From: (b)(6)
Sent: Fri, 13 Oct 2017 00:07:37 +0000
To: (b)(6)
Cc: (b)(6) PREDICTMGT; (b)(6)
(b)(6) Predict@ucdavis.edu
Subject: Re: GHSA Annual report: Input from PREDICT
Attachments: predict-2017-semiannual-report.pdf

Dear (b)(6),

Hope you are well! I am not sure we will be able to meet the timeline for this reporting request. We are currently working on a GHSA report and annual report for PREDICT that will include much of the same information that is requested here. We will be in contact with (b)(6) for guidance and coordination on these extra requests. I have attached the most recent PREDICT Semiannual report here in case it is helpful for reference.

Best,
(b)(6)

On Thu, Oct 12, 2017 at 8:57 AM, (b)(6) @usaid.gov> wrote:
Dear (b)(6)

The Mission is compiling yearly achievements by projects on Ebola and other diseases. Kindly fill in the relevant portions of the template attached and kindly send it back to us by Close of Business (COB) Wednesday, October 17, 2017.

Best regards

(b)(6)

---------- Forwarded message ----------
From: (b)(6) @usaid.gov>
Date: Thu, Oct 12, 2017 at 3:37 PM
Subject: GHSA Annual report: Input from PREDICT
To: (b)(6) @usaid.gov>

Hello (b)(6),

Please ask PREDICT to fill the portions of the report relevant to them COB Oct 17.

Thanks

(b)(6)
(b)(6)
(b)(6)
USAID>GHANA
Cantonments, Accra, Ghana
Direct Line: (b)(6)

Cell Line: (b)(6)
Email: (b)(6) @usaid.gov
Website: http://www.usaid.gov/ghana

USAID | PREDICT

FROM THE AMERICAN PEOPLE

2017 SEMI-ANNUAL REPORT

USAID FROM THE AMERICAN PEOPLE

UC DAVIS VETERINARY MEDICINE One Health Institute

WCS

EcoHealth Alliance

METABIOTA

Smithsonian Institution

TABLE OF CONTENTS

ON THE COVER

Sampling bats for the Ebola Host Project in Liberia. The PREDICT/Liberia team works in a field tent at night to safely collect samples from live bats captured as part of the Ebola Host Project (EHP), an ambitious initiative seeking to discover the animal origins and spillover of Ebola virus (*Ebola zairevirus*) and other priority zoonotic pathogens in Sierra Leone, Guinea, and Liberia. EHP was launched in 2016 and in Liberia the project is implemented by PREDICT partners EcoHealth Alliance and the Society for the Conservation of Nature, Liberia. *Photo: PREDICT/Liberia.*

PREDICT/Cambodia

I. PREFACE

USAID | PREDICT

FROM THE AMERICAN PEOPLE

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 over 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.

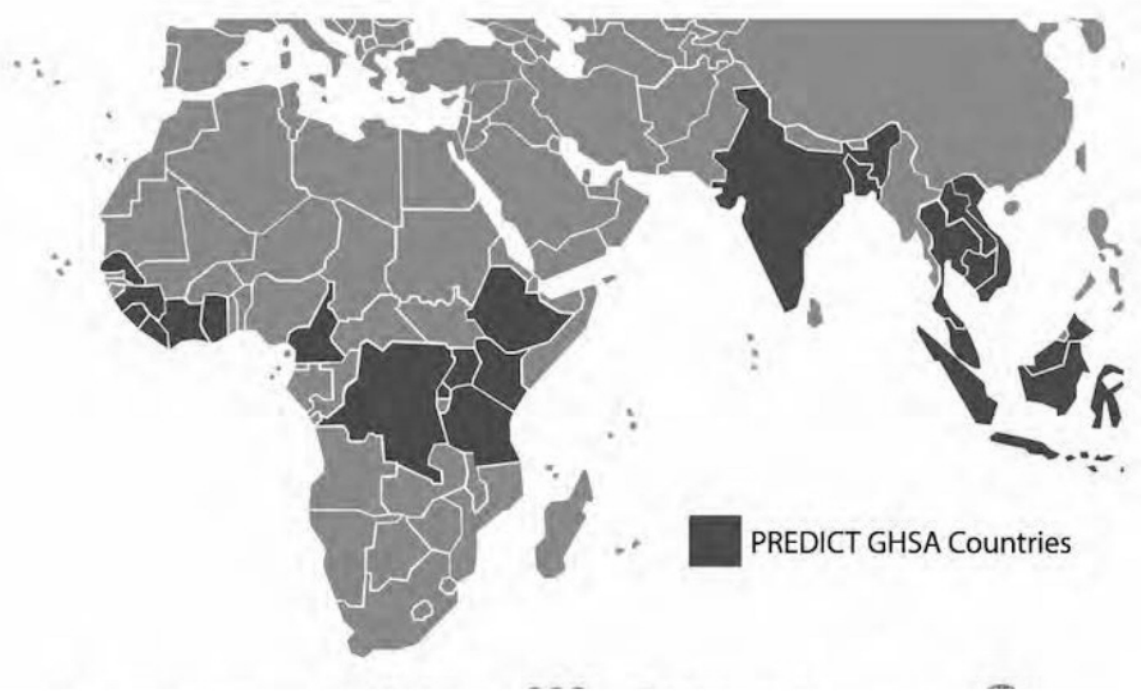
REDUCING PANDEMIC RISK, PROMOTING GLOBAL HEALTH

USAID | PREDICT
FROM THE AMERICAN PEOPLE

Global Health Security Agenda

Supporting the Global Health Security Agenda in Africa and Asia

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.



Using the One Health approach to improve capacity for **zoonotic disease** management and **surveillance** in a cross-sectoral manner and enable early detection of known and emerging disease threats, PREDICT is making significant contributions to strengthen **biosafety and biosecurity**, **national laboratory systems**, and **reporting** efficacy in all engagement-countries, while also improving the stability of these systems through One Health **workforce development**.

The PREDICT Consortium and 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.

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**.

PREDICT/Myanmar

II. MONITORING & EVALUATION

PREDICT Activities with Monitoring and Evaluation Outcomes

ACTIVITY	DEFINITION	MONITORING INDICATOR
Strengthening Systems for Prevention, Detection and Response		
Outbreak Response	Providing technical assistance with outbreak response if requested by the government and approved by USAID	Median number of days from government request to PREDICT assistance
One Health Surveillance and 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	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 in the country with the ability to perform testing for the 4 priority viral families using PREDICT protocols

ACTIVITY	DEFINITION	MONITORING INDICATOR
Workforce Capacity		
Workforce Development: Training	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 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
One Health Strengthening		
Advancement and improvement of One Health practices and 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	Tools developed for implementation and operationalization; Evidence-based informational resources developed including policy briefs, research papers, situational analysis/risk assessment, and zoonotic prioritization resources

OUTBREAK RESPONSE ASSISTANCE

COUNTRIES WHERE PREDICT ASSISTED WITH OUTBREAK RESPONSE

Democratic Republic of Congo • Rwanda • Tanzania • Kenya • Nepal • Bangladesh

8

OUTBREAK RESPONSE SUPPORT

1

AVERAGE NUMBER OF DAYS FROM GOVERNMENT REQUEST FOR PREDICT ASSISTANCE TO ACTIVITY

A field investigation team collects a sample from a dead crow during support provided to the Government of Bangladesh for an unusual die-off investigation. Photo: PREDICT/Bangladesh.

STAFF IN COUNTRY

204

TOTAL STAFF

97%

FROM HOST COUNTRY

STRENGTHENING LONG-TERM ONE HEALTH CAPACITY

CREATING A SUSTAINABLE WORKFORCE FOR ONE HEALTH

198

STAFF FROM HOST COUNTRY

1

STAFF FROM REGION

5

STAFF NOT FROM COUNTRY OR REGION

The PREDICT/Ghana team prepares for a training session on safe sampling of rodents. PREDICT/Tanzania's country coordinator (second from left) provides technical support. Photo: PREDICT/Ghana.

The PREDICT/Cameroon team processes samples in the field. Photo: PREDICT/Cameroon.

ONE HEALTH TOOLS AND RESOURCES

874

TOOLS DEVELOPED FOR IMPLEMENTATION

21

EVIDENCE-BASED INFORMATIONAL RESOURCES

ADVOCACY AND COMMUNICATION TO ADVANCE ONE HEALTH PRACTICES AND POLICY

4

POLICY BRIEFS

17

PUBLICATIONS

USAID | EMERGING PANDEMIC THREATS

FROM THE AMERICAN PEOPLE

ONE HEALTH IN ACTION

USAID

FROM THE AMERICAN PEOPLE

PREDICT

Preparedness&Response

ONE HEALTH IN ACTION

THE ROLE OF ENVIRONMENT IN ONE HEALTH AND NATIONAL HEALTH SECURITY

Across the world, ministries of environment and natural resources and/or environmental protection agencies have different mandates and missions, but many of them focus on the protection of the environment with the goal of protecting public health. Environmental health practitioners monitor food safety from farm to table; are responsible for vector and vermin monitoring and control; and monitor microbial and chemical pollution of the land, water, and air. Natural resource managers monitor ecosystems and landscapes and the creatures that occupy them. They often see trends in the natural world before they are seen in the urban world. For example, unusual wildlife morbidity and mortality can indicate presence

PHOTO BY CHRISTINE JOHNSON

- The majority of known pathogens infectious to

CHARACTERIZING RISK FACTORS & RISK INTERFACES

38

CHARACTERIZED SINCE THE BEGINNING OF PREDICT-2 IN 2014

PATHOGEN, SPILLOVER, AMPLIFICATION AND SPREAD

STRENGTHENING SYSTEMS FOR PREVENTION, DETECTION, AND RESPONSE

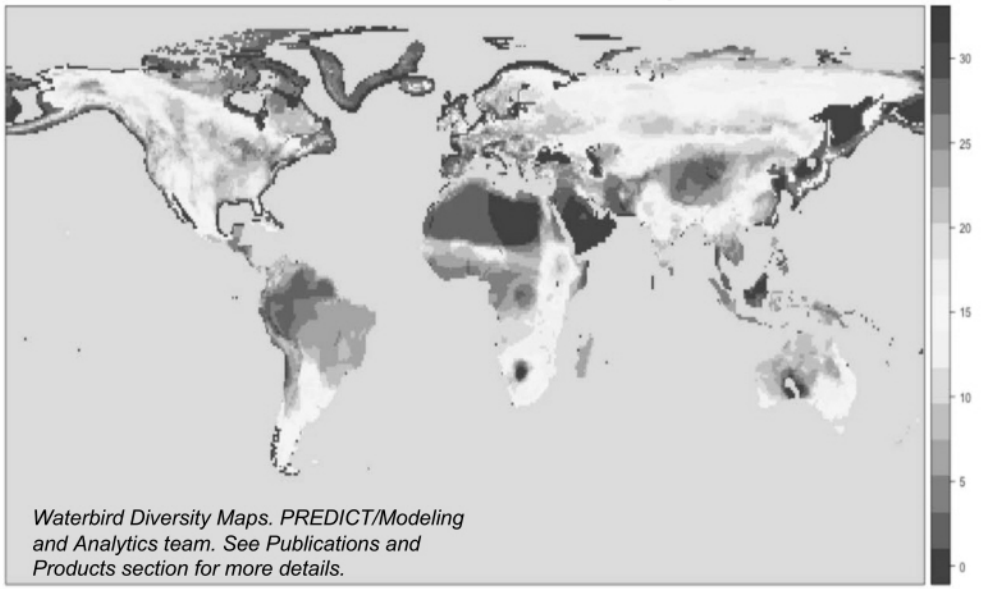
ACQUIRING BETTER INFORMATION ON ECOLOGICAL, BIOLOGICAL, BEHAVIORAL AND OTHER RISK FACTORS FOR SPILLOVER, AMPLIFICATION AND/OR SPREAD

Macaques groom at a temple in Nepal. PREDICT has been exploring risks for zoonotic disease transmission at this high-risk interface in Nepal and other countries where macaques and people are in close contact. Photo: PREDICT/Nepal.

RISK MODELS AND MAPS

48

Models or maps developed, refined, analyzed, and described



Waterbird Diversity Maps. PREDICT/Modeling and Analytics team. See Publications and Products section for more details.

STRENGTHENING EVIDENCED-BASED MECHANISMS FOR PREVENTION

UNDERSTANDING EMERGENCE OF DISEASE PATHOGENS

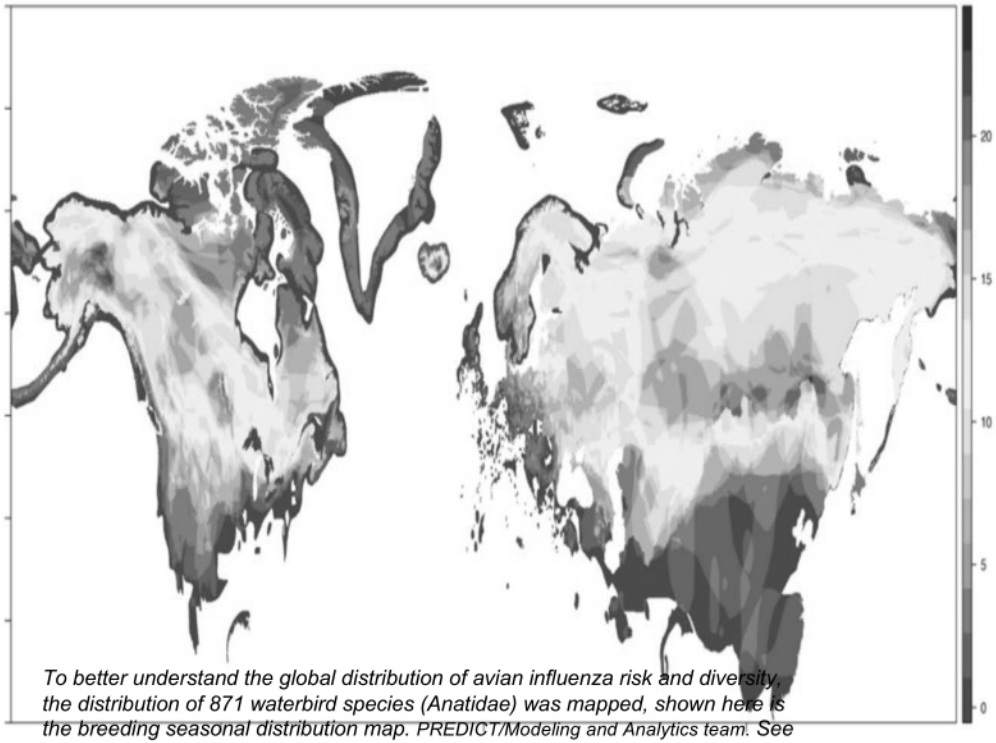
PATHWAYS DESCRIBED

10

VIRAL

38

DISEASE RISK



To better understand the global distribution of avian influenza risk and diversity, the distribution of 871 waterbird species (Anatidae) was mapped, shown here is the breeding seasonal distribution map. PREDICT/Modeling and Analytics team. See Publications and Products section for more details

LAB STRENGTHENING

27

LABS UNDERGOING TRAINING

19

LABS TESTING ALL TARGET VIRAL FAMILIES

STRENGTHENING MECHANISMS FOR DETECTION AND RESPONSE

TARGET VIRAL FAMILIES

CORONA FILO INFLUENZA PARAMAYXO FLAVI

Lab technicians from the PREDICT/Tanzania team work with a trainer from UC Davis to learn viral detection techniques that can detect priority zoonotic diseases. Photo: PREDICT/Tanzania

PREDICT/Malaysia's Mei Ho Lee, who recently passed the biosafety management test, pipettes in a biosafety cabinet. Photo: PREDICT/Malaysia.

ONE HEALTH WORKFORCE CAPACITY

TOTAL # OF PEOPLE TRAINED

318

STRENGTHENING COMPETENCY OF FUTURE AND CURRENT ONE HEALTH PROFESSIONALS

GENDER BREAKDOWN OF TRAINEES*

207 MALES TRAINED

102 FEMALES TRAINED

*Nine trainees did not declare their gender.

The PREDICT/Rwanda human surveillance lead collects a sample from a patient at a health centre. Our PREDICT/Senegal team recently traveled to Rwanda to train in One Health surveillance methods. Photo: PREDICT/Senegal.

INTERVENTION POINTS

PRIORITIZED STRATEGIC PLANNING AND BEHAVIOR COMMUNICATION TO SAFELY AND HUMANELY LIVE WITH BATS IN AND AROUND HUMAN DWELLINGS

DEVELOPMENT OF RISK MITIGATION APPROACHES

Bats trapped outside their roosts at a rural home in Cameroon. PREDICT is developing strategies for reducing disease transmission risk from bats in multiple high-risk interfaces. Photo: PREDICT/Cameroon.

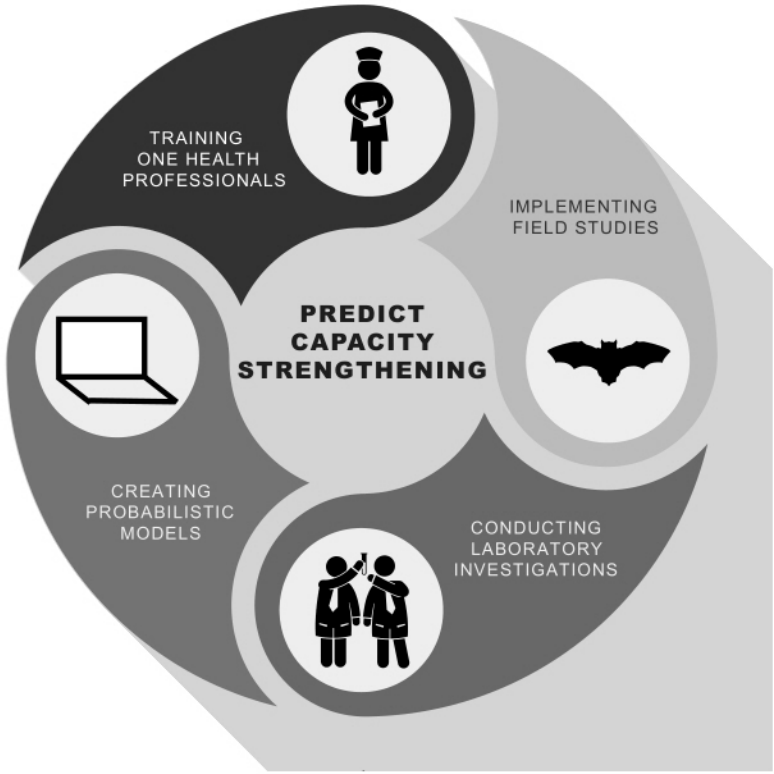
Jonathan Goley/EcoHealth Alliance

III. GLOBAL REPORT

Capacity Strengthening

A systems approach to capacity strengthening around the world

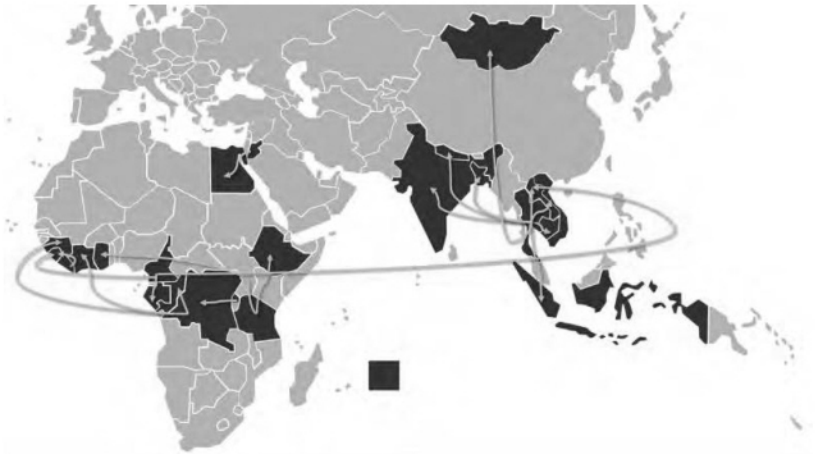
In this era of global connectivity and movement of people and animals, strengthening the entire global system of health professionals that can predict and detect spillover events of emerging viruses before they spread uncontrollably is critical. To this end, PREDICT has been working in many countries in Africa and Asia to conduct 'on the job' longitudinal mentored training to train the next generation of One Health professionals and strengthen global health security. Some individuals excel in focused field, laboratory, or modeling activities, while others span the gamut with cross-cutting skills. Since the start of the project in October 2014, PREDICT has trained 1,298 individuals (35% women) including 1,217 individuals in target countries where we are implementing One Health surveillance activities. Of these individuals, over 450 (35% in total) are host country government staff, a major contribution to long-term improvements in national capabilities for zoonotic disease detection and response.



