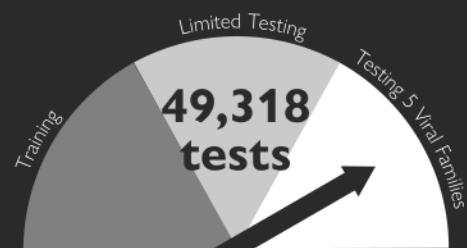


### IMPACT

**117 trained** in One Health skills  
**3,218 individuals sampled**  
**988 individuals interviewed**  
**27 unique viruses detected**

## LAB STRENGTHENING

- Eijkman Institute for Molecular Biology (EIMB)
- Primate Research Center of the Institut Pertanian Bogor (Bogor Agricultural University)



## VIRAL FINDINGS

**P1**

**14 new viruses**  
**6 known viruses**

**P2**

**14 new viruses**  
**5 PREDICT-1 viruses**  
**8 known viruses**



Global Health Security Agenda

# INDONESIA

..... **UUS SAEPULOH, SSi, M.Biomed**

PREDICT/Indonesia, Laboratory Technologist

*Primate Research Center IPB University*

..... **TINA KUSUMANINGRUM, MSc**

PREDICT/Indonesia, Field Coordinator

**PARTNERS**

- EcoHealth Alliance
- Primate Research Center of the Institut Pertanian Bogor (Bogor Agricultural University)
- Eijkman Institute for Molecular Biology



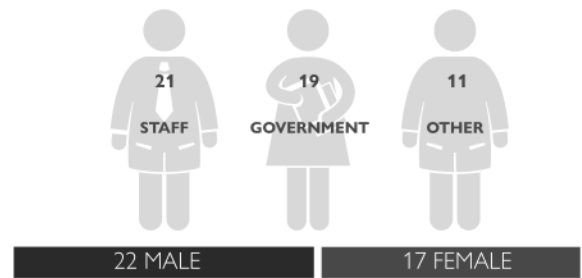
***“PREDICT has given me an opportunity to be a part of global research communities in fighting zoonotic diseases through multisectoral collaboration.”***



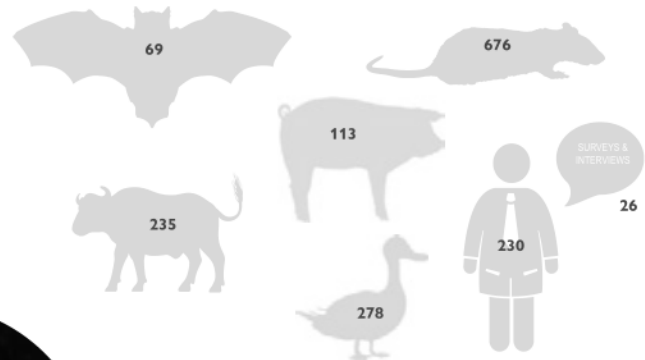
***“Since I joined PREDICT Indonesia, I’ve had many opportunities to improve my knowledge and skills in molecular biology and virology, especially in best practices for viral detection, surveillance, and biosecurity. I hope this knowledge and my ability to share it will increase and strengthen the capacity of laboratory technologies in our institution and across Indonesia for detecting wildlife zoonotic agents.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

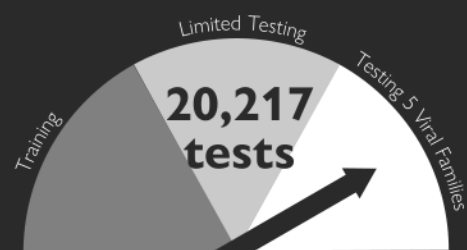


### IMPACT

**39 trained** in One Health skills  
**1,601 individuals sampled**  
**256 individuals interviewed**

## LAB STRENGTHENING

- National Center for Laboratory & Epidemiology
- National Animal Health Laboratory



## VIRAL FINDINGS

**P1**

**16 new viruses**  
**5 known viruses**

**P2**

**5 known viruses**  
**2 new viruses**



Global Health Security Agenda

# LAO PDR

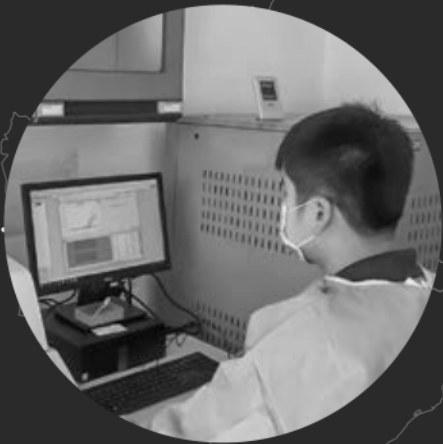
## SINAKHONE XAYADETH

PREDICT/Lao PDR, Laboratory Technician

*National Center for Laboratory & Epidemiology*

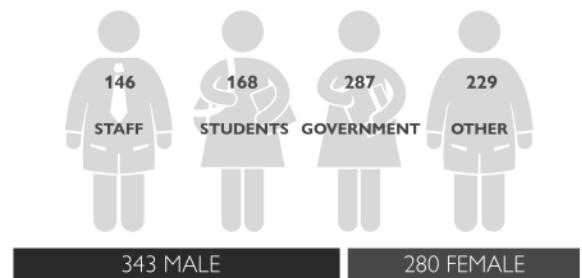
### PARTNERS

- Metabiota, Inc.
- National Animal Health Laboratory
- National Center for Laboratory & Epidemiology

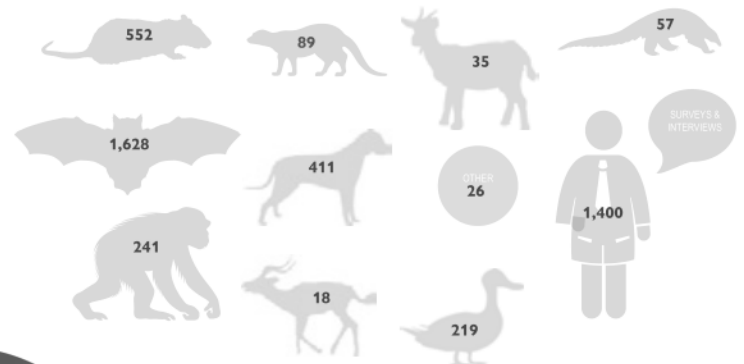


His experience working on the PREDICT project has motivated Sinakhone to further improve the laboratory capacity of his country, with his sights set on continuing his education in advanced molecular laboratory techniques. While the benefits of equipment and supplies, shared protocols, and in-service trainings provided to an organization are clear, the transfer of knowledge, mentorship, and inspiration ignited through involvement in a global project like PREDICT are also of great value and can have long-lasting and far-reaching effects.

## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

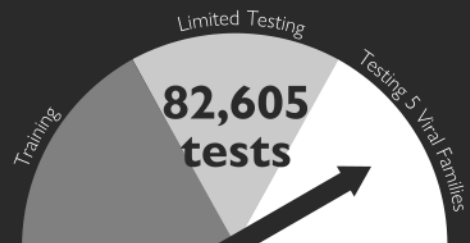


### IMPACT

**597 trained** in One Health skills  
**4,676 individuals sampled**  
**1,400 individuals interviewed**  
**28 unique viruses detected**

## LAB STRENGTHENING

- Wildlife Health, Genetic & Forensic Laboratory, Sabah Wildlife Department
- Virology Lab, Faculty of Veterinary Medicine, University Putra, Malaysia
- PERHILITAN National Wildlife Forensic Laboratory
- National Public Health Laboratory Peninsular Malaysia
- Kota Kinablu Public Health Laboratory



## VIRAL FINDINGS

P1

**57 new viruses**  
**19 known viruses**

P2

**17 new viruses**  
**3 PREDICT-1 viruses**  
**8 known viruses**

# MALAYSIA

## ZAHIDAH IZZATI ZEID

PREDICT/Malaysia Veterinarian

*EcoHealth Alliance*

### PARTNERS

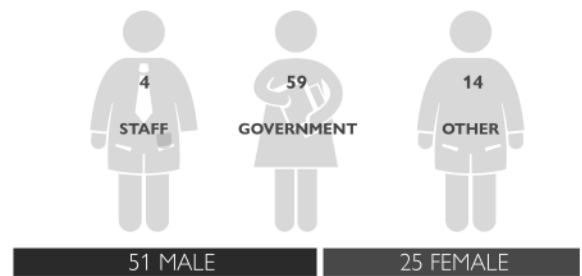
- EcoHealth Alliance
- Conservation Medicine, Ltd.
- Perhilitan & National Wildlife Forensic Laboratory
- Sabah Wildlife Department & Wildlife Health & Genetics & Forensic Laboratory
- Danau Girang Field Centre
- University Malaysia Sabah
- Sabah State Health Department
- Queen Elizabeth Hospital
- Kota Kinabalu Public Health



**Dr. Zahidah has quickly become an important member of the PREDICT team in Malaysia working closely with government partners to build capacity to reduce the likelihood of spillover events.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

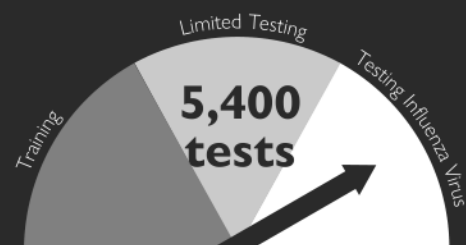


### IMPACT

**76 trained** in One Health skills  
**3,243 animals sampled**  
**1 unique virus** detected

## LAB STRENGTHENING

· State Central Veterinary Laboratory



## VIRAL FINDINGS

**P2**  
**Influenza virus**

# MONGOLIA



## ..... **ULAANKHUU ANKHANBAATAR**

PREDICT/Mongolia, Virologist

*State Central Veterinary Laboratory*

### PARTNERS

- Wildlife Conservation Society
- State Central Veterinary Laboratory

## ..... **ARIUNBAATAR BARKHASBAATAR**

PREDICT/Mongolia, Avian Specialist

*Wildlife Conservation Society*

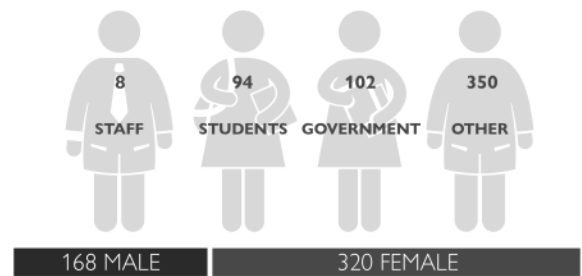


***"I am really interested in wildlife disease in the future."***

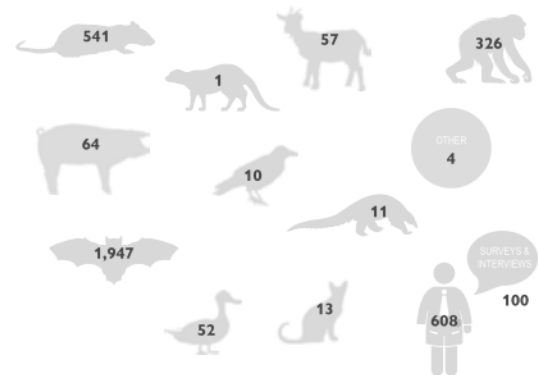


***"Working with the international project team has been a great opportunity for my further research. Also my bird identification has improved."***

## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

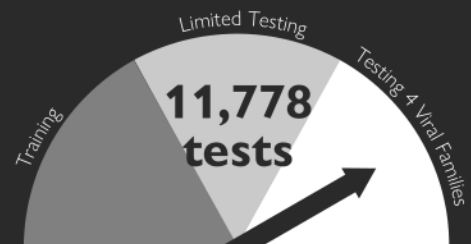


## IMPACT

**488 trained** in One Health skills  
**3,611 individuals** samples  
**100 individuals** interviewed  
**9 unique viruses** detected

## LAB STRENGTHENING

- Livestock Breeding & Veterinary Department
- Department of Medical Research



## VIRAL FINDINGS

**P2**

**6 new viruses**

**3 PREDICT-1 viruses**

# MYANMAR

## ..... OHNMAR AUNG, MD

PREDICT/Myanmar, Country Coordinator

*Smithsonian Institution*

### PARTNERS

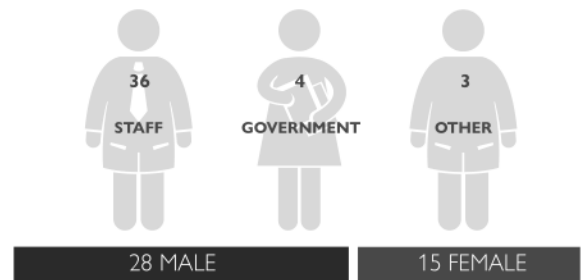
- Smithsonian Institution
- Department of Medical Research of the Ministry of Health & Sports
- Livestock Breeding & Veterinary Department
- Laboratory of the Ministry of Livestock, Agriculture & Irrigation
- Ministry of Natural Resources & Environmental Conservation