A regional approach to building capacity for wildlife surveillance and early detection of viral spillover

In both Africa and Asia, PREDICT teams have been working across borders to build capacity for wildlife surveillance at key interfaces where viral spillover may occur. This involves training exchanges (see map) such as in East Africa where the PREDICT/Ethiopia team traveled to Tanzania to learn bat sampling techniques prior to traveling to Uganda to learn viral family laboratory testing techniques. These training exchanges as well as on-site training in Ethiopia led by PREDICT global team members have led to key capability gains in One Health skills in country as the PREDICT/Ethiopia team can now serve as a resource for training additional individuals, and can independently conduct One Health surveillance and test samples to identify known and novel viruses.

Strengthening capacity regionally also involves building a virtual network of One Health professionals who can share ideas, challenges, and opportunities for innovation. For example, an innovative non-invasive technique using chew



PREDICT's ever evolving network of One Health professionals and locations to date of international trainings and knowledge exchange.

Participants at the South Asia regional macaque disease surveillance training holding an anesthetized animal. Photo: PREDICT/Bangladesh

swabs for collecting samples from free-ranging non-human primates was developed by PREDICT and was a result of team dialogue to minimize stress and handling for animals and people in the field. That technique has now been deployed and scaled-up for use in surveillance activities by PREDICT teams around the world in both natural and densely populated urban settings.

Strengthening the wildlife health workforce and improving One Health networks in South Asia

Early detection of viral spillover in animals and humans involves raising awareness and knowledge across various levels within communities, countries, and regions. In March 2017, to support improved workforce capacity in wildlife disease surveillance in the South Asia region, PREDICT/Bangladesh organized a five-day field training on techniques for rhesus macaque disease surveillance, biosafety, and zoonoses. The team trained two Forestry Officers from the Government of Bangladesh, a PREDICT global team member, and one partner from the PREDICT/India team (part of PREDICT's strategy to foster active One Health networks among professionals globally) on rhesus macaque capture and handling. They also trained the group in sampling methods and proper use of personal protective equipment while in the field to ensure the safety of field researchers and animals.

Preparing for outbreaks – the importance of training

PREDICT teams in many countries are invited by governments to assist in outbreaks where undiagnosed diseases are involved and time is of the essence. Being prepared to respond in an appropriate and timely manner is critical to contain an outbreak before it spreads to new populations. This

involves understanding chain of command along with having trained personnel and logistics support in place to respond at any given time. This year, PREDICT intensified capacity strengthening efforts for outbreak preparedness and response through group trainings. For example, in March 2017, PREDICT/Vietnam and Mongolia team members attended a training with EU-LACANET One Health Project, Wildlife Conservation Society, and the National Animal Health Laboratory on investigating morbidity and mortality in wildlife, determining the impacts of the disease/etiology identified on wildlife populations, assessing the risks to public health, and informing disease management and mitigation. The training advanced the skills of wildlife health staff in the region, who through projects like PREDICT can provide critical support and contribute to national capacity for wildlife disease surveillance. Additionally, online learning activities involving a PREDICT ebook resource and tabletop exercises are utilized for training on protocols involved in disease detection and outbreak response. In April 2017, PREDICT/Tanzania conducted a tabletop exercise to work through a mock outbreak that began in pigs and could involve wildlife and humans. This mock outbreak exercise increased team readiness to participate in future outbreak response efforts, and is currently being refined for future use to increase readiness for other PREDICT teams across the globe.

PREDICT/Tanzania team members sample a bat. Like many teams trained during the first phase of the project, members of the Tanzania team have been working with animal and human health professionals from countries new to PREDICT like Ghana and Ethiopia to help strengthen One Health surveillance skills from sample collection to viral testing and analytics. Photo: PREDICT/Tanzania.

One Health Surveillance – Characterizing Biological and Ecological Risk

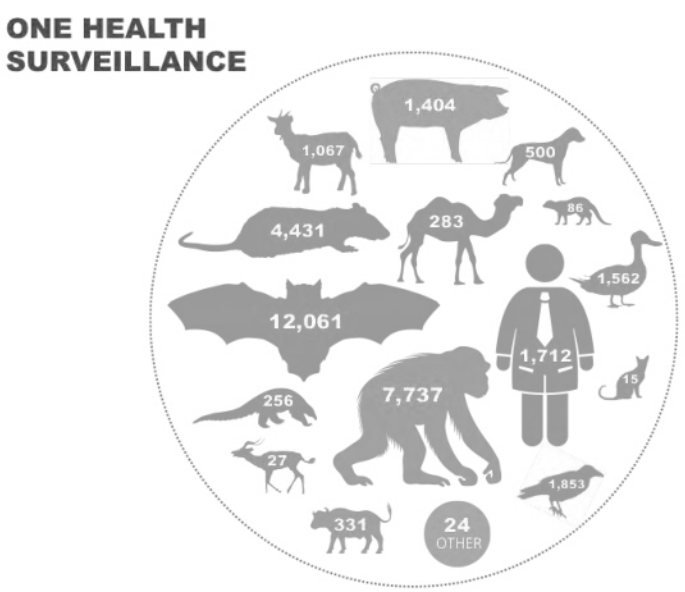
Highlights

We continued optimization of our overall surveillance strategy for animals and humans in coordination with USAID and Emerging Pandemic Threats-2 (EPT-2) partners to detect viral sharing across species, viral spillover in humans, and characterize biological and ecological risk.

We refined our surveillance data collection strategy and tools for risk characterization based on field application and in-country feedback including: 1) site and event characterization with data on animal-human contact, landscape change, and animal and human host ecology; 2) animal information with data on animal contact with people and condition at sampling; 3) sample data, including sample type and condition; and 4) human questionnaire data, including information on occupations, travel, medical history, and animal contact to be collected along with human biological samples.

At the PREDICT Semi-annual Meeting in January 2017, we reviewed global guidelines with regional leads and partners during sessions on operationalizing surveillance, cross-border coordination, and sharing surveillance targets along common epizones.

We engaged with Food and Agriculture Organization (FAO) counterparts on surveillance coordination, both broadly in EPT-2 partner meetings and via regional and local meetings to develop opportunities for collaboration, plan systematic and standardized data collection, and synchronize surveillance activities across wildlife, livestock, and humans. For countries in Africa, we re-adjusted plans mid-year with respect to coordinated triangulated surveillance on livestock sampling



because of FAO directive to focus only on priority zoonotic diseases.

We communicated with local Ministries and in country partners, with FAO where appropriate, to update on surveillance activities and reporting of surveillance data to inform policy development.

We confirmed a list of key contacts for outbreak response activities, as well government and ministry contacts for approval of results for public release. In addition, we implemented outbreak response rapid reporting and completion of checklists to streamline activities in the event a host country government requests PREDICT assistance in outbreak response.

Finally, in collaboration with the Capacity team, we renewed the Institutional Animal Care and Use Committee (IACUC) protocol for safe and ethical animal sampling activities to integrate consortium partner activities in all countries under a single protocol and to update all methods and procedures to better align with PREDICT-2 surveillance plans and targets. We also updated small mammal and rodent sampling methods to align with latest best practices for safe and humane blood collection from facial and saphenous veins and to eliminate the retro-orbital bleeding technique.

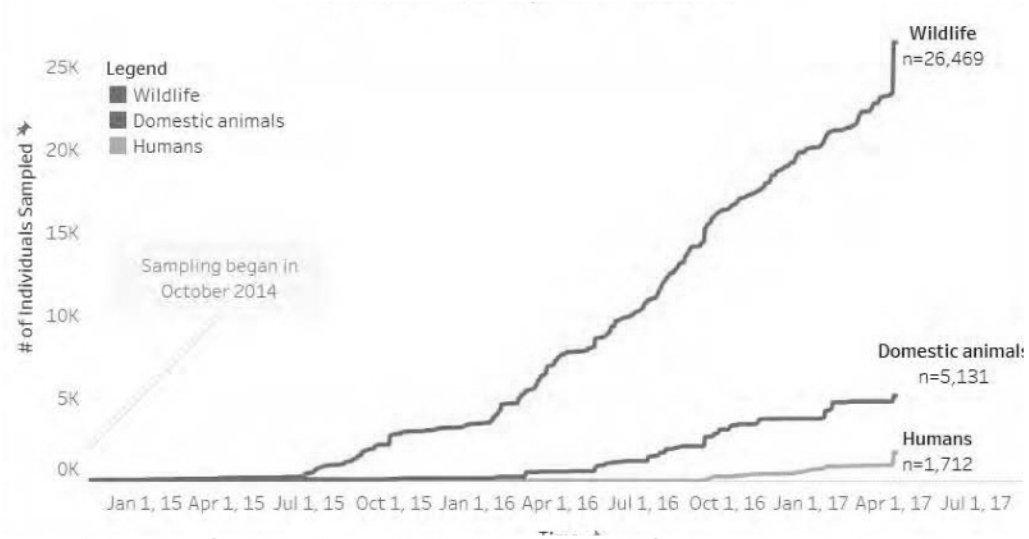


Figure 1. Number of individuals sampled to date among wildlife, domestic, animals, and humans.

One Health Surveillance Success Stories

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

We implemented longitudinal and concurrent surveillance at highest priority sites targeting sampling opportunities for wildlife in contact with people and livestock, livestock in contact with people (coordinated with FAO as appropriate), and initiated surveillance of humans at high occupational risk for zoonotic spillover at sites where wildlife and livestock were proposed for sampling, and humans presenting with undiagnosed syndromes at collaborating clinics/hospitals.

PREDICT has sampled over 26,000 animals and 1,700 people since sampling began in October 2014. Over the past six months, field activities have substantially ramped up with respect to sampling efficiency across wildlife, domestic animals, and humans (Figure 1).

Wildlife

PREDICT made significant progress sampling target wildlife species, primarily bats, rodents, and non-human primates, at high-risk interfaces for zoonotic spillover and spread (Figure 2 next page). Wildlife sampling activities at high-risk interfaces were implemented in 26 countries including: Bangladesh, Cambodia, Cameroon, China, Cote d'Ivoire, Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Guinea, Indonesia, Jordan, Kenya, Lao PDR, Liberia, Malaysia,

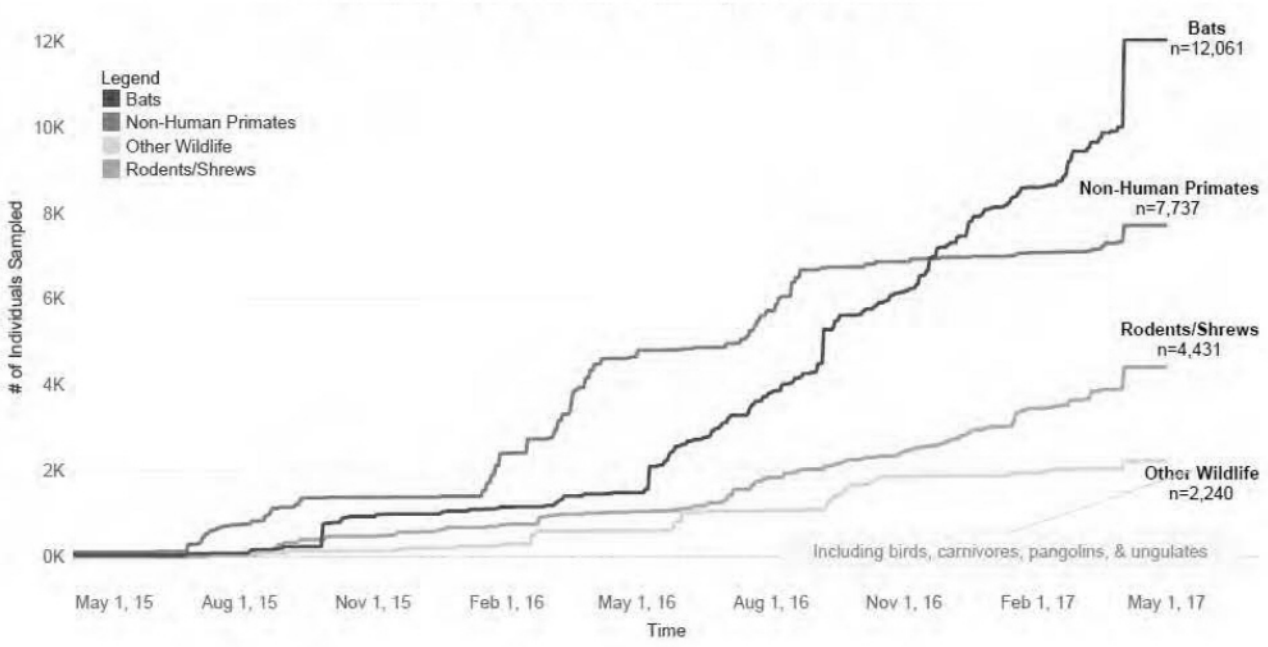


Figure 2. Number of individual wild animals sampled to date, by taxonomic group.

Mongolia, Myanmar, Nepal, Republic of Congo, Rwanda, Sierra Leone, Tanzania, Thailand, Uganda, and Viet Nam.

Livestock and domestic animals

PREDICT has coordinated closely with FAO on planning and sampling livestock at sites designated for concurrent and triangulated surveillance in Asia and Africa. **Concurrent livestock sampling activities were directly supported by FAO in** Viet Nam, Bangladesh, Cambodia, Lao PDR, Malaysia, and Myanmar, and Kenya. PREDICT undertook additional livestock sampling in Bangladesh, Democratic Republic of Congo, Guinea, Sierra Leone, and Uganda. Together with PREDICT teams, FAO undertook sampling of livestock concurrently with wildlife sampling (and human sampling where possible) in Thailand, Indonesia, Nepal, Egypt, Jordan, Ethiopia, and Tanzania (Figure 3 next page).

Due to the recent change in FAO priorities, livestock sampling will likely not be prioritized further in **Liberia, DR Congo, Rwanda, Republic of Congo, Cameroon, Ghana, Senegal, Cote d'Ivoire.** In a few countries, (e.g. Ethiopia, Kenya, and Tanzania), livestock were a central focus for collaboratively prioritized field activities and in some cases sampling was initiated by FAO. For future livestock work, PREDICT is evaluating the feasibility of undertaking the additional fieldwork and laboratory testing of livestock in these few countries to ensure of integrity of our surveillance plans.

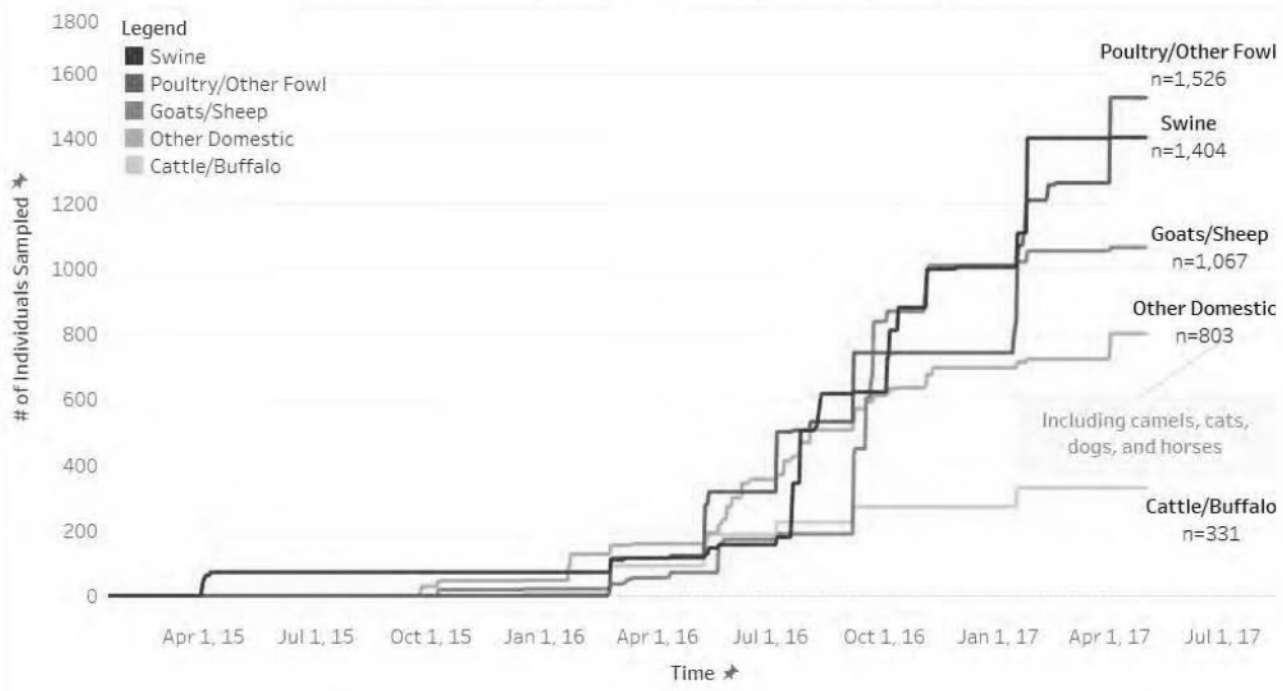


Figure 3. Number of individual domestic animals sampled to date (with data entered into EIDITH).

Humans

To date, **12** countries have received in-country ethical board approval for human biological surveillance, including Cambodia, China, Nepal, Egypt, Cote d'Ivoire, DR Congo, Ghana, Guinea, Rwanda, Sierra Leone, Tanzania, and Uganda. PREDICT shared a comprehensive human syndromic surveillance guide and human sampling protocol, detailing the collection of biological samples and risk characterization data for patients in clinics and hospitals.