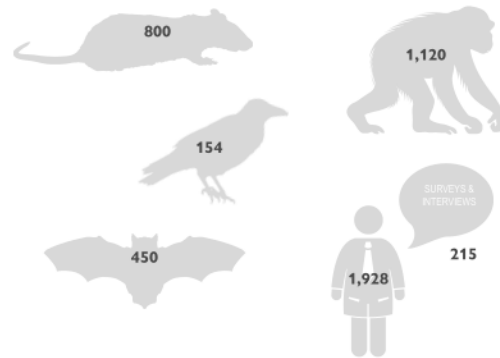
**Dr. Ohnmar Aung is a medical doctor and social scientist. As the country coordinator for PREDICT in Myanmar, she is responsible for guiding and coordinating the project within the country, alongside Myanmar's three ministry partners. Dr. Aung has been a practicing physician for more than 15 years and has extensive experience bringing health infrastructure to communities throughout the country.**



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

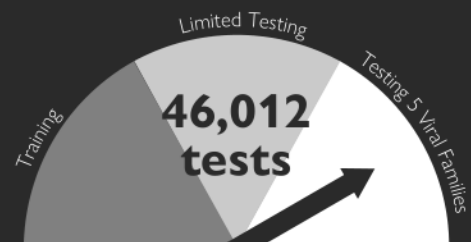


### IMPACT

**43 trained** in One Health skills  
**4,452 individuals sampled**  
**2,143 individuals interviewed**  
**8 unique viruses detected**

## LAB STRENGTHENING

Center for Molecular Dynamics Nepal/  
Intrepid Nepal



## VIRAL FINDINGS

P1	P2
6 new viruses	1 new viruses
5 known viruses	7 known viruses

# NEPAL

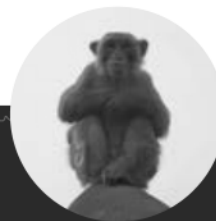
..... **DIBESH KARMACHARYA, PhD**

PREDICT/Nepal, Country Coordinator

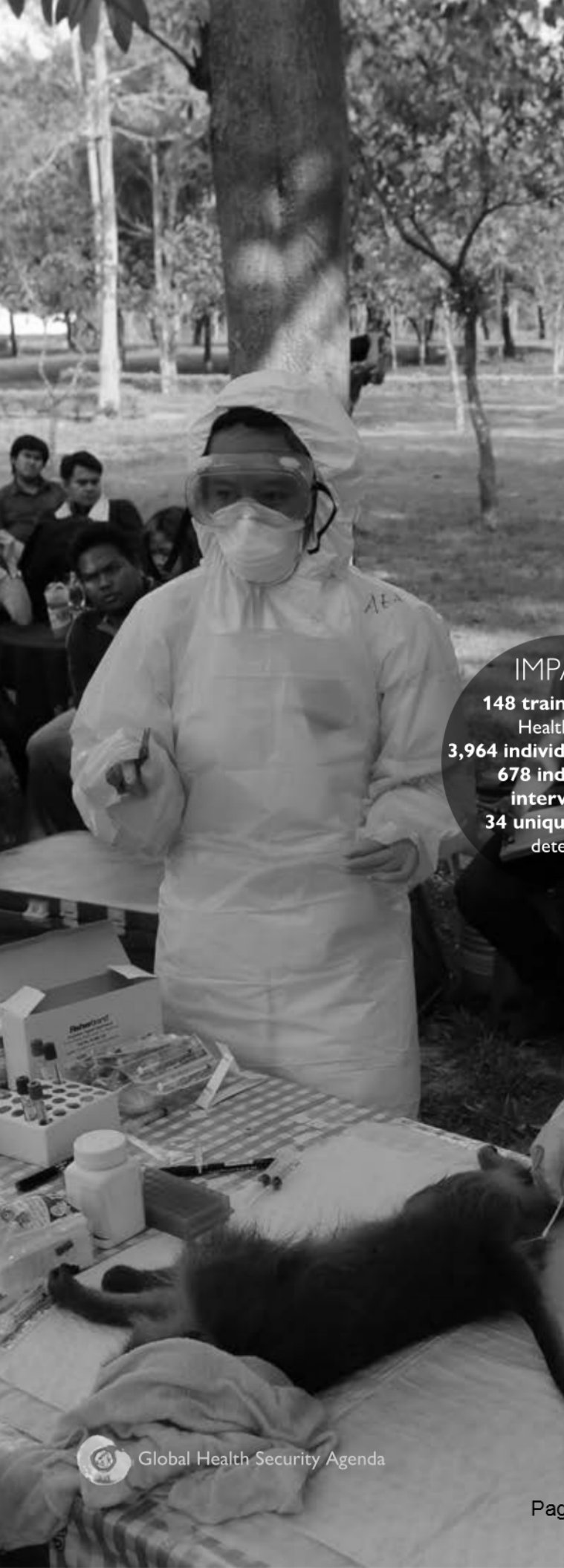
*Center for Molecular Dynamics Nepal*

**PARTNERS**

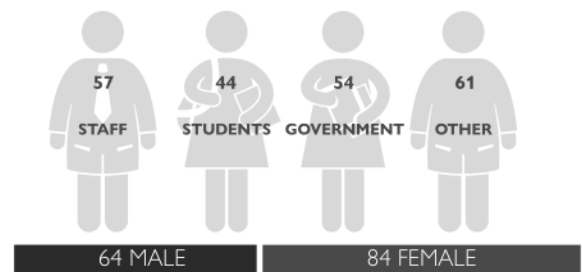
- University of California, Davis
- Center for Molecular Dynamics  
Nepal/Intrepid Nepal



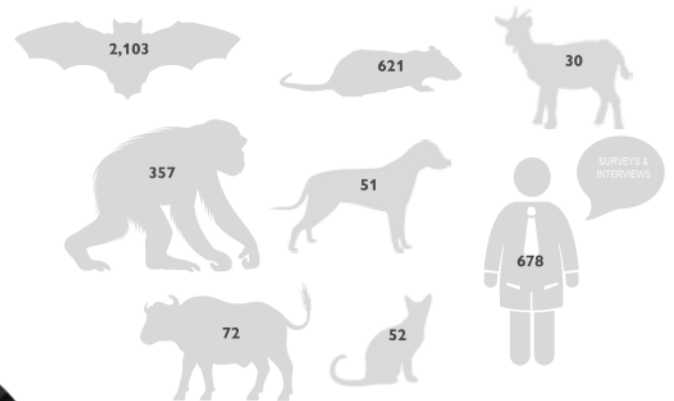
***“PREDICT has helped in building capacity for emerging disease detection and characterization in Nepal greatly enhancing country’s surveillance capabilities.”***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

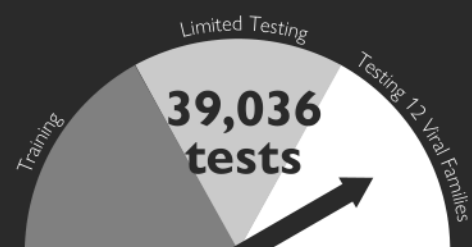


### IMPACT

**148 trained** in One Health skills  
**3,964 individuals sampled**  
**678 individuals interviewed**  
**34 unique viruses detected**

## LAB STRENGTHENING

· WHO-CC Viral Zoonoses Chulalongkorn University



## VIRAL FINDINGS

P1	P2
83 new viruses	6 new viruses
34 known viruses	14 known viruses
	14 PREDICT-1



Global Health Security Agenda

# THAILAND

## PRATEEP DUENGKAE, PhD

PREDICT/Thailand, Co-Country Coordinator

*Faculty of Forestry at Kasetsart University*

## AINGORN CHAIYES

PREDICT/Thailand, Modeling & Analytics Fellow

### PARTNERS

- EcoHealth Alliance
- Chulalongkorn University Hospital
- Kasetsart University
- Department of National Parks, Wildlife & Plant Conservation
- Department of Livestock & Development
- Ministry of Public Health



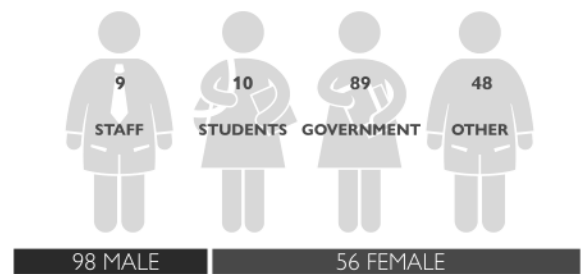
***“I was awarded a PREDICT Modeling & Analytics Fellowship to work with the team at EcoHealth Alliance in New York City. The fellowship helped me to expand my work to evaluate habitat suitability and Nipah Virus Risk of Lyle’s Flying Fox in Thailand. The methods and techniques I learned as part of PREDICT will help me promote the conservation and management of wildlife and wildlife diseases in Thailand and transfer this knowledge to others.”***



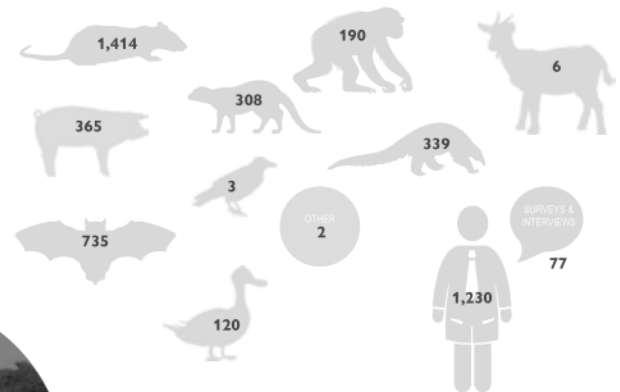
***“I spent my whole career studying the wildlife and natural ecosystems of Thailand. Joining the PREDICT project opened up a whole new area of research for me, and has allowed me to link my knowledge of ecology and animal biology with infectious disease research. It’s been exciting to see how PREDICT has helped to shape the national agenda for One Health in Thailand”.***



## WORKFORCE DEVELOPMENT



## ONE HEALTH SURVEILLANCE

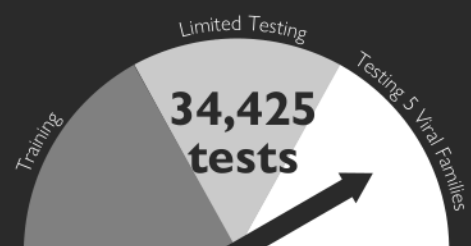


### IMPACT

**154 trained** in One Health skills  
**4,712 individuals** samples  
**1,307 individuals** interviewed  
**9 unique viruses** detected

## LAB STRENGTHENING

- Viet Nam National University of Agriculture
- Regional Animal Health Office No. 6
- National Institute of Hygiene & Epidemiology



## VIRAL FINDINGS

### P1

**23** new viruses  
**7** known viruses

### P2

**2** new viruses  
**1** PREDICT-1 virus  
**6** known viruses



## NGUYEN THI THANH NGA

PREDICT/Viet Nam, Country Coordinator

*Wildlife Conservation Society*

## NGUYEN DUC THINH

PREDICT/Viet Nam, Laboratory Technician

*Viet Nam National University of Agriculture*

## PARTNERS

- Wildlife Conservation Society
- Viet Nam National University of Agriculture
- Regional Animal Health Office Laboratories (RAHO6 & RAHO7), Department of Animal Health
- National Institute of Hygiene & Epidemiology



***“PREDICT is so meaningful not only to me but also globally because of its One Health approach. This is also my first time to work together with wildlife and animal health staffs and I feel very happy to be able to be a part of it.”***



***“I started my career as a member of the PREDICT project program. Being a part of the team has helped me to deepen my expertise, improved my skills, and has given me a golden chance to explore the areas that I’m interested in, that is wildlife, wildlife health and zoonotic diseases. I believe and hope that PREDICT project will not only help me to enhance my personal veterinary skills but its findings will also bring value to animal and human health, and especially the wildlife health in Viet Nam.”***

A black and white photograph of a mule standing in a muddy area, with two children in the background. The mule is in the foreground, facing left, with its shadow cast on the ground. Two children are standing in the background, to the right of the mule. The ground is muddy and reflective. In the background, there is a white building with several windows and some trees.

# PUBLICATIONS

Learn more at [www.publications.predict.global](http://www.publications.predict.global)

- Ahmed Kandeil, Mokhtar R. Gomaa, Mahmoud M. Shehata, Ahmed N. El Taweel, Sara H. Mahmoud, Ola Bagato, Yassmin Moatasim, Omnia Kutkat, Ahmed S. Kayed, Patrick Dawson, Xueting Qiu, Justin Bahl, Richard J. Webby, William B. Karesh, Ghazi Kayali, Mohamed A. Ali. 2019. **Isolation and Characterization of a Distinct Influenza A Virus from Egyptian Bats.** *Journal of Virology* 93(2). doi: 10.1128/JVI.01059-18
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**USAID**  
FROM THE AMERICAN PEOPLE



EcoHealth  
Alliance



METABIOTA™



Smithsonian  
Institution

**From:** (b)(6)  
**Sent:** Tue, 2 Jul 2019 12:33:51 +0000  
**To:** (b)(6); Peter Daszak  
**Cc:** (b)(6)  
**Subject:** [REDACTED]  
**Attachments:** [REDACTED]

(b)(5); (b)(5) -  
Deliberative  
Process Privilege

(b)(5); (b)(5) -  
Deliberative  
Process Privilege

Hi (b)(6) and Peter,

Attached please find the updated [REDACTED]

Can you please 1) confirm the title of your presentation at the plenary session, and 2) send me your biosketch for the program printing by this Thursday?