Human biological sampling and risk characterization surveys using PREDICT's human questionnaire were initiated in **high-risk communities** in **three** countries: Cambodia, Egypt, and Nepal. Human biological sampling and risk characterization **at hospitals and/or clinics** were initiated in **four** countries: Rwanda, Uganda, DR Congo, and China. Both community and clinic-based sampling efforts seek to identify viruses in people with frequent, direct, and often intense contact with wild

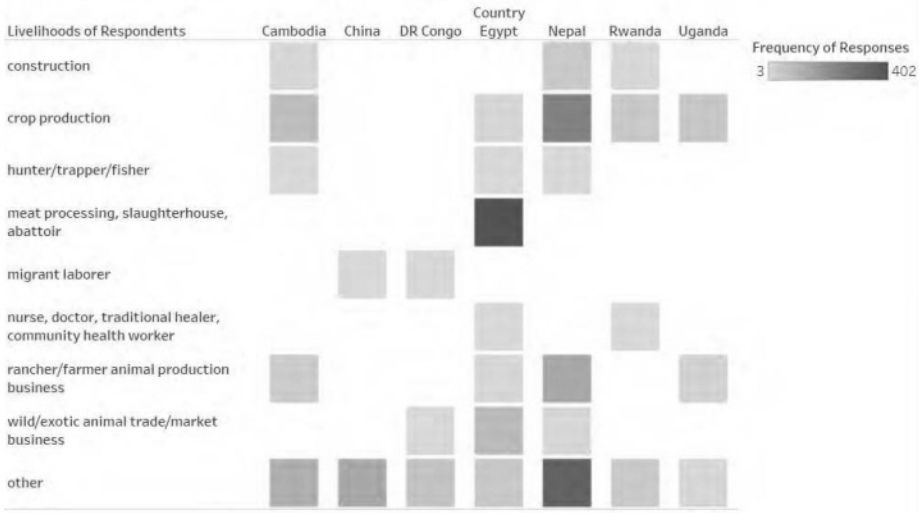


Figure 4a. Livelihoods of individuals sampled in the community or patient clinical setting (note: many individuals responded with more than one livelihood).

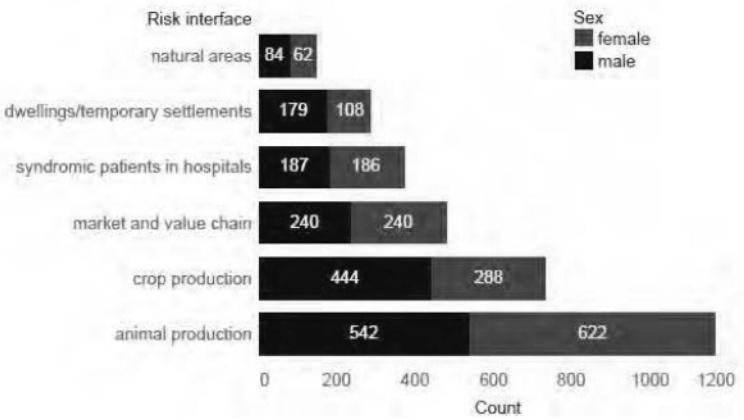


Figure 4b. High risk interface modules completed by individuals sampled in the community or patient clinical setting, disaggregated by gender (note: many individuals sampled had more than one disease transmission interface).

animals. Livelihoods of people sampled in communities and clinic settings in the above seven countries are shown in Figure 4a (above).

In participating countries, people were sampled across a range of disease transmission interfaces within land use settings and anthropogenic activities that pose risk for viral spillover (Figure 4b above right). Additional data were gathered through specific human questionnaire survey modules to characterize the biological, ecological, and behavioral risk inherent to these settings (See the *Investigating Behavioral Risk* section for more details).

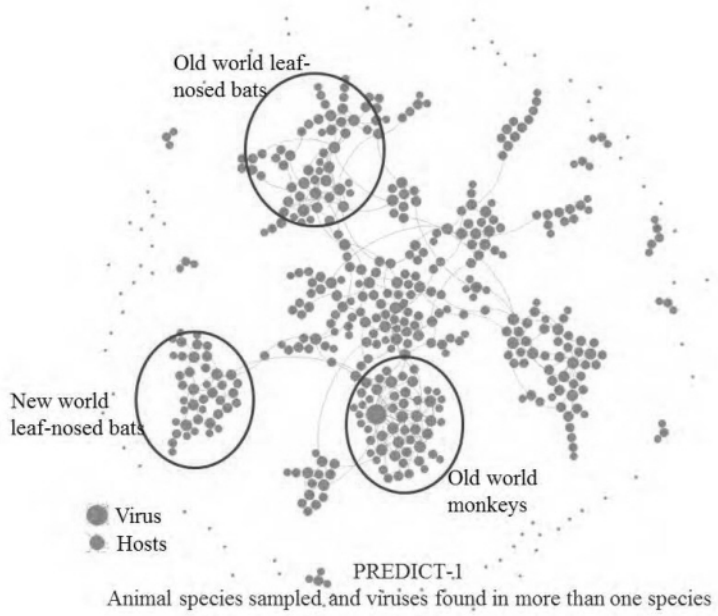
Characterizing Biological and Ecological Risk for Viral Spillover, Amplification, and Spread

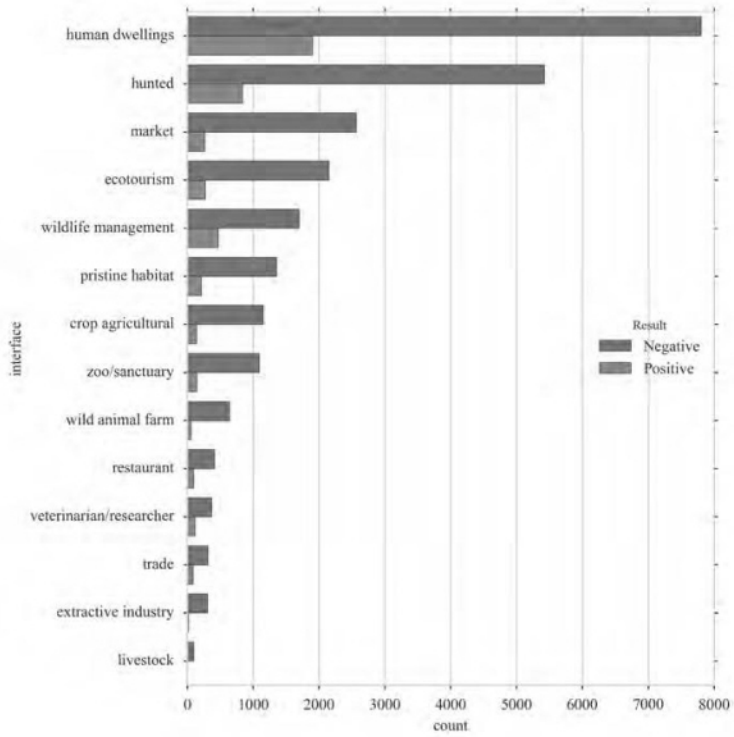
PREDICT developed a risk characterization strategy and initiated development of tools and packages to define risk at the individual level and characterize risk across populations. In all surveillance activities involving wildlife, domestic animals, and people, the same data are collected to facilitate risk biological and ecological risk characterization and host-pathogen dynamics at high-risk interfaces. Tools are now in development, in the form of tables and figures with key metrics to assist country teams in identifying the ecological and biological risk factors for viral spillover, amplification and/or spread. In advance of completion of field data collection activities, the surveillance team is using previous publications based on PREDICT-1 data and/or global disease datasets to identify the points at which animal-human or animal-animal contact occurs that can result in spillover, understand which practices and behaviors facilitate/promote virus spillover from wildlife into livestock or humans or from livestock to humans, persistence/amplification/spread in animals, and/or spread in humans. Findings from risk characterization for studies published in year 3 are summarized below, and will be shared with host country governments to inform future surveillance recommendations and support identification of interventions and public policy.

COUNTRY	RISK FACTORS/INTERFACES DEFINED
LAO PDR, CAMBODIA	Bats are host to astroviruses shed in feces. Astroviruses are distributed widely and some have been identified as a cause of gastroenteritis in humans and other mammals. Wildlife species living close to human habitats could represent a risk for transmission of astroviruses to humans and domestic animals (agent/host risk factor linked to potential for spillover; based on PREDICT data)
LAO PDR, CAMBODIA	Bats are host to a diverse array of coronaviruses (coronaviruses of animal origin were responsible for the Severe Acute Respiratory Syndrome [SARS] outbreak in 2003–2004 and the current epidemics of Middle Eastern Respiratory Syndrome [MERS] in the Arabian Peninsula and Korea). Findings are of importance for public health as Lao PDR and Cambodia have a high biodiversity of bats, often at high-risk interfaces in close proximity to people (agent/host risk factor linked to potential for animal to human spillover; based on PREDICT data)
CHINA	Bats are hosts to novel filoviruses in China. Findings suggest that these viruses have been circulating in two bat species and that densely populated bat caves provide opportunity for cross-infection with different viruses. Considering their feeding habitats, fruit bats are often in close contact with domestic animals and human populations (host risk factor linked to potential for animal to animal or animal to human spillover; based on PREDICT data)

GLOBAL	The expanding international wildlife trade combined with a lack of surveillance for key animal diseases in most countries represents a potential pathway for transboundary disease movement (host/agent risk factors linked to potential animal to animal or animal to human spillover, based on in-depth literature review of reports of OIE-listed terrestrial animal diseases in wild animals)
GLOBAL	The number of declared wildlife shipments into the USA has doubled since 2000, illustrating continually increasing demand, which reinforces the need to scale up capacity for border inspections, risk management protocols and disease surveillance (host/agent risk factors linked to potential animal to animal or animal to human spillover, based on comprehensive data US Fish and Wildlife Services database)
GLOBAL	Bats are host to a diversity of viruses in the coronavirus (CoVs) family, and global diversity and distribution of CoVs in bats is non-random and is driven by variation in the biogeography of bats (host/agent risk factors linked to potential animal to animal or animal to human spillover; based on PREDICT data)
BANGLADESH	Nipah virus was found in Indian flying foxes outside of the area currently recognized to be experiencing recurring outbreaks, suggesting spillover is possible anywhere in Bangladesh if a suitable strain and bat-human interface were present. Human activities such as date palm sap harvesting, concurrent with viral circulation in local bat populations are likely to be the major driver of human outbreaks in Bangladesh (host/agent risk factor and high-risk interface linked to potential animal to animal or animal to human spillover; based on PREDICT data)
EGYPT	High MERS-CoV seroprevalence and the presence of active viral infection circulating in imported and resident camels are indications that MERS-CoV may have become ubiquitous in Egypt. Transport stress and close vicinity of imported camels during transport may precipitate disease dissemination, particularly in animals with latent infection and carrier animals (host/agent risk factor and high-risk interface linked to potential animal to human spillover)
UGANDA/GLOBAL	MERS-related CoVs are highly associated with bats and are geographically widespread (host risk factor linked to potential for animal to human spillover)

Understanding risk of viral sharing and spillover at animal-human interfaces





Figures 5 and 6. Bipartite host-virus network showing viruses found in more than one species. Clustering of hosts shows viruses shared in taxonomically related host species (at left). Number of animals sampled at different interfaces and frequency of negative and positive test findings using PREDICT viral detection protocols (cPCR) (above).

Risk of viral spillover was further investigated with PREDICT-1 data on the epidemiological context for human contact with animals and possible direct and indirect disease transmission routes for all animals sampled from 2009-2014. We assessed sampling and testing effort for all host-interface combinations to evaluate power to detect differences across the 17 categorized interfaces investiagted in PREDICT-1.

Risk of viral spillover at all wildlife-human interfaces is being further characterized based on detection of: 1) known viruses, 2) novel viruses, and 3) viruses with high host plasticity, stratified by viral family as appropriate. Viruses with high host plasticity pose greater zoonotic risk and are more likely to spread. To identify viruses with higher host plasticity and further understand clustering among hosts sharing the same viruses we constructed a detailed network analysis of PREDICT-1 host-virus data. Animal species and viruses with highest centrality measures (higher degree and betweenness centrality) were identified.

Analyses are providing insight to optimize surveillance activities in PREDICT-2 and characterize risk for viral spillover and spread.

Characterizing wildlife hosts of zoonotic flaviviruses to predict zoonotic reservoir hosts and inform surveillance activities

Surveillance activities to recognize important animal reservoirs for human diseases are hampered by incomplete geographic coverage. This flavivirus-specifiic activity seeks to build on PREDICT surveillance efforts by identifying likely sylvatic hosts of flaviviruses beyond the wild animal hosts discovered to date. Data have been collected on all known and suspected flavivirus hosts and vectors, and we used a gradient boosted regression tree model to predict hosts with a high probability of serving as a host for different flaviviruses, based on their ecological traits, behaviour, and interactions with known flavivirus vectors. Intial model results have been used to prioritize animal species with samples collected in PREDICT-1 for additional testing using yellow fever and zika specific PCR tests. Subsequent modelling predictions seek to further evaluate differences in flavivirus predilictions for different hosts and geographic areas with wildlife hosts that have a high probability of enabling sylvatic cycles of flavivirus transmission that can potentiate viral spread and continued spillover to human populations.

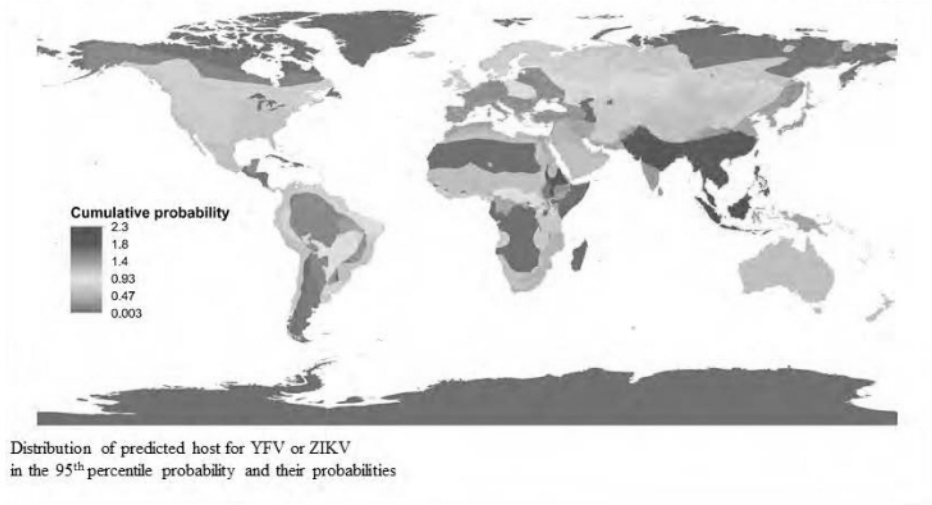
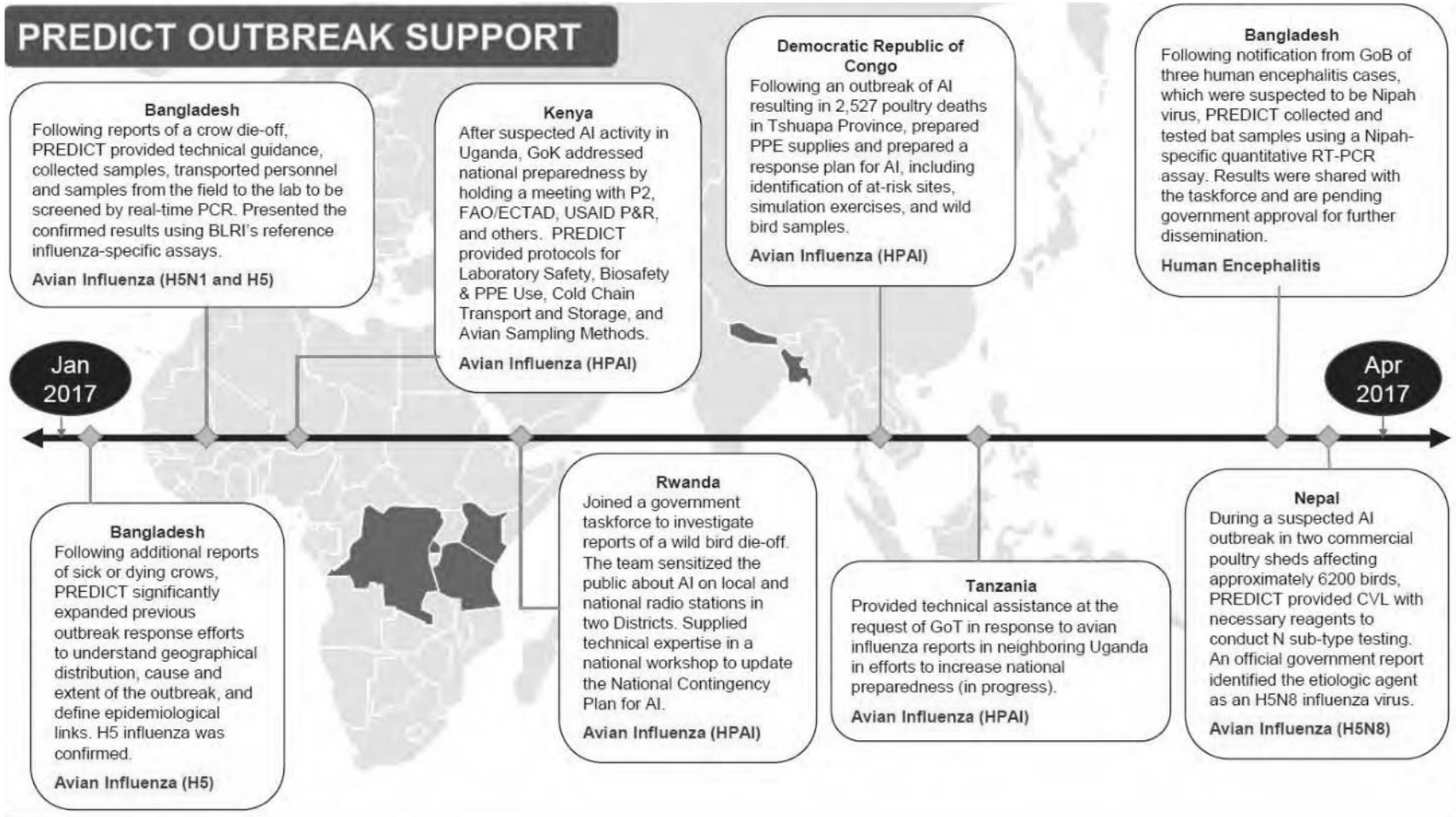


Figure 7. Distribution of predicted hosts for Zika virus and Yellow fever virus and their probabilities of being a host for one of the viruses.

Outbreak Assistance

Between Oct 2016 and March 2017, PREDICT provided support to government and international organizations during **eight** outbreaks in **six** countries. PREDICT assisted host governments during epidemics of zoonotic diseases involving wildlife populations (wild birds), and avian influenza epidemics in poultry. Of these outbreaks, many involved technical support to government response teams. The Outbreak Response Timeline (below) describes the support provided during outbreak response efforts. Additional information on outbreak response efforts is included in the country-specific sections as relevant.