Thank you very much.

Best,

(b)(6)

(b)(6)

EcoHealth Alliance  
460 West 34th Street, [REDACTED]  
New York, NY 10001

(b)(6) (U.S. mobile)  
(b)(6) (Skype)  
(b)(6) (WeChat)

*EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science, we develop solutions that promote conservation and prevent pandemics.*

Page 116 of 153

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of the Freedom of Information and Privacy Act



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of the Freedom of Information and Privacy Act

**From:** (b)(6)  
**Sent:** Thu, 31 Aug 2017 19:17:20 +0000  
**To:** (b)(6) (GH/HIDN); Peter Daszak; (b)(6)

(b)(6)

**Cc:** (b)(6)

**Subject:**

**Attachments:**

(b)(6)

Dear All,

I am sharing with you the final itinerary for your trip to Beijing (and Hong Kong for (b)(6) Peter, and (b)(6) and the tentative meeting agenda at Chinese Academy of Sciences on September the 4th.

Please find information in the attachments. My local phone number has changed to (b)(6) (b)(6) please feel free to call me anytime if anything I can help.

Thank you. Look forward to seeing you soon in Beijing!

Best,

(b)(6)

(b)(6)

EcoHealth Alliance

460 West 34th Street – 17th floor  
New York, NY 10001

(b)(6) U.S. mobile)  
(b)(6) (China mobile)

(b)(6) (Skype)  
(b)(6) (WeChat)

*EcoHealth Alliance leads cutting-edge scientific research into the critical connections between human and wildlife health and delicate ecosystems. With this science, we develop solutions that prevent pandemics and promote conservation.*

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of the Freedom of Information and Privacy Act

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Withheld pursuant to exemption

(b)(5) ; (b)(5) - Deliberative Process Privilege  
of the Freedom of Information and Privacy Act

**From:** Peter Daszak  
**Sent:** Wed, 28 Sep 2016 16:04:07 +0000  
**To:** (b)(6)  
**Cc:** (b)(6)  
(b)(6)@ucdavis.edu)  
**Subject:** For tomorrow's call  
**Importance:** High

Here are some things I'd like to mention on tomorrow's call:

Outreach to the NYC MedTech meeting, the NY Genome Center (b)(6)  
(b)(6), Friedrich Loeffler Institute (Germany)  
OFFLU opportunity next steps  
CNVP (China NVP) update

I also want to take this opportunity to introduce (b)(6) who has joined EHA to focus on the GVP project. (b)(6)  
(b)(6) She's got great analytical skills and will be working on a bunch of useful analyses for the GVP as we move forward. Please keep her cc'd on the invites and I'd like her to join our calls, mainly to keep track of the follow up I need to do here, if that's ok with everyone...

Cheers,

Peter

**Peter Daszak**  
*President*

EcoHealth Alliance  
460 West 34<sup>th</sup> Street – 17<sup>th</sup> Floor  
New York, NY 10001

(b)(6) (direct)  
(b)(6) (fax)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science we develop solutions that promote conservation and prevent pandemics.*

---

**From:** (b)(6) [mailto:(b)(6)@usaid.gov]  
**Sent:** Wednesday, September 28, 2016 11:41 AM  
**To:** Peter Daszak  
**Cc:** (b)(6)  
**Subject:** Re: Terms of Reference for GVP governance

Great

(b)(6)  
U.S. Agency for International Development  
Office: (b)(6)  
Mobile: (b)(6)

On Sep 28, 2016, at 11:29 AM, Peter Daszak <[daszak@ecohealthalliance.org](mailto:daszak@ecohealthalliance.org)> wrote:

(b)(6)

I will have the maps of India with you by 4pm today. Does that work?

Cheers,

Peter

**Peter Daszak**  
*President*

EcoHealth Alliance  
460 West 34<sup>th</sup> Street – 17<sup>th</sup> Floor  
New York, NY 10001

(b)(6) (direct)  
(b)(6) (fax)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance leads cutting-edge research into the critical connections between human and wildlife health and delicate ecosystems. With this science we develop solutions that promote conservation and prevent pandemics.*



**From:** (b)(6) [mailto:(b)(6)@usaid.gov]

**Sent:** Wednesday, September 28, 2016 10:35 AM

**To:** (b)(6); Peter Daszak; (b)(6)

**Subject:** Terms of Reference for GVP governance

All, attached is a first draft of a TOR to share with Vulcan next week. We can discuss on tomorrows call.

(b)(6)

--

(b)(6)

Bureau for Global Health

U.S. Agency for International Development

Office: (b)(6)

Mobile:

**From:** (b)(6)  
**Sent:** Wed, 15 May 2019 02:00:10 +0000  
**To:** (b)(6) Peter  
**Daszak;** (b)(6)@usaid.gov; (b)(6)@ecohealthalliance.org; (b)(6)@metabiota.com; (b)(6)  
**Subject:** FW: Latest News from GVP: May 2019

Hi everyone,

We just distributed the GVP newsletter with the latest edits incorporated. We also added everyone, who sent inquiries through the website since 2017, to the distribution list.

Regarding the animation, I've asked for additional edits at the end and am waiting to hear back.

Best,

(b)(6)

---

**From:** Global Virome Project [mailto:gvp@ucdavis.edu]  
**Sent:** Tuesday, May 14, 2019 4:18 PM  
**To:** (b)(6)@ucdavis.edu>  
**Subject:** Latest News from GVP: May 2019



---

Dear Partners,

On behalf of the [Global Virome Project](#), we are pleased to share this latest edition of our newsletter highlighting recent, select stories of our work setting the foundation to characterize the world's emerging viruses.

All the best,

Global Virome Project Steering Committee

---

**Thai Virome Project**



On October 24-25, 2018, stakeholders from Thailand and members of the core and technical working groups of the Global Virome Project met in Bangkok for a roundtable meeting and developmental workshop. Professionals from the science and technology, biotechnology, medicine, wildlife, public health, and animal health sectors representing government agencies, universities, and international organizations came together to discuss next steps to develop a large-scale viral discovery initiative for Thailand.



By the end of the meeting, attendees reached a consensus to establish a Thai Virome

Project Partnership (TVPP), synergizing expertise from multiple Thai organizations. They also developed a roadmap, which outlined key milestones for the upcoming years. In late January 2019, the TVP core group convened again to further develop implementation strategies for the Thai Virome Project Partnership and to establish a TVPP Secretariat.

---

## China Virome Project

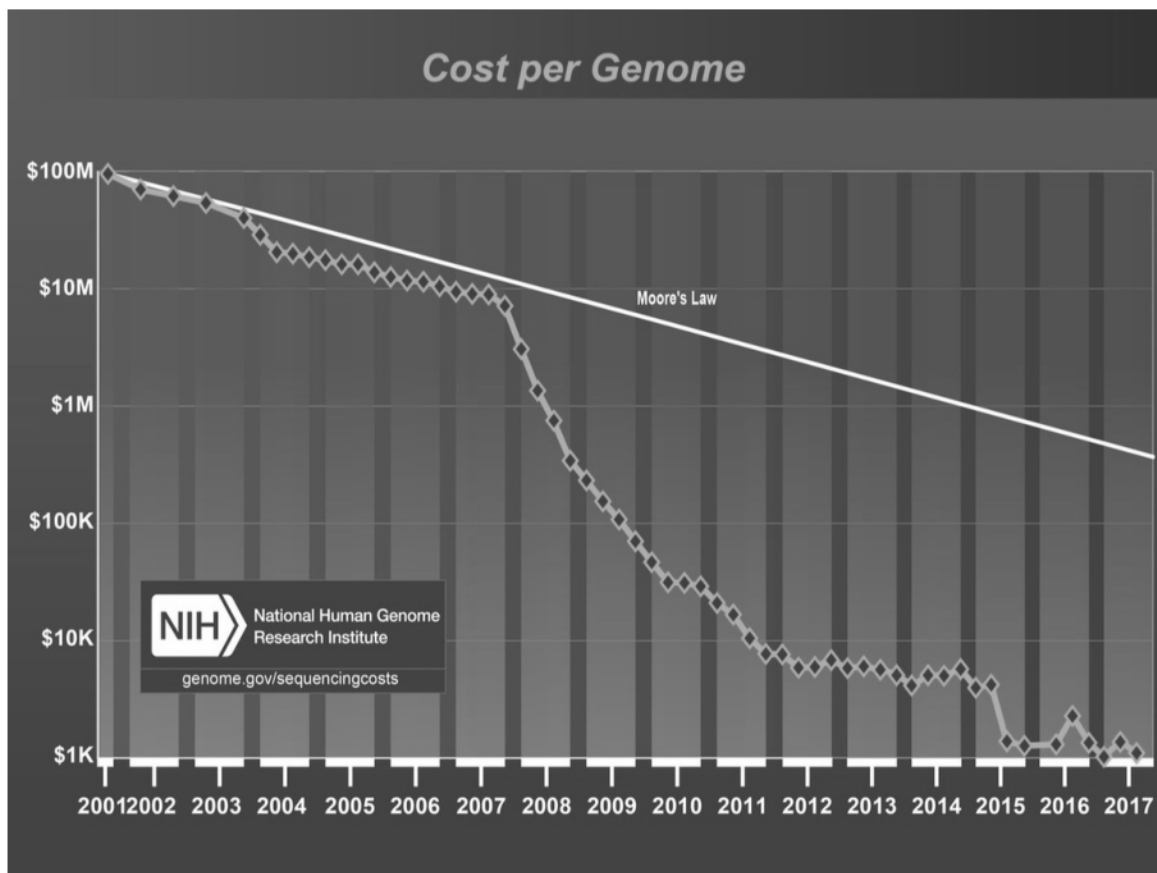
In mid-February, a group of experts from the Chinese Academy of Sciences, Chinese Center of Disease Control and Prevention, and National Natural Science Foundation of China convened in Beijing to discuss and explore steps forward to implement a large-scale emerging viral discovery project in China.

By the end of the meeting, attendees agreed to officially launch and announce the China Virome Project in 2019.

The meeting was led by (b)(6), and authorities and researchers are working closely with the GVP core team to establish the working committee and develop a central proposal.



## Analysis of Nagoya Protocol and Capacity Building Potential of GVP to be published by *Yale Journal of International Law*



As an international scientific collaboration with important relationships with biodiverse countries, the Global Virome Project is close to one of the most pressing questions in international law today: *How can international research partnerships create frameworks that ensure the benefits resulting from their research are equitably shared?* With respect to research involving genetic resources, the most relevant treaties to that question are the 1992 Convention on Biological Diversity and the 2010 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization.

The GVP's Ethical, Legal, and Social Implications Working Group—(b)(6)  
(b)(6)—analyzed this question in the context of four large global biogenomic surveys, including the Global Virome Project. They identified models for benefit sharing, awareness of the Nagoya Protocol's terms and influence, and potential

for capacity building in the countries where their research activities are or were undertaken.

Their analysis has been accepted for publication by the Yale Journal of International Law, one of the highest impact journals in the field. The findings will assist not only the Global Virome Project in adopting best practices for its own work, but also the international biogenomic research projects that follow its lead. The manuscript is scheduled for publication in fall 2019.

---

## GVP: 2018 TEDMED Hive Innovator



GVP was named a 2018 "Hive Innovator" by TEDMED, the health and medicine edition of the world-famous TED conference. TEDMED's Hive program is dedicated to startups



celebrating the power of imagination and human potential. (b)(6)

(b)(6)

(b)(6)

The video will be released by TEDMED in the coming months.

Related:

The Spread of Disease (TEDMED Blog)

---

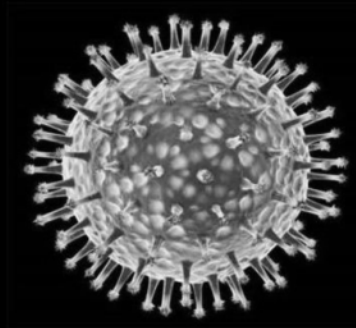
## GVP at ASM Biothreats Conference

(b)(6)