Investigating Behavioral Risks

Training behavioral scientists worldwide

The Behavioral Risk team continues to build capacity internationally through trainings on topics such as: Human Subjects Research, Questionnaire Administration, and Qualitative Methods (including semi-structured interviewing, focus group moderation, observational research, and coding). Additional training information can be found in the Capacity Strengthening section. The map (right) provides a snapshot of behavioral risk data collection activities across the globe.

Collecting data to contextualize exposures and behavioral risk

Behavioral risk data collection has been initiated in 15 countries. As part of project activities to explore risks for zoonotic disease transmission and animal contact in depth, teams in 10 countries have conducted over 700 ethnographic interviews and over 40 focus groups (comprised of close to 350 participants). We have begun to analyze these data and are actively working with country teams to provide support for data analytics. Early insights from ongoing analyses are provided below.

What have we learned?

Bat-focused behavior change messaging

The behavioral risk team conducted a preliminary analysis of potential messaging for behavior change interventions using bat-focused interventions as a case example, given their relevance to large-scale pandemics, including SARS and Ebola.

Snapshot of Behavioral Risk Activities across the Globe

Analysis of qualitative data will continue on an ongoing basis in conjunction with analysis of other data from One Health surveillance activities, including biological sampling and quantitative behavioral questionnaire data. Items from the questionnaire that can be potentially triangulated with qualitative data include:

- Demographic data (drinking water, toilets, food storage)
- Occupational and livelihood data
- Medical history (help seeking behaviors, beliefs about cause of symptoms)
- Data on human movement (exposures due to travel)
- Data on animal contact

In-depth Bushmeat Value Chain investigations in the Democratic Republic of Congo (DRC) and the Republic of Congo (ROC)

In-depth behavioral risk investigations in DRC

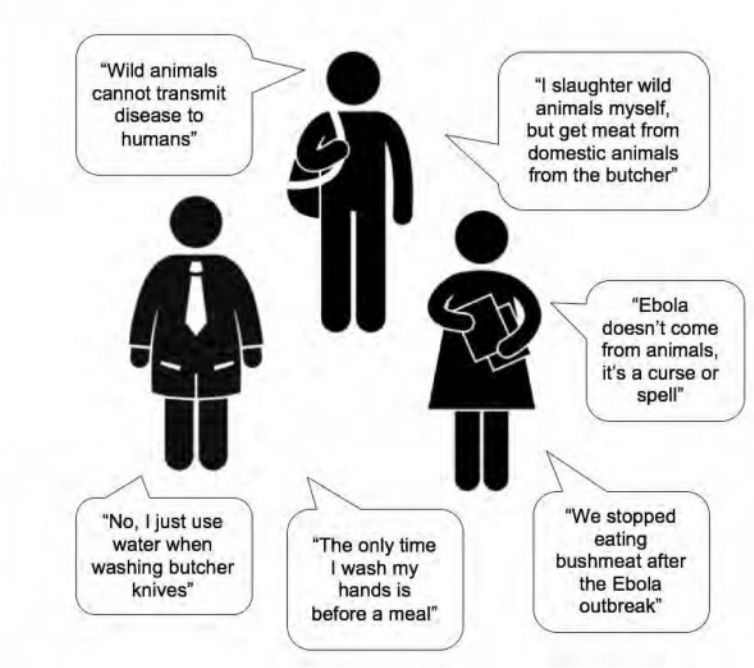
The PREDICT DRC team completed 21 quantitative questionnaires and 33 in-depth interviews with vendors, wholesalers, transporters, and distributors from eight main bushmeat markets in Kinshasa. The dynamics of these markets were originally characterized during our formative behavioral data collection phase in early 2016, when 25 vendor interviews were conducted in these markets. Through these interviews, discussions were held on beliefs about disease transmissibility, where people source their meat, and from whom they purchase it, with the goal of talking to a respondent's bushmeat value chain contacts, such as wholesalers, distributors, and transporters.

The behavioral data collection work is part of ongoing One Health surveillance in Kinshasa, where syndromic surveillance including biological sample collection and administration of the behavioral risk questionnaire is being conducted in two hospitals (Kingasani and St. Joseph) that are adjacent to some of the bushmeat markets targeted for further in-depth qualitative behavioral risk investigation.

Preliminary insights

Animal to human transmission of illness

- Many individuals, particularly bushmeat butchers and vendors, expressed doubt that wild animals could transmit illness to humans. They often drew on personal experiences, explaining that they would have already fallen ill if this was a significant risk. Wild animals are seen as "natural" and uncontaminated whereas domestic animals are sometimes perceived as risky to human health, due to artificial conditions.
- Vendors in Kinshasa bushmeat markets independently reported a similar story about the origins of the most recent Ebola epidemic. According to interviewees, a hunter in the forest caught a wild animal and left it in a cage while he continued hunting. Another hunter came and stole this hunter's catch and sold it in the market. The first hunter put a spell on this meat, and subsequently everyone that ate this meat became sick, and died from Ebola.
- Many bushmeat vendors interviewed in all sites in DRC reported that Ebola severely affected the bushmeat trade for around 3-6 months. Public health messages about



Risk perceptions from bushmeat market interviews in DR Congo.

Ebola were received by many interviewees and consumers reported avoiding bushmeat, especially monkeys, during this period, out of fear of Ebola. During that 3-6 month period, fear of Ebola devastated bushmeat market business, reported bushmeat vendors.

Biosecurity in bushmeat markets

- Concerns about biosecurity are consistently voiced in markets by butchers and vendors, specifically in the sections of markets where bushmeat is sold. Some animals were slaughtered, butchered and sold in one place, other meat arrived recently killed but fresh and then were smoked, and others meat arrived already smoked and ready to be sold.
- Disposal of bio-waste: most vendors interviewed use wooden or concrete slabs covered with cardboard or cement bags to cut and butcher the meat, both domestic and wild. They leave these soiled cardboard pieces for the trash removal service, which comes weekly or daily in the larger markets of Kinshasa, and which vendors must pay for to remove the waste and viscera each evening. Small markets, or informal roadside markets have less organized structures for disposing of waste.
- Water/hand washing: due to water scarcity and lack of functional water faucets, for many it is very difficult to wash their hands. For some bushmeat vendors and slaughterers, the only time they are able to wash their hands is just before they eat.
- Veterinary services: in certain markets, it was noted there is a lack of veterinary services, and in others, veterinary services exist, but mostly to inspect domestic animals, because they are more concerned about them than bushmeat. Some vendors are skeptical of the vigilance of inspectors as they report often having to pay brides. Many participants reported inspections when meat arrived at the port, but were skeptical of the vigilance of the inspectors.
- Butchering/slaughtering: many bushmeat vendors reported butchering or slaughtering bushmeat themselves, without the use of abattoirs. Whereas with domestic animals, it is more common to take the animals to an abattoir for slaughtering. Field staff and vendors observed that no protection was used, and furthermore, respondents would manipulate entrails of animals by hand, and continue touching other things, without washing their hands. Individuals also use the same utensils to slaughter, butcher and eviscerate all the animals they find. They use a cloth, or piece of foam to wipe down the utensils and rinse them at the end of the night with water only.

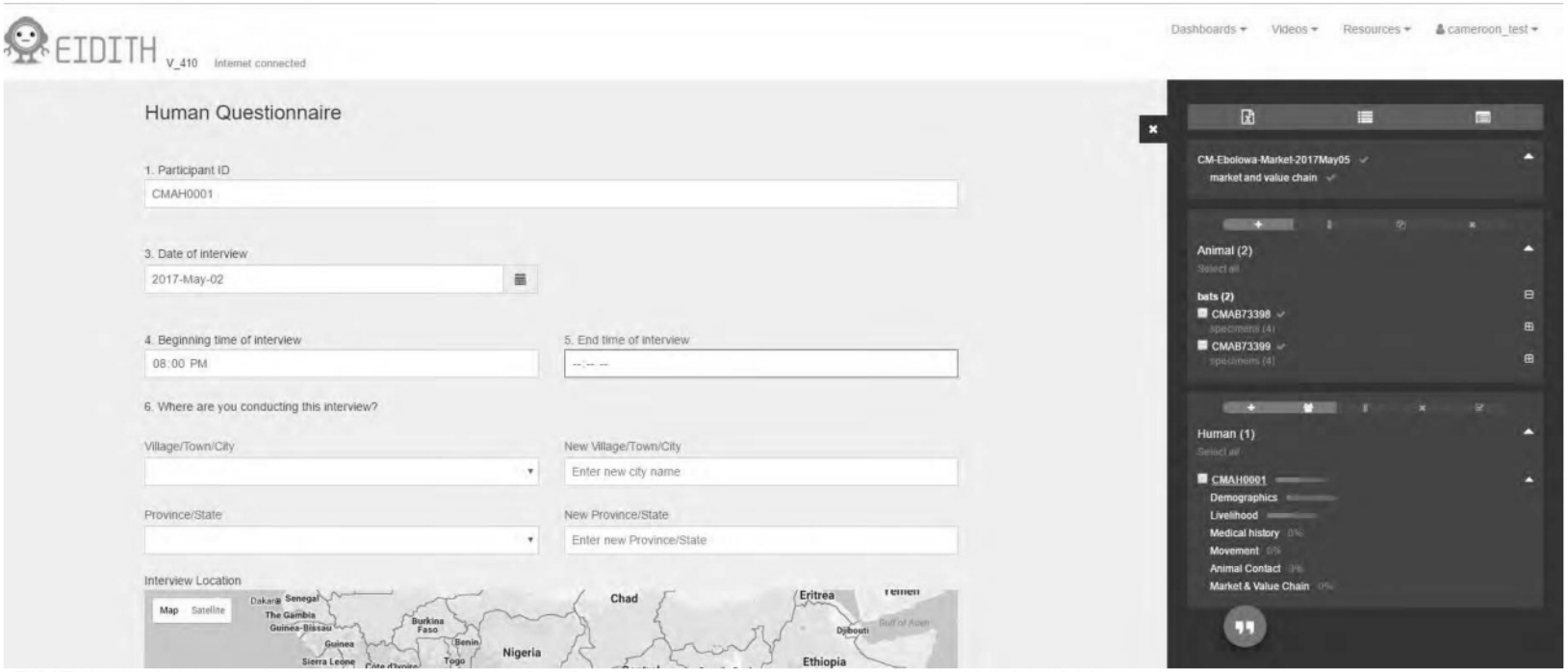
In-depth behavioral risk investigations in ROC

The PREDICT/ROC team identified and trained two Brazzaville-based interviewers (previous USAID/PREVENT – project supervisors) on behavioral research methods and the PREDICT protocol. Observational research was conducted at three fresh bushmeat markets: Marche Totale, Draggage, and Ouenze. PREDICT interviewers completed 12 questionnaires in three markets and one bushmeat restaurant in March 2017, and will continue to administer questionnaires at all sites. In the next 3-6 months, the team plans to conduct ethnographic interviews and focus groups with contacts of identified vendors and work their way up the bushmeat value chain to wholesale distributors, restaurant owners, private clients, butchers, and hunters. A parallel sampling approach will be used to enable comparison to Kinshasa market sites: 30-40 ethnographic interviews with bushmeat market vendors in five selected bushmeat markets and 10-15 ethnographic interviews with bushmeat restaurant workers in Brazzaville (planned for April – June 2017).

Improving Global Surveillance Networks

Strengthening One Health data platforms

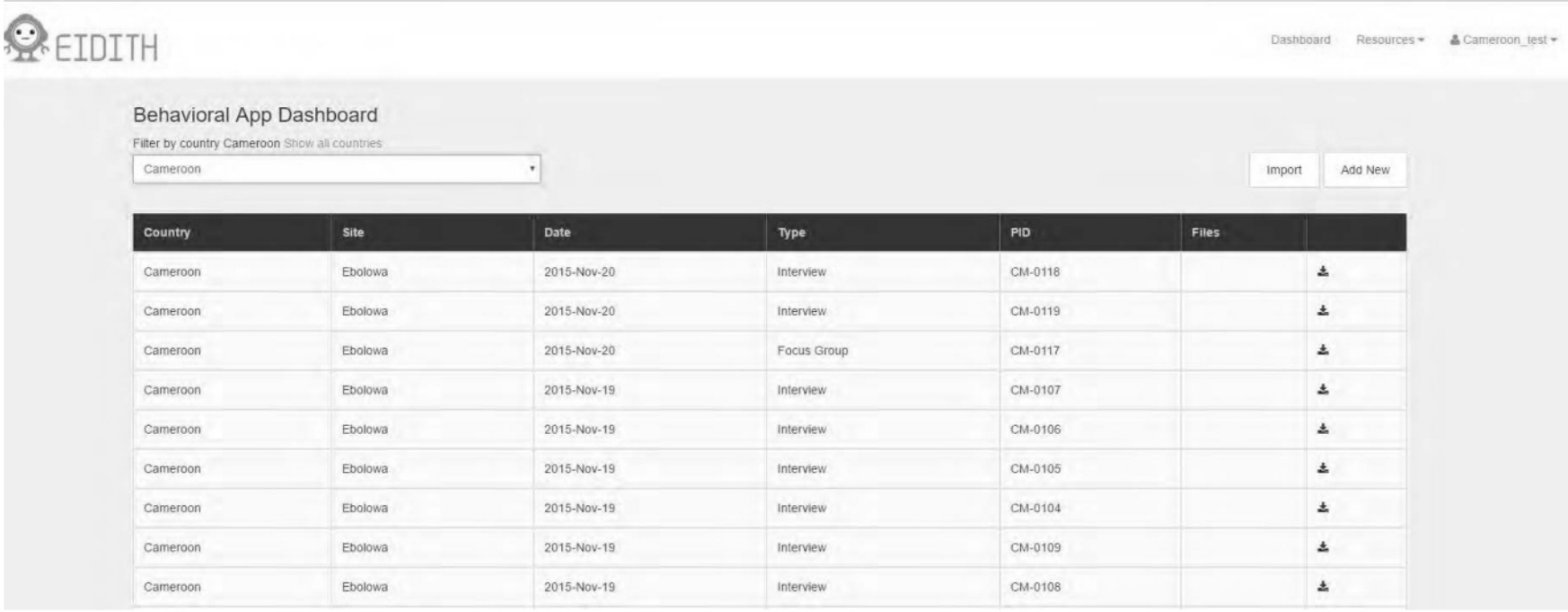
The Emerging Infectious Disease Information and Technology Hub (EIDITH) *Surveillance Data Collection Application* was continually optimized to improve efficiency and scope. These improvements included the ability to clone events, and the development of additional tools for uploading large batches of animal, sample, specimen, and test result data using Microsoft Excel templates. Morphometric data collection fields for all taxa groups were also added to improve data completeness and web application forms were added to report serological test results. Further, a new *Country Indicator Report* was added to assist the country teams and global leads with tracking data and progress of submissions.



EIDITH's newly improved application for entering data from human surveillance and behavioral risk activities.

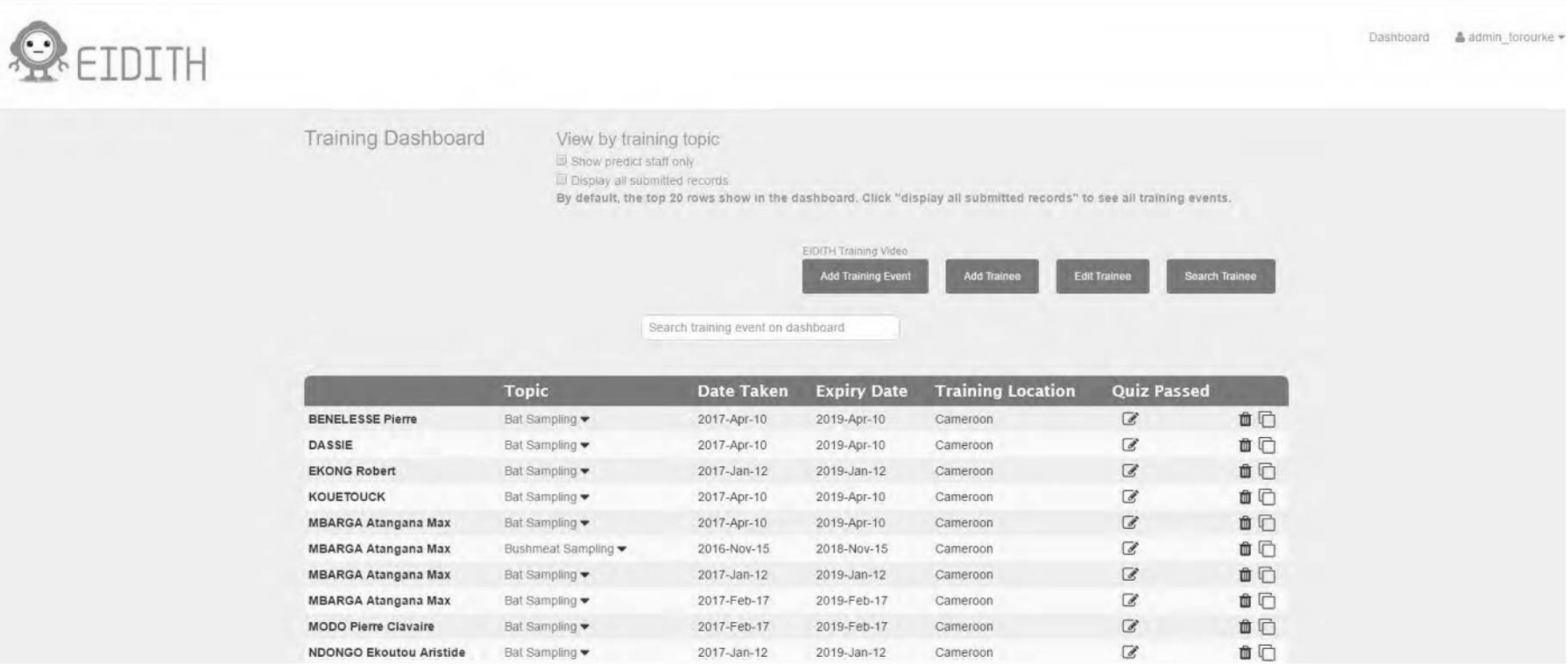
To enable paper-based data collection and rapid digitization, optical mark recognition (bubble) forms and a web application for collection of data about human-animal contact and other risk factors were created. This allows human data to be entered concurrently with animal surveillance data. Human questionnaire bubble forms specifically for use in behavioral risk investigations for the Ebola Host Project were also released during this period.

In collaboration with the Behavior Risk team, we released the *Behavioral Application* allowing behavioral data from qualitative research activities to be integrated with quantitative surveillance data. The app collects metadata from ethnographic interviews and focus groups and enables capability for teams to upload and archive transcripts.



Country	Site	Date	Type	PID	Files	
Cameroon	Ebolowa	2015-Nov-20	Interview	CM-0118		
Cameroon	Ebolowa	2015-Nov-20	Interview	CM-0119		
Cameroon	Ebolowa	2015-Nov-20	Focus Group	CM-0117		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0107		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0106		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0105		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0104		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0109		
Cameroon	Ebolowa	2015-Nov-19	Interview	CM-0108		

A screenshot of the dashboard from the new Behavioral data application enabling PREDICT teams to better assess and link data collected under all project activities from qualitative work (e.g., ethnographic interviews and focus groups) and quantitative data (biological sample data, viral findings, and behavioral risk surveys).



A screenshot of the training app dashboard, which allows improved monitoring of the status of all PREDICT trainees and staff.

Finally, to support the Capacity Strengthening team with monitoring of project training status, new forms for tracking trainees were added to the EIDITH *Training Application*. These forms improve data entry and the accuracy of reporting on PREDICT training activities and allow managers the capability to view trainee status to ensure all staff are adequately trained for planned activities.

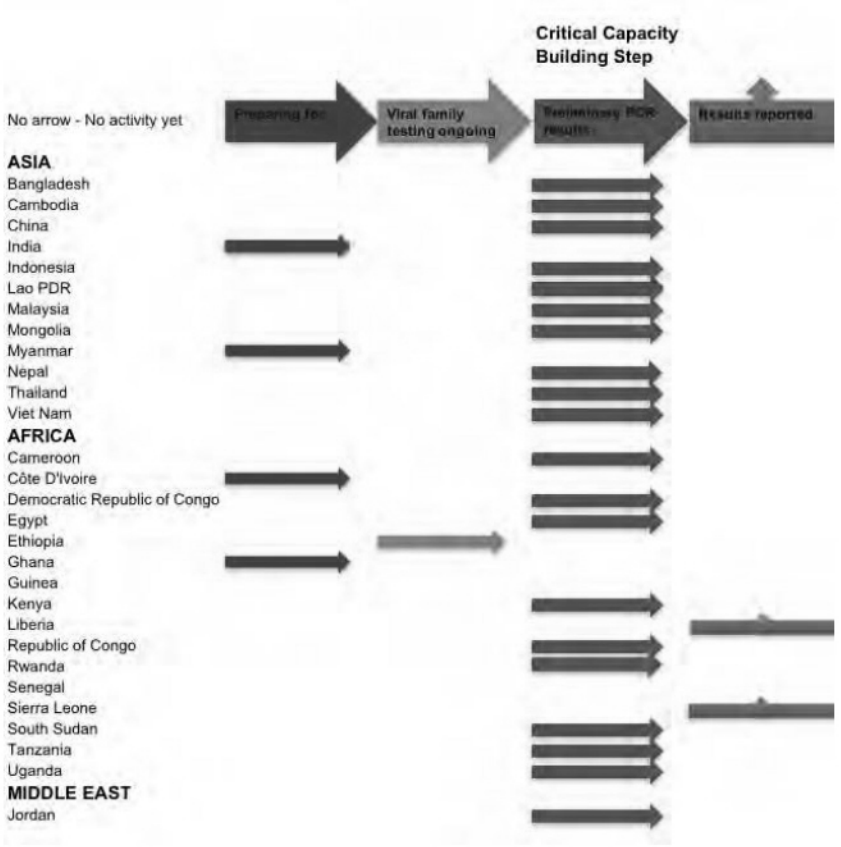
Viral Detection and Lab Implementation

Laboratory capacity building

PREDICT is targeting 48 laboratories for training and testing for priority viral families (Corona, Paramyxo, Filo, Influenza, Flavi viral families), 26 gained 1-step increase in capacity and five labs gained a 2-step increase: eight labs began training/preparing for testing, eight began testing, 15 labs produced preliminary results, 12 labs submitted sequence results for interpretation, government results reports have been prepared for seven countries, and reports have been presented to two countries.

The PREDICT/Ethiopia team with students from Addis Ababa University, and technicians from the Ethiopia Public Health Institute and National Animal Health Disease Investigation Center during viral detection training with the PREDICT lab manager from UC Davis Photo: PREDICT/Ethiopia.

Summary of major milestones in laboratory testing by country



PREDICT viral interpretation results*

Viral Family	Number of known viruses found in P1	Number of novel viruses found in P1	Number of additional known viruses found in P2	Number of additional novel viruses found in P2	Total
Coronavirus	31	69	7	8	115
Paramyxovirus	12	74	0	16	102
Filovirus	0	0	0	0	0
Influenza virus	8	0	0	0	8
Flavivirus	3	5	0	0	8
Hantavirus	4	3	2	0	9
Rhabdovirus	0	31	0	3	34

**Not yet approved for release; subset of PREDICT-1 data for selected viral families*

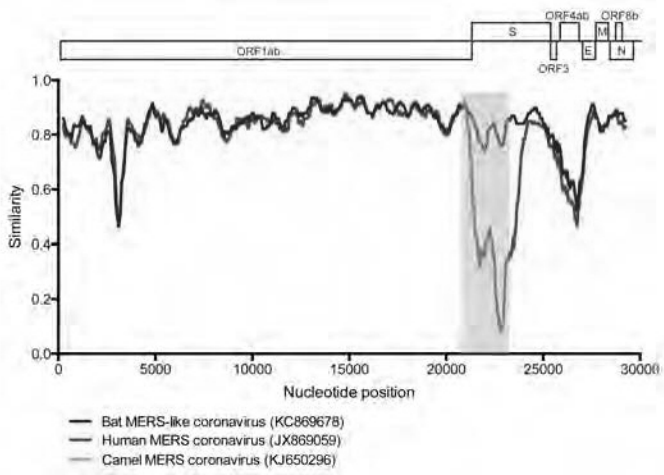
New publications

Further evidence for bats as the evolutionary source of MERS Coronavirus, published in *mBio*, 2017 Mar-Apr; 8(2): e00373-17

Summary of findings: We describe a MERS-like CoV identified from a *Pipistrellus cf. hesperidus* bat sampled in Uganda (strain PREDICT/PDF-2180), further supporting the hypothesis that bats are the evolutionary source of MERS-CoV. Phylogenetic analysis showed that PREDICT/PDF-2180 is closely related to MERS-CoV across much of its genome, consistent with a common ancestry; however, the spike protein was highly divergent (46% amino acid identity), suggesting that the two viruses may have different receptor binding properties. Structural modeling and generation of a MERS-CoV recombinant virus showed the virus did not have the key residues to enter and maintain infection in human cells. Our findings suggest that PREDICT/PDF-2180 is unlikely to pose a zoonotic threat. Recombination in the S1 subunit of

Distribution of Pipistrellus hesperidus *(based on IUCN data) and the location of the bat positive for this virus.*

the spike gene was identified as the primary mechanism driving variation in the spike phenotype and was likely one of the critical steps in the evolution and emergence of MERS-CoV in humans.



Nucleotide identity Simplot showing that PREDICT/PDF-2180 is closely related to MERS-CoV across much of the genome but highly divergent in subunit 1 of the spike protein, suggesting that it has different receptor binding properties.

Accepted for publication to the journal *Virus Evolution*: Global patterns in coronavirus diversity.

Summary. Through an innovative approach, this article addresses the critical need to identify ecological and evolutionary drivers of coronavirus (CoV) diversity at hotspots for zoonotic emergence. Using PREDICT data from 20 countries and including sequences from 100 unique viruses (91 from bats) the study “cements bats as the major evolutionary reservoir of coronaviruses.” In addition, the study provides a model for exploring global viral diversity and advances the overall understanding of CoV biodiversity and risk factors for zoonotic emergence.

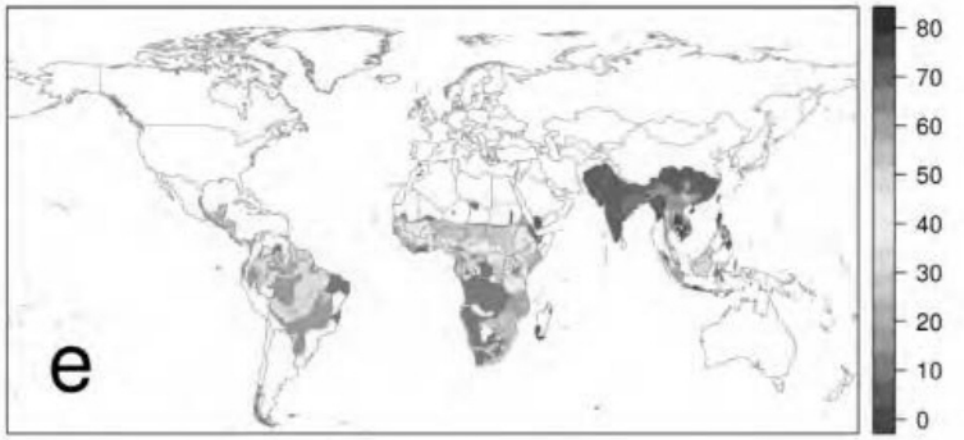
Tools in development

- **Coronaviruses**: Completed a further six full-genome sequences for PREDICT corona viruses to: 1) understand their evolution and 2) develop primer sets for in-country PCR characterization of spike proteins.
- **Paramyxoviruses**: Continued development of a reverse genetics system for further characterization of paramyxoviruses to evaluate viral pathogenicity and host range; sequenced the genomes of one paramyxovirus detected, others are ongoing.
- **Ebola Serologic Assay**: Completed development - Indirect ELISA using recombinant full length Glycoprotein to screen (group assays to detect exposure to all Ebola species); In Development - Peptide ELISA to distinguish between Ebola species (Ebola species-specific assay)
- **Refining our deep-sequencing approach**: Comparing results of high throughput sequencing using unbiased sequencing and VircapSeq-VERT to identify when each tool is preferable for use by host species and virus.

Modeling and Analytics

Major highlights and successes

As part of efforts to further extend modeling and analytics capability to PREDCT's global partners, the Modeling and Analytics (M&A) team developed a software package to allow in-country and other partners to analyze PREDICT data. The *EIDITH R Package* "provides programmatic access and analytical tools for data from PREDICT and is housed at the Emerging Infectious Disease and Information Technology Hub (EIDITH)." The software includes documentation, training modules, and even mock datasets to explore. All issues of data security were ensured by the project information management (IM) and M&A teams, whereby access to data is limited via an individual's project-secured login credentials.



A new map identifying locations on the planet that likely harbor the most zoonotic viruses from primates, including those yet-to-be-discovered.

Version 2.0 of the Emerging Infectious Disease (EID) hotspots maps for emerging zoonoses was launched, with a completely new analysis identifying where on the planet the next EID will most likely originate. The new map replaces the Jones *et al.* hotspots map from 2008, and an article will be released by *Nature Communications* later this year. Following publication, all data from this project and the outputs of these models will be publicly released, allowing researchers around the world to access this important information.

In addition, the team finalized for public release a new strategy to identify sites on the planet that likely have the highest number of unknown high-risk viruses that are yet-to-be-discovered ("missing zoonoses"). A manuscript has been accepted by *Nature* and will be published in June 2017 (see map).

PREDICT was well-represented at the International Meeting on Emerging Diseases and Surveillance (IMED) in Vienna, Austria on November 4-7, 2016. Presentations included: "Identifying the next Zika: An analysis of zoonotic potential in Flaviviridae"; "Global correlates of emerging zoonoses: Anthropogenic, environmental, and biodiversity risk factors"; and "The Global Virome Project".

At a workshop with FAO partners, PREDICT's M&A representative presented an overview and first results of Africa Sustainable Livestock 2050 modeling in Ethiopia, February 20-24, 2017.

Progress and new model development

Advancing tools for African Sustainable Livestock (ASL) 2050

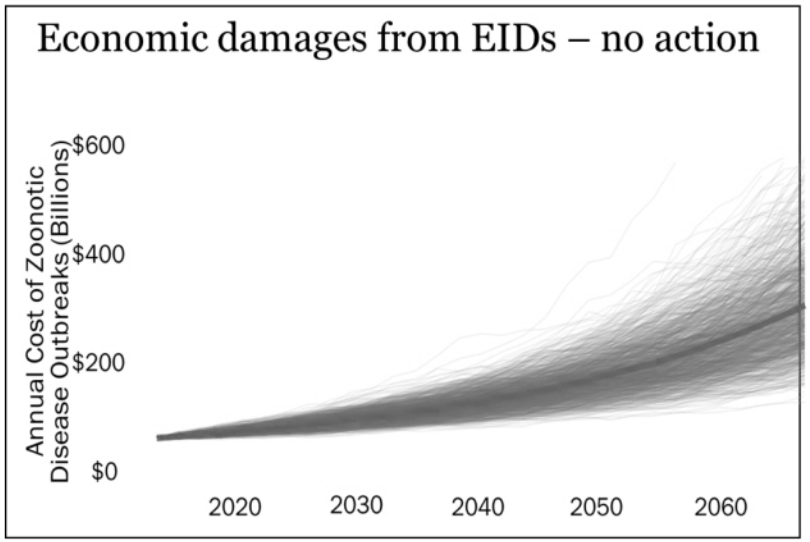
The team worked with EPT-2 partners at FAO to develop a hotspots analysis for the ASL 2050 project. This allows us to identify how proposed changes to livestock production in Africa will affect the risk of zoonotic disease emergence. Analyses show important regional differences in the drivers of EIDs that can be used to help policy goals.

The team developed a dynamic model to analyze how intensification of poultry production and different surveillance and control policies (e.g., culling) will impact avian influenza risk in the Africa region.

Innovative approaches to discover new viruses and explore long-term trends in pandemic risk

To identify sites for optimal targeting of global viral discovery from mammal and water bird populations, the M&A team developed a flexible modeling approach that can be used nationally, regionally or globally, and that identifies the most cost-effective allocation of resources to discover new viruses from wildlife. Individual models and maps were developed for 30 countries, 10 regions, and globally.

In addition, we estimated the number of currently undiscovered 'missing zoonoses' globally, extending the previous analysis from ~750 mammal host species to all terrestrial mammals (n=5304 spp.).

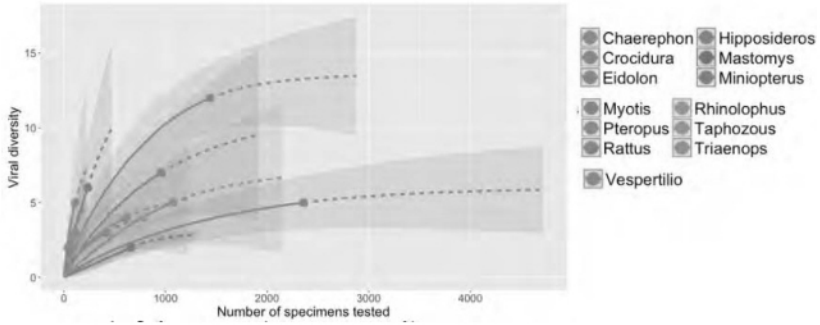


Analysis of the likely economic cost of emerging infectious diseases over the next 50 years if no coordinated global action is taken. Total cost is $3.6 trillion. Investing in a control program that reduces the number of events or size of events by only 5% gives a 96:1 return-on-investment.

To assess long-term trends in pandemic risk, we calculated expected global economic damages from EIDs over the next 50 years *(figure above)* using data from the Emerging Infectious Disease Repository (EIDR), which is partially funded by PREDICT work.

Analyzing PREDICT-1 data to support surveillance

Using PREDICT-1 data, we developed an interactive *viral accumulation curve* tool and searchable table to allow in-country staff to explore viral discovery data and compare the efficacy of different sampling protocols.



A viral accumulation curve for paramyxoviruses that is part of an interactive tool developed for PREDICT staff to enable exploration of viral discovery data and compare the efficacy of different sampling protocols.

To identify the risk interfaces that produce the most novel viruses in our sampling, we designed a power analysis using viral detection rates and animal sampling distributions from PREDICT-1.

In order to understand which PREDICT coronaviruses are more likely to jump from one host species to another (i.e. their potential to infect people) we analyzed host and viral relatedness (phylogenies) for all viral discovery data in China.

Additionally, we designed a way to help rank novel viruses by their zoonotic potential and calculated the “Phylogenetic Host Breadth” (genetic diversity of all known hosts for a virus) for all PREDICT-1 viruses based on observed host associations.

Finally, to assess most productive timing for sample collection, we began analysis of seasonal patterns in viral detection from PREDICT-1 data, including integration of life history data and global climate datasets.

New products and cutting-edge insights

In addition to the EIDITH R software package highlighted above, the M&A team developed another R package, fasterize, to improve and accelerate time-consuming risk analyses and for implementing high-speed algorithms for geospatial analyses. This tool will be made open source and will be of value to researchers globally doing spatial analyses.

To better understand the diversity of viruses in birds, we developed a preliminary model examining avian life-history traits and viral richness in birds using data from 1907 avian-virus associations from the literature for 929 bird species and 142 viruses.

We designed new approach to refine a global model to predict the number of zoonotic viruses per mammalian host species. This activity used a novel geographic cross-validation procedure for evaluating spatial models by excluding species by zoogeographic region.

We updated a database of viral decay/survival studies to include 272 publications to conduct an analysis of risk of viruses surviving on surfaces and in the environment. These data will be made public once compiled.

After the **emergence of Zika virus**, we developed a series of analyses to assess the zoonotic potential of other, less studied Flaviviruses:

- Network analysis based on host and vector associations for all known flaviviruses from the literature

- Map of global flavivirus diversity based on mammal and bird host distributions and human case distributions
- Analysis of the characteristics of all known flaviviruses to identify which are more likely to be able infect humans.

Global Virome Project

To estimate the costs and optimize potential sampling sites to enable planning and strategizing for the Global Virome Project, we used spatial analyses which combined maps of mammal and waterbird biodiversity, hotspot risk, 'missing zoonoses' and access costs for an additional 13 PREDICT countries. Individual GVP site allocation models and maps were developed for 30 countries, 10 regions, and globally.
In addition, we developed and ran an economic model to calculate Return on Investment for a 10-year investment in the Global Virome Project. Results are featured in an Emerging Disease Insights brief soon to be available online.

For more information

A full list of PREDICT Modeling and Analytics team products and output is included in the *Monitoring and Evaluation Appendix 1*.

A visualization of sites for optimal targeting of global viral discovery from mammal and waterbird populations developed for PREDICT and the Global Virome Project.

One Health Partnerships

Highlights and success stories

We developed a One Health outbreak simulation exercise for students, which was piloted with international students from Dartmouth College. The exercise examined an undiagnosed illness (modeled on the 1998-99 emergence of Nipah virus in Malaysia) through the human health, animal health and environment sectors, bringing together information to elucidate the transmission chain and demonstrating the value of multisectoral collaboration via a One Health approach.

Building on global economic analyses in the World Bank's 2012 "People, Pathogens and Our Planet" report, PREDICT partnered with the World Bank and the Network for Evaluation of One Health to hold an expert workshop in February 2017 to examine how to align methods, metrics and data to inform national decision making. Through the workshop, we established a methodology for country-level economic analysis of One Health. These methods are being applied in PREDICT countries, reinforcing overall efforts in collaboration with the World Bank to operationalize One Health and assist countries in determining cost-effective pandemic prevention and preparedness measures.

As part of ongoing investigations to advance our understanding of the value of the One Health approach, we disseminated the One Health data collection form to PREDICT countries. By systematically documenting examples of One Health, we can evaluate its effectiveness and identify best

One Health in Action, a case study booklet released by PREDICT and P&R is available online at: onehealth.predict.global

practices for local and national platforms, creating synergies with EPT-2 partner Preparedness and Response (P&R) to maximize benefits generated from One Health approaches. The "One Health in Action" case study booklet highlighting examples was also released by PREDICT with P&R on the first international One Health Day and is available online.