---

## GVP at Ohio State University Seminar

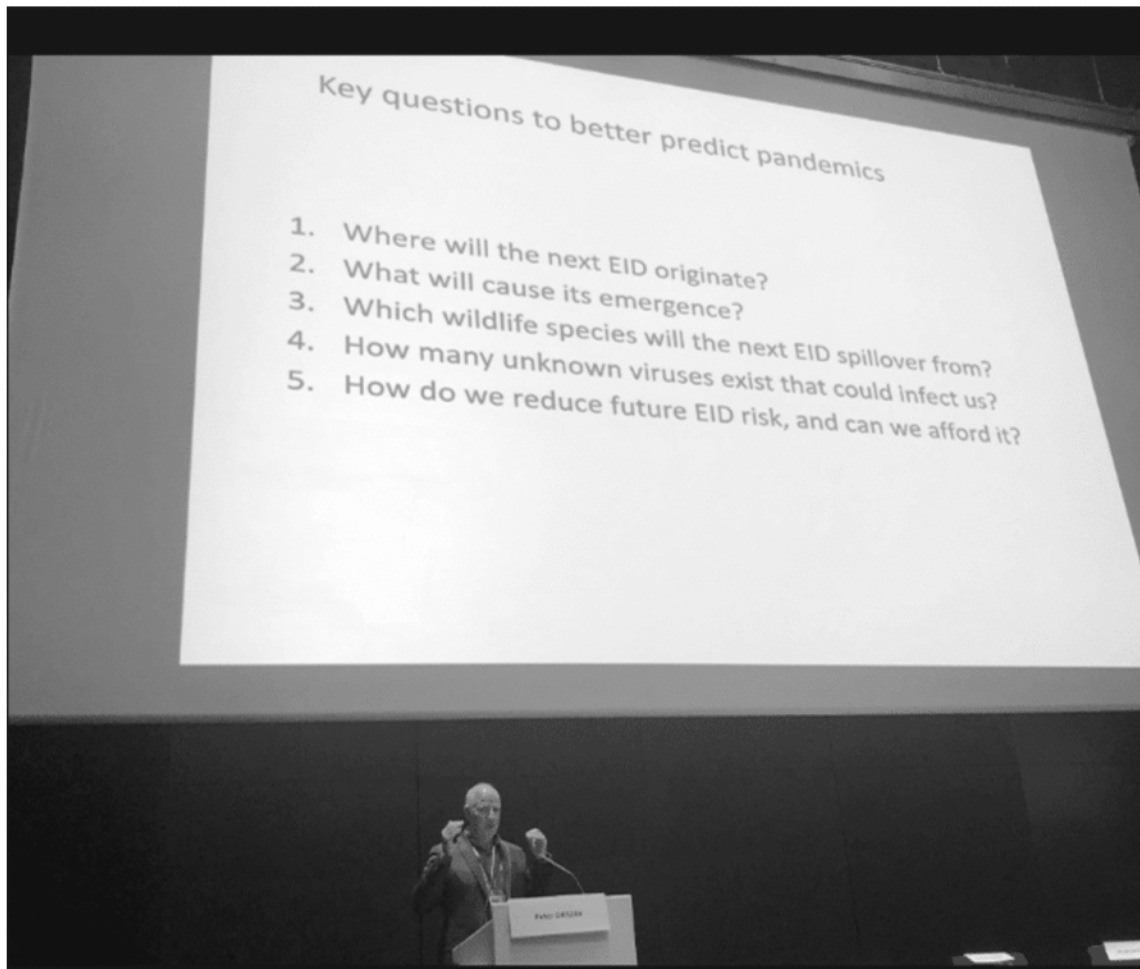
## GVP: Making *future threats* known



(b)(6)

---

**GVP at Emerging Viral Disease Symposium in Geneva**



Dr. Peter Daszak, GVP Science and Technology lead, presented a talk, "The Global Virome Project: Epidemic Forecasting," at the [2nd Symposium for Emerging Viral Diseases](#) at the University of Geneva in April.

---

## Coming Up

- GVP is developing an animated video with Science Animated, a UK-based animation

company. Stay tuned for its debut!

- There will be a prospective benefit-cost analysis of the Global Virome Project to better understand the economic impact of implementing GVP and its return on investment. Updates to follow soon.

---

Have you read our manuscript in *Science*? Access the full paper [here](#).

---



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UC Davis One Health Institute 1089 Veterinary Medicine Drive  
Davis, CA | 95616 US

emma®

This email was sent to (b)(6)@ucdavis.edu.  
To continue receiving our emails, add us to your address book.

**From:** (b)(6)  
**Sent:** Thu, 27 Sep 2018 06:56:07 +0000  
**To:** (b)(6)  
**Cc:**  
**Subject:** Fwd: [GVP] Action Requested - Update Thailand Agenda  
**Attachments:** 04 Thailand National Virome Project\_Draft Agenda\_Aug 23\_(b)(6).docx

Dear (b)(6)

This is the most updated version that I have in hand. Please use word document version for your edits.

Best regards,

(b)(6)

USAID Regional Development Mission Asia  
Bangkok, 10330

E-mail: (b)(6)@usaid.gov

Tel: (b)(6), Fax: (b)(6)

----- Forwarded message -----

**From:** (b)(6)  
**Date:** Thu, Aug 23, 2018 at 1:42 PM  
**Subject:** Re: [GVP] Action Requested - Update Thailand Agenda  
**To:** (b)(6)@usaid.gov>

ส่งตารางที่แก้ไขมาให้พี่ก๊วก่อนค่ะ

ขอบคุณค่ะ

(b)(6)

(b)(6)

ศูนย์วิทยาศาสตร์สุขภาพโรคอุบัติใหม่ โรงพยาบาลจุฬาลงกรณ์

Thai Red Cross Emerging Infectious Diseases - Health Science Centre  
WHO Collaborating Centre for Research and Training on Viral Zoonoses  
King Chulalongkorn Memorial Hospital  
Faculty of Medicine, Chulalongkorn University

Rama4 road, Patumwan

Bangkok, Thailand 10330

Tel (b)(6)

Fax

**From:** (b)(6)@usaid.gov>

**Sent:** Monday, August 20, 2018 10:24 AM

**To:** (b)(6)

(b)(6)

**Cc:** (b)(6) (FAORAP); (b)(6)

(b)(6)

**Subject:** Fwd: [GVP] Action Requested - Update Thailand Agenda

Dear colleagues,

Please see attachment the draft meeting agenda with GVP's inputs. We have to further work out more details from our end. In addition, I have asked (b)(6) (15-20 min talk) to provide his perspective on the establishment Thailand National Virome Project.

Best regards,

(b)(6)

USAID Regional Development Mission Asia  
Bangkok, 10330

E-mail: (b)(6)@usaid.gov

Tel: +(b)(6) Fax: +(b)(6)

----- Forwarded message -----

**From:** (b)(6)@ucdavis.edu>

**Date:** Fri, Aug 17, 2018 at 1:19 AM

**Subject:** Re: [GVP] Action Requested - Update Thailand Agenda

**To:** (b)(6)@usaid.gov>

**Cc:** Peter Daszak <daszak@ecohealthalliance.org>, (b)(6)@ucdavis.edu>, (b)(6)

(b)(6)@metabiota.com>, (b)(6)@metabiota.com>, (b)(6)

(b)(6)@usaid.gov>, (b)(6)@usaid.gov>

Here you go -- thanks for the opportunity to input.

Ours looks like a lot of changes, but it is mostly restructuring.

We also think we need to ask speakers to include Q&A for each section or to shorten sections further to allow for questions.

Have a nice day,

(b)(6)

On Thu, Aug 16, 2018 at 7:13 AM, (b)(6)@usaid.gov> wrote:

Hi Team,

A huge thank you to those who have provided input to the agenda. If you have not yet provided input, particularly for speaker name and session title, please take a moment to do so today.