One Health policy advocacy

To strengthen integration of the environment sector in One Health and health security, we suggested key additions and updates to the World Health Organization (WHO) for their forthcoming guide for national action planning for health

security as well as the WHO Joint External Evaluation tool to reflect wildlife pathogen surveillance, disease forecasting, and risk management opportunities. We also provided expert guidance on a draft matrix of impacts to health from environmental change and One Health "vignettes" to inform potential actions by the G7.

We prepared a One Health policy statement for the American Public Health Association (APHA), highlighting needs and opportunities for the public health community to advance health security and pandemic prevention and preparedness capacity in the U.S. and globally. The policy statement draws on strategies and lessons learned from PREDICT-2 and was prepared in collaboration with the health focal point from the UN Office for Disaster Risk Reduction (UNISDR). This fills a critical policy gap in the APHA.

Eight new publications, products, and policy briefs

- "Evaluating One Health: Are we Demonstrating Effectiveness?" in the journal *One Health* (collaboration with P&R).
- "Summarizing US Wildlife Trade with an Eye Toward Assessing the Risk of Infectious Disease Introduction" in *EcoHealth*, reviewing 14 years of import data, including from PREDICT countries, to examine possible zoonotic disease risks.
- "Global Environmental Change and Emerging Infectious Diseases: Macrolevel Drivers and Policy Responses" (book chapter).
- "Avoiding catastrophes: seeking synergies among the public health, environmental protection, and human security sectors" in *The Lancet Global Health* (commentary).
- "Wildlife hosts for OIE-Listed diseases: considerations regarding global wildlife trade and host–pathogen relationships" in *Veterinary Medicine and Science* (Published findings of host-pathogen analysis entitled).
- Post on the *Lancet Global Health* blog on disease drivers and animal vaccination targets to optimize the Coalition for Epidemic Preparedness innovation (CEPI - with partners from the World Bank, Harvard and OIE: Available online).

- 'One Health in Action' case study booklet (English and French, see above for link).
- A briefing document on the role of environment in One Health and national health security.

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

- Presented on economic consequences of EIDs as well as disease drivers and pathogen surveillance in wildlife and relevant costing items as integral components of national action planning for health security at the WHO Stakeholders Consultation on Planning, Costing and Financing for accelerated IHR implementation and Global Health Security (non-PREDICT).
- Presented at high-level GHSA event held at the State Department.
- Presented on PREDICT approaches and EID risk mitigation at multiple side events at the Convention on Biological Biodiversity (CBD) Thirteenth Conference of the Parties, including dissemination of key messages from the infectious disease chapter of the WHO-CBD State of Knowledge Review on Biodiversity and Human Health. A formal decision was passed reinforcing the value of One Health and recognizing the drivers of EIDs.
- Hosted session on One Health at the AAAS Science Diplomacy conference, presenting on drivers of disease and the economics of One Health.
- Presented on the drivers of disease and the PREDICT project on a Future Earth webinar.
- Presented on PREDICT One Health effectiveness metrics at the EU Network for Evaluation of One Health meeting.
- Presented on policy engagement for One Health, One Health and viral discovery, and organized a symposium on future health at the One Health/EcoHealth Congress.
- Attended the FAO-OIE Global Framework for the progressive control of Transboundary Animal Diseases Steering Committee meeting.
- Attended the OFFLU Steering Committee meeting, presenting on influenza surveillance activities in wild birds.
- 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.
- Presented on One Health cost-effectiveness at the American Public Health Association meeting.

Management and Operations

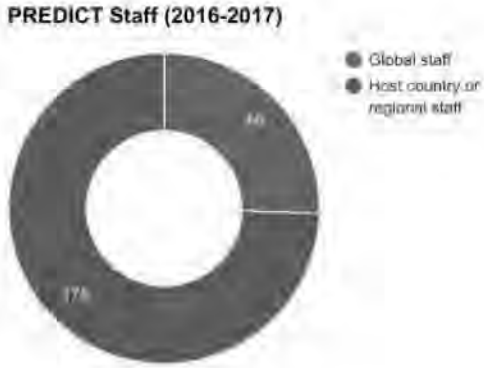
Highlights and successes

We held our semi-annual meeting in Pacifica, California January 10-11, 2017 bringing together key personnel and operations team leads to discuss project status, review data, and work with our external advisory panel to strategize for project success. The meeting was a success, with the panel recognizing PREDICT's work in virology and genomics as "cutting edge".

PREDICT worked with the Chinese Academy of Sciences (CAS) to plan and successfully host the "Inaugural Global Virome Project (GVP) Steering Committee and Working Group Meeting", February 6-7, 2017 in Beijing. GVP is a developing project seeking to "pre-empt emerging pandemic threats by identifying the majority of unknown viruses throughout the world that are likely to infect humans." This was the "first global in-person meeting since the Bellagio Forum in August 2016 where initial project goals were identified. In Beijing, participants, many from PREDICT and EPT-2 partners FAO and WHO worked together to discuss evolving strategies and plans and to establish coordination among working groups. As an instrumental step towards advancing GVP from concept to action, the CAS continued the discussions after the meeting with their own "China National Virome Project" session. For more info on GVP visit: http://www.globalviromeproject.org/

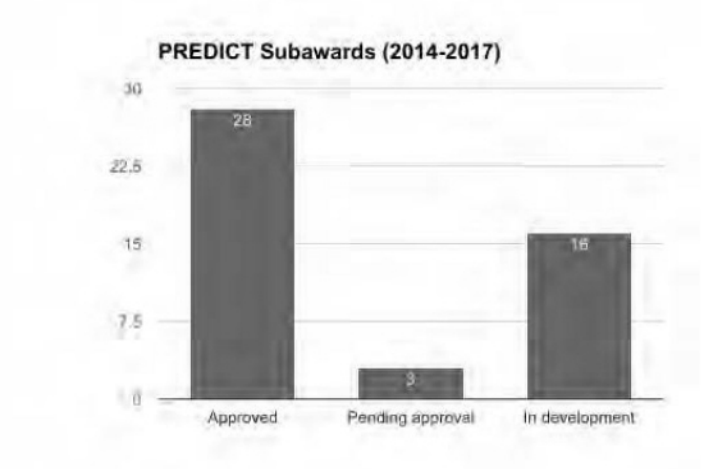
Personnel

We continued to manage and coordinate an international consortium of partners consisting of over 230 staff, 75% from the host country or region where we work.

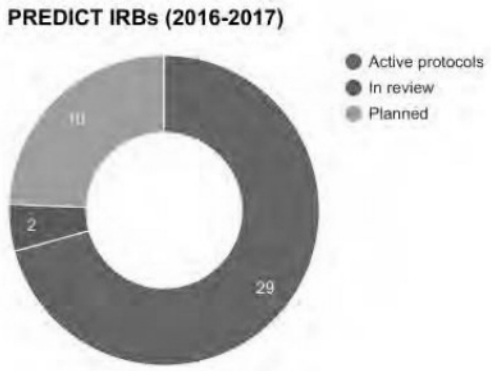


Partnerships

Continuing to build and formalize One Health partnerships, we executed 10 subaward agreements this period, 90% of the agreements with foreign government entities in Asia and Africa enabling PREDICT to further advance capabilities for zoonotic disease surveillance, detection, and response.



Status of subaward agreements and contracts over the life of the project.



Status of permissions from ethical committees (global and host country) approving human subjects research for human surveillance activities.

Permissions

PREDICT continued working with global and international partners to ensure compliance with all international and host country laws, regulations, and policies, including Memorandums of Understanding and Letters of Agreement, permissions for conducting research and collecting samples, import and export permissions, biosafety certificates, and ethical clearance for conduct of One Health surveillance (institutional review boards and animal care and use committees).

Communications

PREDICT continued outreach and communication efforts at the global and host country levels producing briefings, reports, online communications, and establishing social media channels on Research Gate for scientific publications and presentations and Twitter (@PREDICTproject) for general outreach and information. In addition, PREDICT continued our commitment to open data, making host county government approved findings available online through the PREDICT BioProject on GenBank and through our HealthMap hosted data portal at data.predict.global.

PREDICT/Cambodia

IV. COUNTRY REPORTS

CAMEROON

USAID | PREDICT
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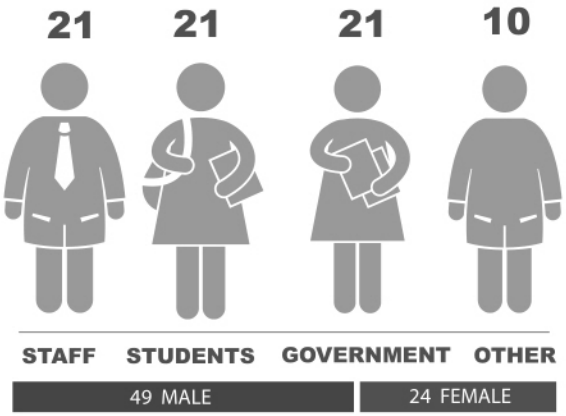
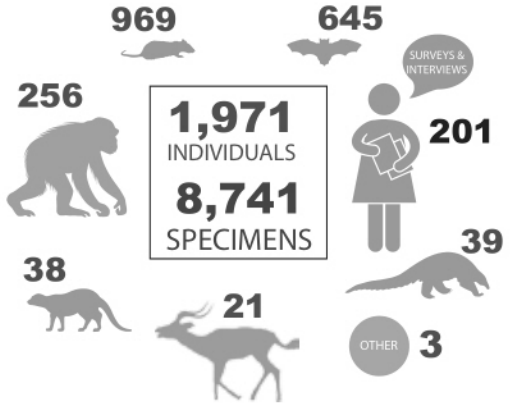
Global Health Security Agenda

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

9,497
TESTS

CENTRE FOR ARMY HEALTH RESEARCH (CRESAR)

TRAINING	LIMITED TESTING	TESTING ALL TARGET VIRAL FAMILIES

IMPACT

1,971 individuals sampled (wildlife)

201 individuals interviewed in behavioral risk investigations

9,497 tests across 5 viral families

73 trained in One Health skills

The PREDICT/Cameroon field team processes samples during wildlife surveillance activities. *Photo: PREDICT/Cameroon.*

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PREDICT/Cameroon

Success stories

Strengthening preparedness and response for priority zoonotic diseases

In February 2017, PREDICT/Cameroon provided support to the National Program for the Prevention and Control of Emerging and Re-emerging Zoonotic Diseases to prepare and implement a monkeypox virus awareness and surveillance strengthening meeting. This workshop used a One Health approach to raise awareness of this potentially important disease and to improve surveillance strategies following the recent outbreaks in Cameroon and the Central African Republic. The workshop focused on the animal species at risk of monkeypox, as well as symptoms, zoonotic transmission, recent outbreaks, and control and prevention measures. PREDICT also assisted the National Veterinary Laboratory to prepare and present on monkeypox surveillance sample collection procedures. The workshop brought the One Health approach to a local level through the inclusion of a broad range of actors in the East Region capital of Bertoua and in Yokadouma, a rural town in the same region close to important wildlife populations. Senior representatives from the region including the Governor and representatives from ministries responsible for public health, livestock, wildlife, environment, public security, and communication were present, as were community stakeholders. Such an approach develops knowledge of key pathogens in areas most at risk and promotes the One Health approach through action. The One Health approach will facilitate early case detection, and rapid and efficient response to avoid disease spread.

PREDICT staff, Steve Leumi, processes samples for disease detection at the Military Health Research Center (CRESAR) laboratory in Yaoundé, Cameroon. Photo: PREDICT/Cameroon.

Training government staff in One Health skills

PREDICT has been supporting surveillance for prioritized zoonotic diseases and other emerging disease threats including filoviruses (such as Ebola and Marburg viruses) and influenza viruses in the South Region of Cameroon (Sangmelima, Meyomessala, and Ebolowa). Bats and rodents living in and around houses and various animals in bush meat markets are being sampled to identify viruses that could potentially infect people. This surveillance effort, a collaborative partnership with the ministries responsible for livestock (MINEPIA), wildlife (MINFOF), and environment (MINEPDED) is directly strengthening national capacity for zoonotic disease surveillance by providing hands-on opportunities for training government staff from the central,

regional, divisional, and sub divisional levels to engage in biosafety; safe animal capture, handling, and sampling; safe sample transport and storage; and viral detection. These experiences are connecting government staff from various ministries with field-based activities using the One Health approach and enhancing their skills for improved implementation of zoonotic disease surveillance and outbreak response. PREDICT also provides laboratory learning opportunities for One Health and continues to be a resource for strengthening the roles played by partners of the National Program for Zoonosis such as MINFOF, MINEPIA, and MINEPDED.

Working to build a national One Health disease detection network

PREDICT is strengthening Cameroon's workforce by enhancing infrastructure and providing training opportunities for current and future laboratory scientists at the project laboratory, the Military Health Research Center (CRESAR). PREDICT has contributed to CRESAR's leading national role in the fight against emerging infectious diseases in Cameroon by training staff and deploying tests that can detect nationally prioritized zoonotic diseases of public health concern: the filoviruses Ebola and Marburg, and influenza viruses (including HPAI), along with other known and potentially emerging viral threats. In addition, PREDICT has conducted trainings at CRESAR for staff from other national laboratories including five staff members from National Public Health Laboratory, and staff from the National Veterinary Laboratory. These activities facilitate improvements in linkages between national labs for a stronger One Health disease detection network. Additionally, numerous interns including graduate DVMs and PhD students benefit from PREDICT's partnership and investments, receiving applied learning opportunities typically unavailable in university curriculum such as: biosafety; safe laboratory techniques; data management; and molecular zoonotic disease detection techniques.

Laboratory systems

PREDICT/Cameroon is partnering with the Military Health Research Center (CRESAR), the project lab actively testing all animal samples and assisting with training staff from the National Public Health Laboratory and the National Veterinary Laboratory. CRESAR has capability to perform tests for all five target viral families, which include priority zoonotic diseases such as Ebola, Marburg, and avian influenza.

Implementing partners

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

Contacts

Country Coordinator: Moctar Mouiche, Metabiota, Inc. (mmouiche@mosaic.com)

Global Point of Contact: James Ayukekbong, Metabiota, Inc. (jayukekbong@metabiota.com)

Dashboard legend

Workforce Development. Numbers represented are from the life of project (September 2014 to March 31, 2017).

One Health Surveillance. Individuals refers to the number of unique animals or humans from which samples were collected. Specimens indicates the total number of samples collected from all individuals. All numbers shown are from the life of project (September 2014 to March 31, 2017).

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COTE D'IVOIRE

USAID | PREDICT
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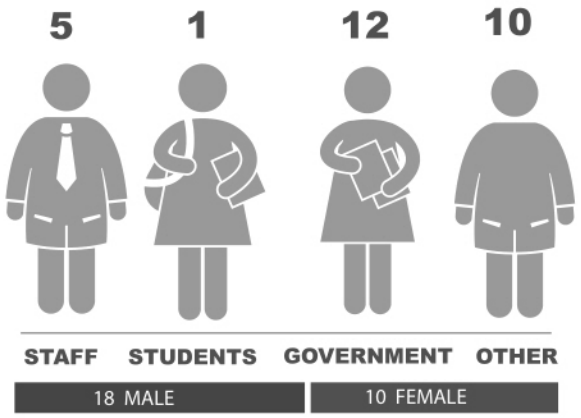
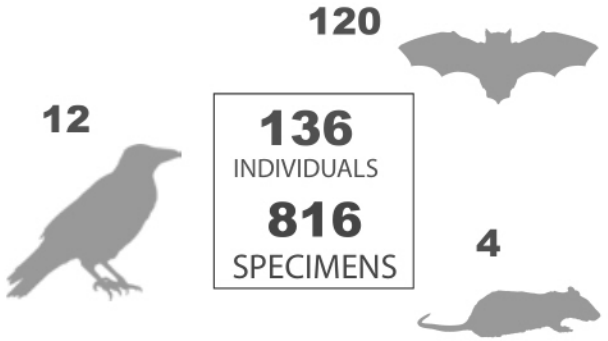
Global Health Security Agenda

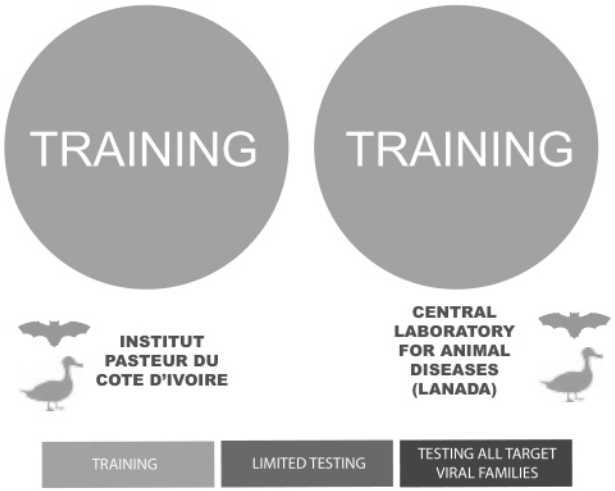
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

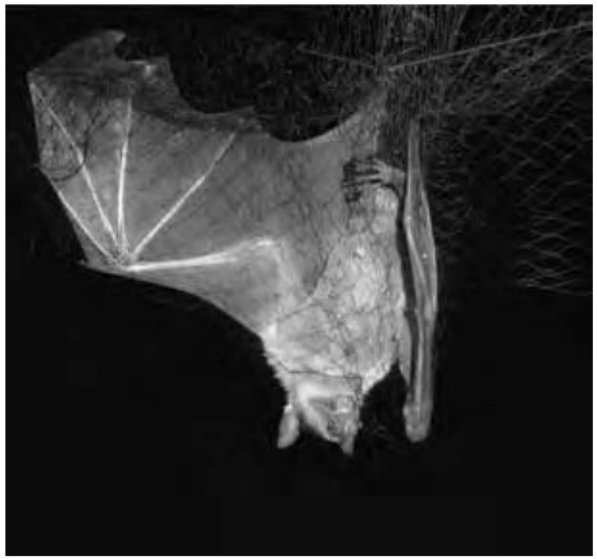


IMPACT

136 wild animals sampled

Training initiated for viral testing

28 trained in One Health skills



A bat captured for sampling by PREDICT in Côte d'Ivoire.
Photo: PREDICT/Côte d'Ivoire

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PREDICT/Côte d'Ivoire

Success stories

One Health in action

In Côte d'Ivoire, PREDICT is putting the One Health approach into action following the initial bridging of animal and human health sectors for training in the One Health skills required for zoonotic disease surveillance and viral detection. Both in-country partners, Institut Pasteur Côte d'Ivoire (IPCI) and the Laboratoire National d'Appui Développement Agricole (LANADA) elevated their collaborative efforts from training to practical implementation in November 2016, through field trips to three sites targeted for PREDICT's risk-based zoonotic disease surveillance activities. During the trip, team members engaged community members, assessed animal sampling sites and hospitals for concurrent human and animal sampling, and launched wildlife sample collection activities collecting 816 samples from 136 animals (120 bats, 12 birds, and four rodents). In addition, the team successfully collected and deposited field data into the project information management system encouraging data sharing across partners for informed decision making. The trip bridged gaps between animal and human health professionals and provided an applied forum for knowledge exchange where valuable insights and input from both the animal and human health perspectives led to the selection of the Marahoué National Park area as the primary surveillance site in Côte d'Ivoire for the project's One Health surveillance activities. As a result of these efforts, the Ministry of Waters and Forest requested that government veterinarians receive on-the-job training in animal capture and sampling from PREDICT staff, further adding to capacity-building in the region. While the initial trainings helped build bridges between national animal and human health sectors, the project's ongoing practical collaboration between IPCI and LANADA, as well as plans for involvement of government veterinarians during field activities, is strengthening the foundation of the One Health approach in this region, encouraging multi-sectoral efforts, and increasing in-country capacity for disease surveillance and outbreak response.

PREDICT/Côte d'Ivoire engaged community members in Marahoué in November-December 2016 in preparation for wildlife surveillance. Photo: PREDICT/Côte d'Ivoire

Laboratory systems

PREDICT/Côte d'Ivoire is partnering with the Central Laboratory for Animal Diseases, Bingerville (LANADA) and the Institut Pasteur du Cote d'Ivoire (IPCI) for specimen testing, both are preparing for implementation of viral family protocols for five priority families (corona, filo, flavi, influenza, and paramyxo viruses).

Implementing partners

Metabiota Inc., Institut Pasteur de Côte d'Ivoire (IPCI), Laboratoire d'Appui au Développement Agricole (LANADA)

Contacts

Country Coordinator: Dr. Kalpy Julien Coulibaly (kalpyjuliencoulibaly@pasteur.ci)

Global Point of Contact: Frantz Jean Louis (fjeanlouis@metabiota.com)

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DEMOCRATIC REPUBLIC OF CONGO

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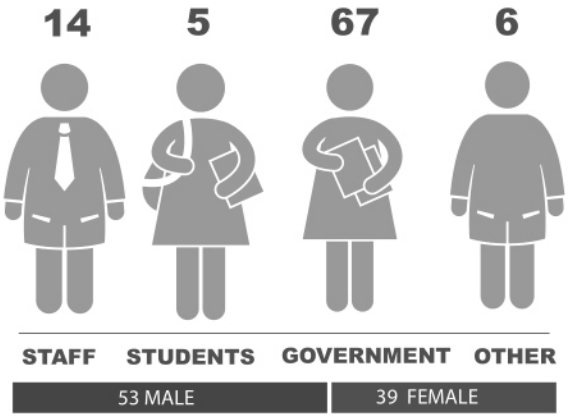
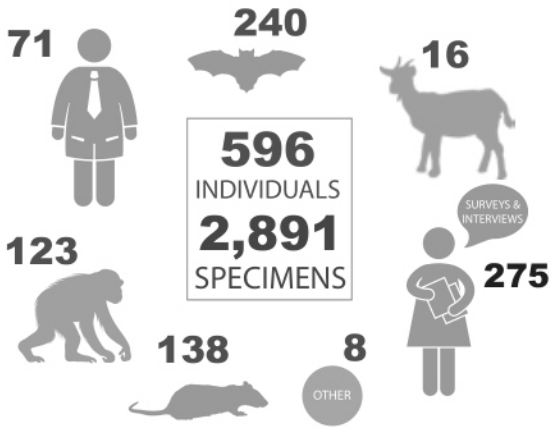
Global Health Security Agenda

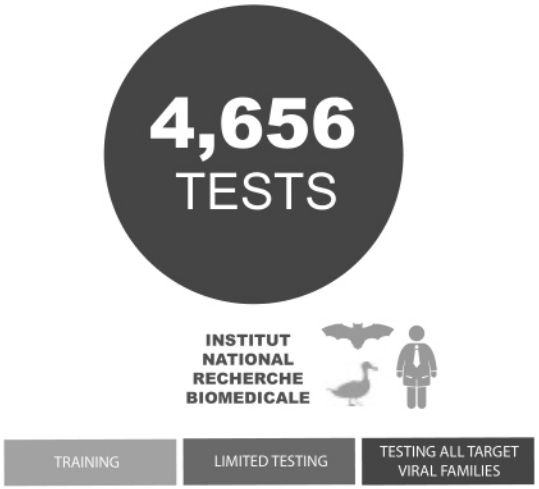
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

596 individuals sampled (animals and people)

275 individuals interviewed in behavioral risk investigations

4,656 tests across 8 viral families

92 trained in One Health skills

Hunted monkeys in the bushmeat value chain in Congo, Democratic Republic of Congo. *Photo credit: Ipos Ngay/PREDICT DRC*

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PREDICT/Democratic Republic of Congo

Success stories

Deploying and sustaining outbreak response activities for Yellow Fever

At USAID request to support the yellow fever outbreak response, PREDICT/DRC facilitated the USAID purchase of a mobile laboratory, received by Institut National Recherche Biomédicale (INRB), the national reference laboratory of DRC, in November 2016. This K-Plan mobile laboratory effectively strengthens the country's ability to respond to epidemics through rapid detection of causative agents through serology and molecular biology. From November 30-December 16, 2016, 10 staff (primarily medical biologists and lab technicians from the Virology Department of INRB) were trained to use the mobile lab by the Founder and CEO of K-Plan. The first simulation exercise with field samples was done February 6th at INRB, and more trainings are planned for personnel later in 2017. In addition to the acquisition of a mobile laboratory, PREDICT/DRC enabled yellow fever outbreak detection and response activities, which relied on INRB's capabilities for laboratory diagnostics (reagent supply, staff time, fuel for back-up generator), 13 investigative trips to Kongo-Central, Kwango, and Kwilu provinces with the Ministry of Health, and supplies (isothermal boxes and fuel) to maintain cold chain for the transport of vaccines during mass immunization campaigns. Although the end of the yellow fever epidemic was officially declared by the Minister of Public Health on February 14, 2017, surveillance efforts continued through March 2017 with samples collected from about one hundred suspected

Dr. Charles Kumakamba, PREDICT/DRC Laboratory Manager, explains the conventional PCR process to students from the Field Epidemiology and Laboratory Training Program at Institut National Recherche Biomédicale (INRB). Photo: Placide Mbala, PREDICT/DRC.

cases per month for analysis at the INRB virology laboratory. The PREDICT/DRC team continues to actively manage USAID yellow fever outbreak response funds that support laboratory diagnostics at the INRB; to support the feasibility study for the deployment of the mobile laboratory in Lufu (a DRC border city with Angola where the first imported cases of yellow fever were detected); to support training of more INRB staff on the use of the mobile lab for sustained use of the mobile lab for effective and rapid response investigations; and to support ongoing immunization campaigns.

Collaborative training and support for workforce development

PREDICT trained 30 students (medical doctors, veterinarians, medical biologist and laboratory technicians) from the Field Epidemiology and Laboratory Training Program (FELTP), a program launched in partnership between the World Health Organization, the United States Centers for Disease Control and Prevention, the University of Kinshasa, the African Field Epidemiology Network, and USAID. In March 2017, PREDICT provided training to this cohort of students in project sample collection protocols, including an overview of priority taxa, interfaces of interest, animal capture methods, sample types, sample storage and transport from the field and storage in the laboratory prior to analysis, and lab-based training in conventional PCR analysis and cloning. PREDICT's hands-on support of this residency-based program in applied epidemiology and public health management builds capacity in the country by preparing a workforce capable of laboratory management, outbreak investigation, and disease surveillance, and contributes to awareness and support of the One Health platform.

Laboratory systems

PREDICT/DRC is partnering with the Institut National Recherche Biomédicale (INRB) a national lab implementing viral family protocols for five priority families (corona, filo, flavi, influenza, and paramyxo viruses), INRB also provides testing support for the Republic of Congo.

Implementing partners

Metabiota, Inc., UC Davis, Institut National de Recherche Biomedicale (INRB), Kinshasa School of Public Health (KSPH), Mountain Gorilla Veterinary Project (MGVP)

Contacts

Country Coordinators: Prime Mulembakani, Metabiota, Inc (pmulembakani@metabiota.com); Eddy Kambale, MGVP (ekambale@gorilladoctors.org)

Global Point of Contact: James Ayukekbong, Metabiota, Inc. (jayukekbong@metabiota.com)

Dashboard legend

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EGYPT

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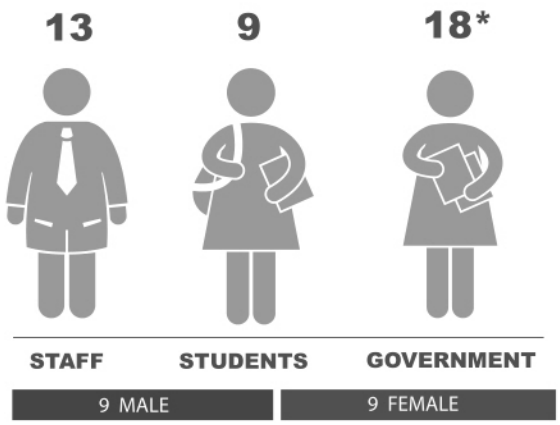
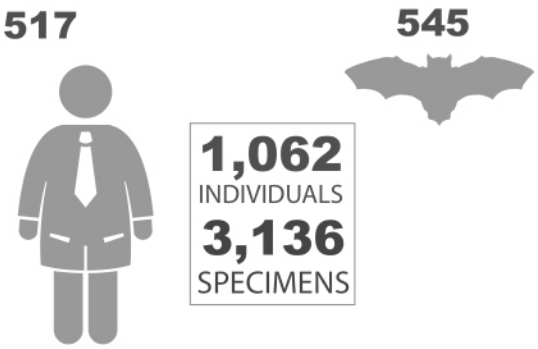
Global Health Security Agenda

WORKFORCE DEVELOPMENT



* Trained staff are government employees

ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

IMPACT

1,062 individuals sampled (animals and people)

Training initiated for viral testing

18 trained in One Health skills

A member of the PREDICT/Egypt team records answers for the behavioral risk questionnaire at a camel market. *Photo: A. Nageh*

PREDICT/Egypt

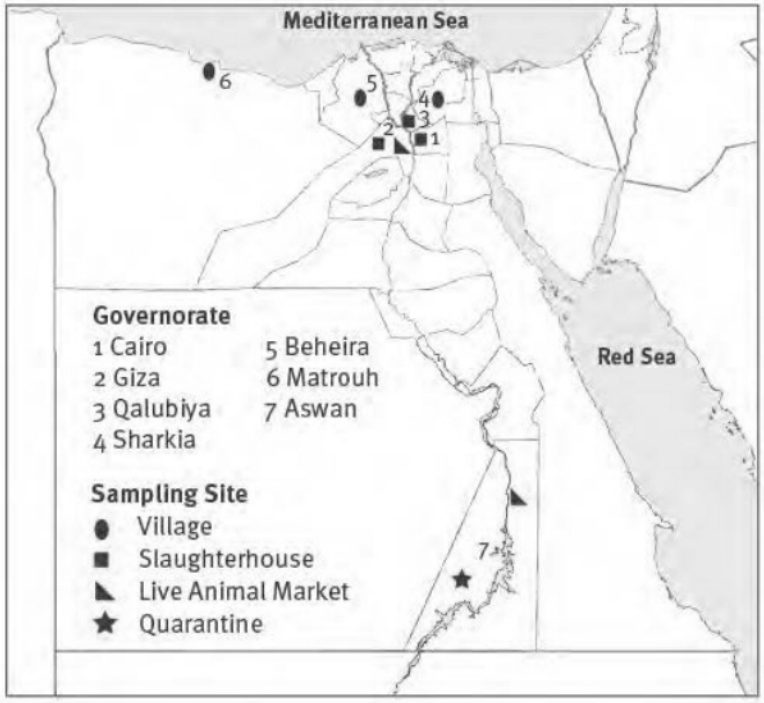
Success stories

Targeted risk-based surveillance for priority zoonotic diseases

Targeting human and animal populations in the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) epizone, PREDICT/Egypt has initiated One Health surveillance activities targeting high-risk animals (wildlife and livestock) and humans at key interfaces selected in collaboration with Egyptian government partners and the Food and Agriculture Organization of the United Nations (FAO). To date, the PREDICT/Egypt team has captured, sampled, and released more than 400 bats. All specimens are being tested for corona and paramyxoviruses, with additional PCR testing for MERS-CoV. Family level viral testing for filoviruses and influenza viruses is also planned. Additionally, more than 400 humans have been enrolled in surveillance activities to date, with all participants completing the behavioral risk questionnaire and providing biological specimens for viral testing (which will include serological testing for MERS-CoV antibodies).

One Health partnerships lead to new publication on MERS-CoV prevalence

PREDICT supported FAO partners in cross-sectional surveillance activities of camels and bats for MERS-CoV, which resulted in a publication in the journal *Eurosurveillance*. The article entitled “Cross-sectional surveillance of Middle East respiratory syndrome coronavirus (MERS-CoV) in dromedary camels and other mammals in Egypt, August 2015 to January 2016” sheds light on the seroprevalence of MERS-CoV in both imported and resident camel populations in Egypt.



Map of sampling locations for cross-sectional surveillance activities described in the article “Cross-sectional surveillance of Middle East respiratory syndrome coronavirus (MERS-CoV) in dromedary camels and other mammals in Egypt, August 2015 to January 2016”. Source: Euro Surveill 2017 Mar 16; 22(11): 30487. doi: 10.2807/1560-7917.ES.2017.22.11.30487

While all samples from domestic camels and bats tested negative for MERS-CoV antibodies, one sample from a sheep apparently in contact with seropositive camels was antibody positive, suggesting cross species transmission and warranting further investigation. The article is freely available from *Eurosurveillance* at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5356426/

Regional collaboration for One Health surveillance

As part of PREDICT's efforts to encourage regional capacity strengthening and build active One Health networks among professionals, PREDICT/Egypt was invited to cross-train the PREDICT/Jordan team in the project's human surveillance protocols this summer after the Jordan team receives IRB approval. This cross training collaboration was proposed due to the Egypt team's success launching and conducting human surveillance activities and because of the similarities between surveillance objectives in both countries. The planed training will involve three to four team members of PREDICT/Egypt, who will travel to Jordan for approximately one week to conduct classroom and field trainings in coordination with PREDICT global team members.

Blood is drawn from an enrolled individual at an Egyptian camel market. Photo: A. Nageh.

Laboratory systems

PREDICT/Egypt is partnering with the Center of Scientific Excellence for Influenza Viruses (CSEIV) of the Egypt National Research Centre (NRC) for animal and human specimen testing. The lab is preparing to implement viral family protocols for two priority families (corona and paramyxoviruses), with the potential of adding testing for filo and influenza viral families.

Implementing partners

EcoHealth Alliance and the Egypt National Research Centre (NRC)

Contacts

Country Coordinator: Dr. Mohamed Ahmed Ali, Egypt National Research Centre (mohamedahmedali2004@yahoo.com)

Global Point of Contact: Dr. William Karesh, EHA (karesh@ecohealthalliance.org)

Country Liaison: Patrick Dawson, EHA (dawson@ecohealthalliance.org)

Dashboard legend

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ETHIOPIA

USAID | PREDICT
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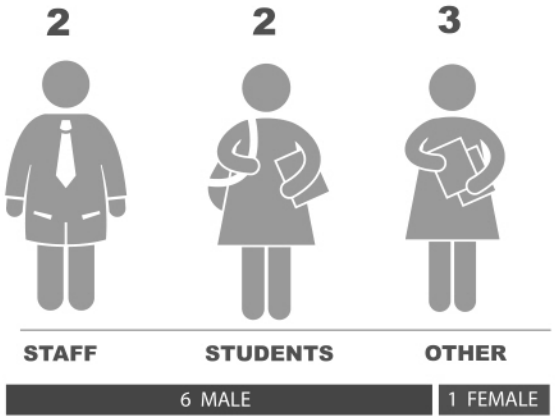
Global Health Security Agenda

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE

LAB STRENGTHENING

IMPACT

212 individuals sampled (wildlife)

Training initiated for viral testing

7 trained in One Health skills

A vervet monkey chews on an oral swab that will be tested for viruses by the PREDICT/Ethiopia team.
Photo: PREDICT/Ethiopia

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PREDICT/Ethiopia

Success stories

Strengthening the wildlife sector for surveillance of zoonotic diseases

PREDICT/Ethiopia continues to work in partnership with local authorities and the Ethiopian Wildlife Conservation Authority (EWCA) to strengthen capacity for surveillance of wildlife populations for zoonotic disease threats. In November 2017, PREDICT/Ethiopia conducted wildlife sampling around pastoralist communities surrounding the Awash National Park, targeting priority high-risk animal-human interfaces where zoonotic viruses may be shared with livestock and people. The team collected non-invasive samples (saliva and feces) from non-human primates (olive baboons, sacred baboons, and grivet monkeys) for viral testing, which through continued mentorship and training will enhance disease detection capacity of the animal health sector in Ethiopia. The PREDICT/Ethiopia team conducted sampling activities along the livestock value chain at another high-risk interface in the southern Borana area that includes the transboundary livestock trade between Kenya and Ethiopia and borders the Yabelo Wildlife Sanctuary. At this site, the team successfully collected non-invasive samples (saliva and fecal) from non-human primates and transferred the samples to the Addis Ababa University PREDICT lab for viral family testing to detect known and novel viruses. By working together with EWCA, PREDICT is directly supporting improvements in wildlife disease surveillance and helping address a critical gap in the national plan targeting improvements in the animal health sector for zoonotic disease detection and response.

The Negele camel market in Borana, one of PREDICT/Ethiopia's wildlife sampling sites near the Yabelo Wildlife Sanctuary, where livestock are traded between Kenya and Ethiopia. Photo: PREDICT/Ethiopia.

Strengthening regional networks and improving the workforce for disease detection

For detection of priority zoonotic diseases, a well-trained and equipped workforce is crucial. From October 9th-16th, 2016, PREDICT/Ethiopia staff traveled to Uganda to receive training from project partners at the Makerere University. In addition, from February 8th-10th, 2017, one of PREDICT's global subject matter experts led workshops at Addis Ababa University for project staff, students, and government partners from the Ethiopia Public Health Institute and National Animal Health Disease Investigation Centre. These workshops introduced and reinforced standard operating procedures and practices for laboratory work, including basic laboratory safety, emergency preparedness, and safe waste disposal, and

hands-on training in nucleic acid extraction and viral detection techniques. As a result of the trainings, PREDICT/Ethiopia gained core skills and capacity for viral detection. Government relations also benefitted for developing technical lab capabilities at the national level, and for building a One Health platform.

Supporting the development of a National One Health Council

Throughout 2017, PREDICT/Ethiopia collaborated with partners from USAID/Preparedness and Response and the Food and Agriculture Organization (FAO) of the United Nations in technical working groups focused on strengthening capacity for surveillance of priority endemic and emerging zoonotic diseases in Ethiopia. The meetings furthered the progress for developing the Ethiopian One Health National Council with national stakeholders along with special working groups for Anthrax, Rabies, and Brucellosis.
PREDICT/Ethiopia supports these national One Health initiatives by providing technical assistance for developing and strengthening national capacity, especially through opportunities that put One Health in action through zoonotic disease surveillance at high-risk human-animal interfaces.