Thanks again,

(b)(6)

(b)(6)

U.S. Agency for International Development (USAID) (b)(6)

Bureau for Global Health, Office of Infectious Disease, Emerging Threats Division

(b)(6)

Desk: (b)(6)

Cell:

E-mail: (b)(6)@usaid.gov

(b)(6)

On Mon, Aug 13, 2018 at 1:59 PM (b)(6)@usaid.gov> wrote:

Hi GVP Colleagues,

As per our conversation on Thursday, we would like to request your assistance in updating the agenda for the Thailand National Meeting, to be held Oct. 24-25 in Bangkok. In particular, we would like to ensure that speaker name and session titles have been added.

Please input your edits to [this google doc](#). If you're unable to access it, I have also attached a recent draft of the agenda in which you can make your edits. In case helpful for framing, I've pasted below some feedback from the GoT that (b)(6) shared.

We would appreciate your feedback by **COB Wednesday, 8/15**.

Thanks!

(b)(6)

#### Feedback

(b)(5) - Deliberative Process Privilege

(b)(6)

U.S. Agency for International Development (USAID) (b)(6)

Bureau for Global Health, Office of Infectious Disease, Emerging Threats Division

(b)(6)



Desk: (b)(6)  
Cell:   
E-mail: (b)(6)@[usaid.gov](mailto:usaid.gov)

(b)(6)

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of the Freedom of Information and Privacy Act

**From:** (b)(6) (Beijing)  
**Sent:** Mon, 20 May 2019 06:58:23 +0000  
**To:** (b)(6) (GH/ID)  
**Subject:** (b)(5) - Deliberative Process Privilege  
**Attachments:**

(b)(6) attached are some edits/comments intended for a Chinese audience. For a US audience, I believe your draft is fine.

Sent via the Samsung Galaxy S8, an AT&T 4G LTE smartphone

(b)(6)  
United States Agency for International Development  
U.S. Embassy Beijing

----- Original message -----

**From:** (b)(6)@state.gov>  
**Date:** 5/19/19 17:50 (GMT-10:00)  
**To:** (b)(6)@state.gov>  
**Cc:** (b)(6)@state.gov>  
**Subject:** RE: Draft document outlining opportunity for China-US partnership on GVP  
Hi, (b)(6)

I've made some modification and comments, mainly for the purpose of convincing Chinese side. They may not be needed if the concept is to present to the US side.

For your consideration.

Best,

(b)(6)

**Official**  
**UNCLASSIFIED**

---

**From:** (b)(6) (Beijing) <(b)(6)@state.gov>  
**Sent:** Saturday, May 18, 2019 12:26 PM  
**To:** (b)(6) (Beijing) <(b)(6)@state.gov>  
**Subject:** Fwd: Draft document outlining opportunity for China-US partnership on GVP

(b)(6) can you take a look at this draft and provide your comments? Thanks.

Sent via the Samsung Galaxy S8, an AT&T 4G LTE smartphone

(b)(6)  
United States Agency for International Development  
U.S. Embassy Beijing



----- Original message -----

From: (b)(6)@usaid.gov>

Date: 5/15/19 04:24 (GMT-10:00)

To: "(b)(6) (Beijing)" <(b)(6)@state.gov>, Peter Daszak

<daszak@ecohealthalliance.org>, (b)(6)@ecohealthalliance.org>, "(b)(6)

(b)(6)@usaid.gov>

Subject:

(b)(6), when we last spoke we discussed (b)(6)

(b)(6) As you will remember the intent was for this document to be used both by (b)(6) and the US Embassy/DOS to advocate for such a partnership within our respective systems. (b)(6) We have not yet shared with

(b)(6) but (b)(6) has tweaked it with (b)(6) With your comments/edits we would then share with (b)(6) for his input. Also, any thoughts on next steps would be appreciated.

Hope the trip to Zimbabwe and SA was a good one

(b)(6)

(b)(6)

Bureau for Global Health  
U.S. Agency for International Development

Office: (b)(6)

Mobile: (b)(6)

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of the Freedom of Information and Privacy Act

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of the Freedom of Information and Privacy Act

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of the Freedom of Information and Privacy Act

**From:** (b)(6)  
**Sent:** Mon, 4 Sep 2017 07:51:23 +0800  
**To:** (b)(6)  
**Subject:** Fwd: FINAL China Sept. Itinerary & Meeting Agenda  
**Attachments:** (b)(5) - Deliberative Process Privilege

(b)(6)  
U.S. Agency for International Development  
Office: (b)(6)  
Mobile: (b)(6)

Begin forwarded message:

**From:** (b)(6)@ecohealthalliance.org>  
**Date:** September 1, 2017 at 9:58:54 AM GMT+8  
**To:** (b)(6)@im.ac.cn>  
**Cc:** (b)(6) <(b)(6)@usaid.gov>, Peter Daszak  
<daszak@ecohealthalliance.org>, (b)(6)@wh.iov.cn>, (b)(6)  
<(b)(6)@ecohealthalliance.org>, (b)(6)  
<(b)(6)@usaid.gov>, (b)(6)@ecohealthalliance.org>, (b)(6)  
<(b)(6)@ecohealthalliance.org>, (b)(6)@im.ac.cn>, (b)(6)  
<(b)(6)>  
**Subject: Re: FINAL China Sept. Itinerary & Meeting Agenda**

Thanks for correcting this, (b)(6)

Noted and updated in the attached agenda.

Best,  
(b)(6)

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Withheld pursuant to exemption

(b)(5) - Deliberative Process Privilege  
of the Freedom of Information and Privacy Act

**From:** (b)(6)  
**Sent:** Mon, 18 Feb 2019 02:37:42 +0000  
**To:** (b)(6)@usaid.gov  
**Subject:** Fwd: Latest document from GVP

Fyi

(b)(6)  
Emerging Threats  
Global Health  
USAID  
(b)(6)

Begin forwarded message:

**From:** (b)(6)@ecohealthalliance.org>  
**Date:** February 18, 2019 at 10:06:16 AM GMT+8  
**To:** (b)(6)@ucdavis.edu>  
**Cc:** Peter Daszak <daszak@ecohealthalliance.org>, (b)(6)@usaid.gov>, (b)(6)@ecohealthalliance.org>  
**Subject:** Latest document from GVP

Dear (b)(6)

If you have seen the update I sent to you 12 hours ago, the China side has decided to have an official announcement of the China Virome Project in this April. Peter and I will work closely with them to establish the committee and develop different management and technic plans as needed for the announcement.

And we think what the global committee have done will be very helpful for the China team in shaping their project, so wonder would you be able to share with Peter and I the latest versions of all documents developed by the working groups, as well as any other document you think will be useful?

Instead of directly sending those to the China team, Peter and I will discuss to develop a new document that would fit into China's situation, and a new presentation for (b)(6) to talk with the Chinese government.

Please let me know if any question. Thank you very much!

Best,

(b)(6)