Laboratory systems

PREDICT/Ethiopia is partnering with the Addis Ababa University Aklilu Lemma Institute of Pathobiology, the project lab actively testing all animal samples and serving as a training center for staff from the national laboratory system, the Ethiopia Public Health Institute, and the National Animal Health Disease Investigation Centre.

The PREDICT/Ethiopia and Uganda teams at Makerere University in Uganda where the Ethiopia team received training in viral detection techniques. Photo: PREDICT/Ethiopia

Implementing partners

UC Davis and the Addis Ababa University, Aklilu Lemma Institute of Pathobiology

Contacts

Country Coordinator: Professor Nigatu Kebede, Aklilu Lemma Institute of Pathobiology (ALIPB/AAU: nigatukebede@yahoo.com)

Global Point of Contact: Dr. Woutrina Smith, UC Davis (wasmith@ucdavis.edu)

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GHANA

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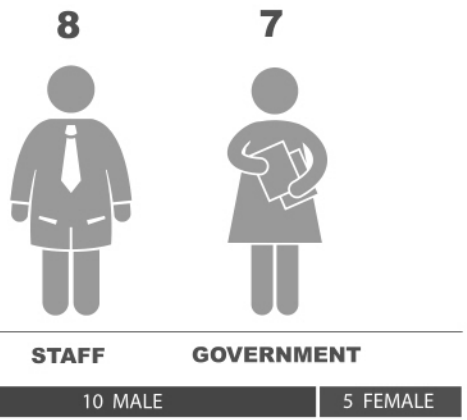
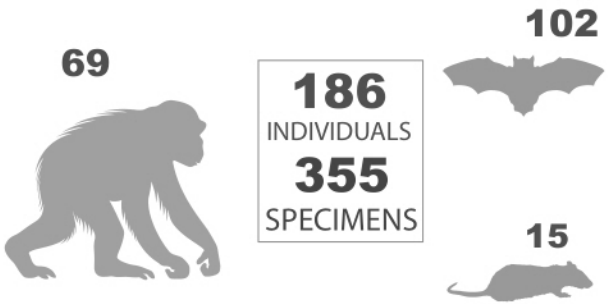
Global Health Security Agenda

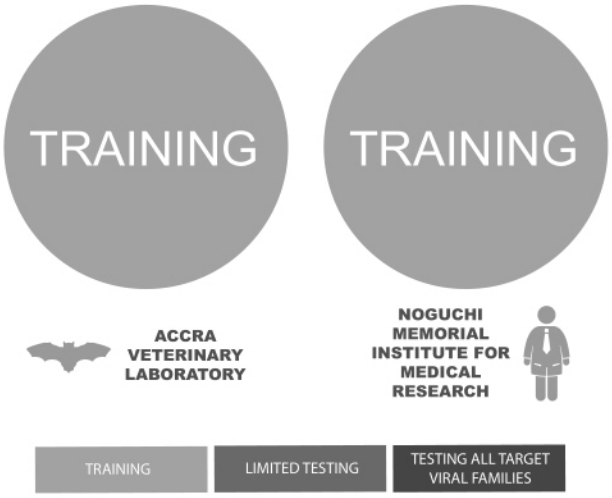
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

186 individuals sampled (wildlife)

Training initiated for viral testing

15 trained in One Health skills

Mona monkeys (*Cercopithecus mona*) and sheep feed on discarded corn cobs/husks immediately adjacent to a home in a village near the Boabeng-Fiema Monkey Sanctuary.
Photo: Terra Kelly

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PREDICT/Ghana

Success stories

Strengthening national surveillance and laboratory systems

To support strengthening national surveillance and laboratory networks in Ghana for rapid detection of zoonotic viruses, PREDICT/Ghana team members from the Wildlife Division of the Forestry Commission, Accra Veterinary Laboratory of the Veterinary Services Directorate at the Ministry of Food and Agriculture, and the Noguchi Memorial Institute for Medical Research at the University of Ghana participated in a series of field and laboratory-based training workshops. These implementing partners, all critical nodes in Ghana's animal and human surveillance and laboratory networks, are well integrated with the national surveillance systems and serve as the centers working to advance Ghana's capabilities for detecting known and novel viral threats.

Field personnel from the Wildlife Division, Forestry Commission and the Veterinary Services Directorate staff anesthetize and sample a rodent as part of the field-based training on PREDICT's safe animal capture and sampling protocols. Photo: PREDICT/Ghana.

PREDICT/Ghana team members participated in intensive field-based training sessions on protocols for personal protective equipment (PPE), biosafety and biosecurity; bat, rodent, and primate sampling; safe handling and transport of samples under ultra cold conditions; and surveillance data entry and management. In addition, PREDICT contributed to the development of the One Health workforce in Ghana through a joint laboratory protocol training workshop with personnel at the Accra Veterinary Laboratory and Noguchi Memorial Institute for Medical Research. The workshop, held at the Accra Veterinary Laboratory, included hands-on training sessions on laboratory biosafety, nucleic acid extraction, cDNA synthesis, gel electrophoresis, and results interpretation using PREDICT viral-family PCR techniques.

As a result of these field and laboratory trainings, the PREDICT/Ghana team, which consists of local staff from ministry and university partners that form part of the foundation for the national surveillance and disease detection system, are equipped with a broader technical skill set and are actively applying the One Health approach. Through PREDICT,

Ghana's health workforce is gaining opportunities to expand core capabilities and integrate animal and human surveillance and laboratory networks.

Laboratory systems

PREDICT/Ghana is partnering with the Accra Veterinary Laboratory, Veterinary Services Department, Ministry of Food and Agriculture for animal sample testing, and the Noguchi Memorial Institute for Medical Research at the University of Ghana for human sample testing. Both labs are preparing to implement viral family testing.

Implementing partners

UC Davis; Veterinary Services Department, Ministry of Food and Agriculture; Wildlife Division of the Forestry Commission, Ministry of Land and Natural Resources; and the Noguchi Memorial Institute for Medical Research at the University of Ghana

Contacts

Country Coordinator: Samuel Otis Bel-Nono, Veterinary Services Department, Ministry of Food and Agriculture (belsam1044@gmail.com)

Global Point of Contact: Terra Kelly, UC Davis (trkelly@ucdavis.edu)

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GUINEA

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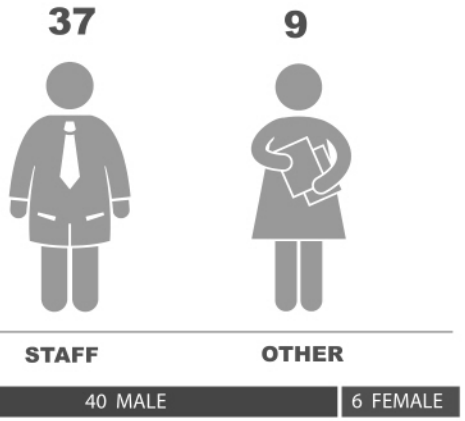
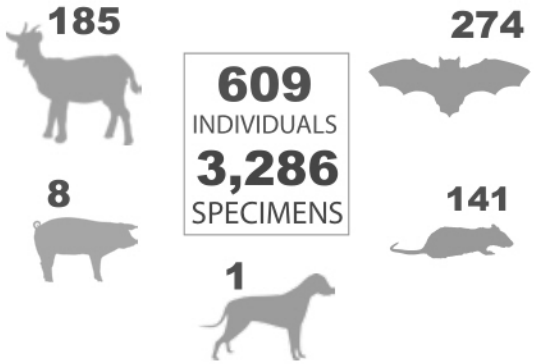
Global Health Security Agenda

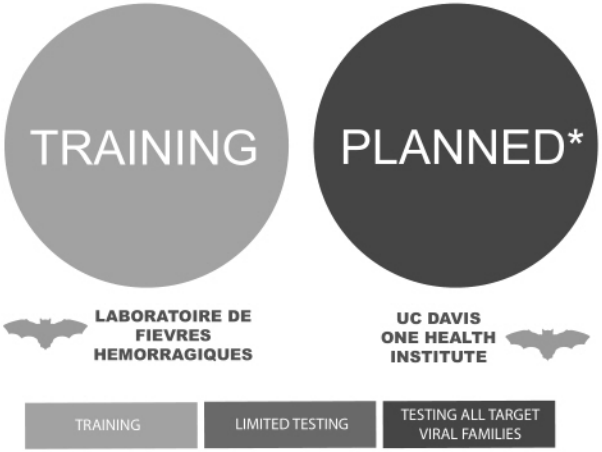
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



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

IMPACT

609 individuals sampled (wildlife and domestic animals)

Training initiated for viral testing

46 trained in One Health skills

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PREDICT/Guinea and Ebola Host Project team members process samples during a training event in Nzerekore. *Photo: PREDICT/Guinea.*

PREDICT/Guinea

**Guinea is implementing the Ebola Host Project along with PREDICT teams in Liberia and Sierra Leone.*

Success stories

Training Guinea's animal health workforce for Ebola virus surveillance

In November 2016, PREDICT led a large-scale training session in Nzerekore, Guinea to prepare 22 participants recruited from veterinary, biology, and ecology backgrounds for their engagement as Ebola Host Project (EHP) field staff. In anticipation of the event, PREDICT garnered support from animal and human health officials in Guinea fostering dialogue and emphasizing the importance of the One Health approach for zoonotic disease surveillance, a successful effort demonstrated by the presence of local, regional, and national government staff at the event's opening ceremony. With support from animal, environment, and human sectors of the Guinea government, as well as administrative authorities from the Nzerekore Region, PREDICT led six days of training in both classroom and practical field contexts. Following theoretical training focused on project protocols, training guides and quizzes on biosafety and biosecurity, animal identification and sampling methods, waste disposal, cold chain, laboratory safety, and emergency preparedness, trainers led activities to apply this knowledge during a three-day field session where hands-on practical skills were developed and refined. This intensive hands-on training succeeded in equipping all 22 participants with the core skills required for safe implementation of zoonotic disease surveillance and outbreak response activities, effectively building and reinforcing national capacity as Ebola Host Project sampling activities continue in Guinea. As a result, PREDICT was able to formally launch community sensitization and Ebola Host Project sampling activities with the trained team, collecting samples from over 300 animals (livestock, rodents/shrews, and bats) to date. All samples were safely stored to await viral testing.

Following three days of classroom preparation, PREDICT trainees practice hands-on skills for rodent sampling in Nzerekore, Guinea. Photo: PREDICT/Guinea

Laboratory systems

PREDICT/Guinea is exploring partnership with the Laboratoire de Fièvres Hémorragiques to assess potential plans for strengthening laboratory capacity. 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.

Implementing partners

Metabiota, Inc. and UC Davis

Contacts

Country Coordinator: Alpha Camara, Metabiota (acamara@metabiota.com)

Global Point of Contact: Frantz Jean Louis, Metabiota (fjeanlouis@metatbiota.com)

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JORDAN

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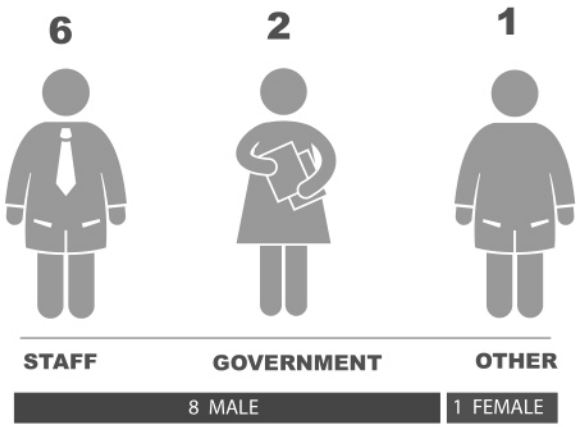
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE

250
INDIVIDUALS
1,750
SPECIMENS

LAB STRENGTHENING

880
TESTS

JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (JUST)

TRAINING | LIMITED TESTING | TESTING ALL TARGET VIRAL FAMILIES

IMPACT

250 individuals sampled (wildlife)

880 tests across 4 viral families

9 trained in One Health skills

A Bedouin sheikh walks with camels in Jordan. PREDICT is working with partners to explore zoonotic disease transmission risks along the animal value chain. *Photo: PREDICT/Jordan.*

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PREDICT/Jordan

Success stories

Collaborative One Health training

PREDICT/Jordan organized a technical coordination workshop entitled, "Advancing Health Security in Jordan - Linking People, Animals and Environment" on February 26, 2017 in Amman in collaboration with USAID/Jordan. The event was attended by senior officials from USAID/Jordan, the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), World Organization for Animal Health (OIE), Ministry of Agriculture (MOA), Ministry of Health (MOH), Ministry of Environment (MOE), as well as the Dean of Research, Dean of Medicine, Dean of Veterinary Medicine, professors, and Master's students from Jordan University of Science and Technology (JUST). A total of 40 participants attended the workshop and technical sessions. The aim of this workshop was to coordinate efforts by domestic and international stakeholders and partners working in Jordan such as MOA, MOH, MOE, WHO, FAO, OIE, and JUST to apply a One Health framework to health security. At the end of the technical sessions meeting attendees created an overall strategic work plan to advance collaboration and strengthen One Health in Jordan, as well as individual recommendations for MOH, MOE, MOA, USAID, WHO, and local universities.

Sustaining collaborative partnerships for One Health

Although PREDICT/Jordan initiated activities less than one year ago, all project focal points are now fully engaged,

Participants of the "Advancing Health Security in Jordan - Linking People, Animals and Environment" Meeting in Amman, Jordan on February 27, 2017. (From L to R: Nicholas Kaufman, Acting Director, Office of Population and Family Health, USAID Jordan; Dr. William B. Karesh, Executive Vice President for Health and Policy, EcoHealth Alliance and PREDICT global lead; Dr. Lewis J. Tatem, Deputy Mission Director, USAID Jordan; Dr. Ehab Abu-Basha, PREDICT Country Coordinator, JUST; and Maysa Al-Khateeb, Project Liaison, USAID Jordan). Photo by USAID/Jordan.

including partners from the Ministry of Agriculture, Ministry of Health, Ministry of Environment, WHO, FAO, OIE, and Royal Scientific Society. Additionally, the PREDICT/Jordan country coordinator regularly meets with the project liaison at USAID/Jordan, Maysa Al-Khateeb, to plan activities, share project updates, facilitate partner coordination, and monitor progress. PREDICT/Jordan focal points from MOA, MOH, and MOE now meet regularly with PREDICT/Jordan and USAID/Jordan, and they have forged the beginning of a collaborative platform to formally promote One Health activities in-country. These relationships founded on effective communication will be key in responding to future outbreaks of

zoonotic diseases and achieving disease surveillance sustainability in Jordan.

Laboratory systems

PREDICT/Jordan's laboratories are based at the Jordan University of Science and Technology (JUST). The Diagnostic Lab at the Veterinary Health Center and Molecular Biology Lab is implementing viral family testing for wildlife and camel samples. Human specimens will also be tested at JUST (pending collection). Confirmatory sequencing is being conducted at JUST's Princess Haya Biotechnology Center.

Implementing partners

EcoHealth Alliance and Jordan University of Science and Technology (JUST)

Contacts

Country Coordinator: Dr. Ehab Abu-Basha, JUST (abubasha@just.edu.jo)

Global Point of Contact: Dr. William Karesh, EHA (karesh@ecohealthalliance.org)

Country Liaison: Patrick Dawson, EHA (dawson@ecohealthalliance.org)

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KENYA

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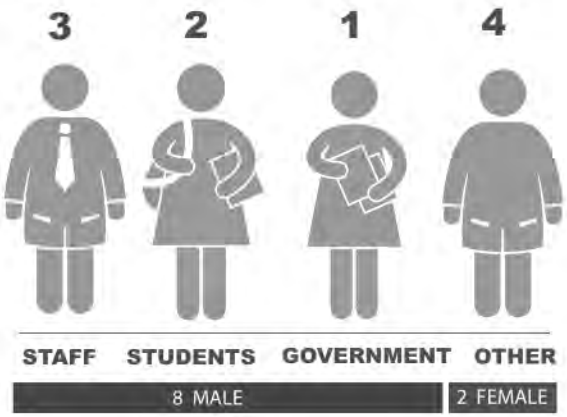
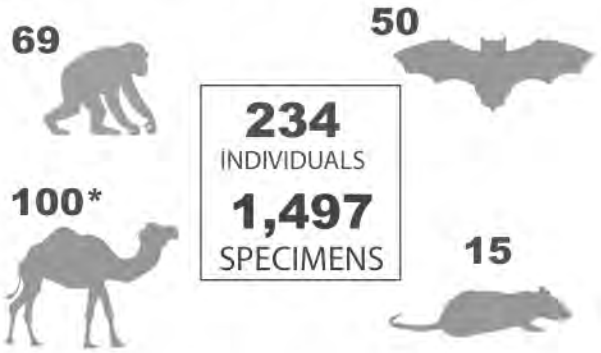
Global Health Security Agenda

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



*Samples collected in collaboration with FAO

LAB STRENGTHENING

IMPACT

234 individuals sampled (wildlife and domestic animals)

100 tests for coronaviruses

10 trained in One Health skills

Kenya Wildlife Service veterinarian training on PREDICT laboratory techniques.
Photo: Suzan Murray, PREDICT/Kenya

PREDICT/Kenya

Success stories

One Health surveillance for nationally recognized priority zoonotic diseases

PREDICT launched concurrent wildlife and livestock surveillance activities in Laikipia County, an area targeted as a high-risk human-animal interface along the animal value chain where the team previously conducted sampling of dromedary camels. In November, PREDICT collected more than 1,150 specimens from nonhuman primates, bats, rodents, and camels. The camel samples were collected from livestock at Suyian and Loisaba Ranches, while samples from remaining animals were captured at Mpala Ranch and included bats living in the attic of the mobile medical clinic, baboons living adjacent to a public roadway and river, and rodents around these sites. Testing has been initiated at the Institute of Primate Research Lab using techniques that can screen for both priority zoonotic viruses of national public health concern, like Ebola, along with other novel and emerging viral threats.

Supporting emergency outbreak preparedness and response

Following notification of an outbreak of avian influenza in neighboring Uganda, PREDICT/Kenya participated in an avian influenza consultative meeting convened by the Directorate of Veterinary Services (DVS). The meeting on January 18th (two days following the notification of the outbreak) was held to identify actionable steps in avian influenza surveillance, prevention, and control. PREDICT discussed and shared protocols (basic laboratory safety, biosafety and personal protective equipment (PPE) use, cold chain, and avian

Representatives of PREDICT and FAO attend workshop to discuss aligning public health priorities to GHSA. Photo: PREDICT/Kenya.

sampling methods as options for the surveillance team as they prepared to collect samples. PREDICT was requested to standby in case support was required for sample testing. As a result, PREDICT gained experience preparing to support outbreak response activities, has improved systems and communications in coordination with in-country partners and PREDICT's global team, and remains in a state of readiness.

Sustaining One Health collaborative partnerships

PREDICT/Kenya participated in Joint External Evaluation (JEE), the collaborative public health assessment aligned with the Global Health Security Agenda (GHSA). In addition to the primary JEE workshop, PREDICT/Kenya provided technical assistance on the importance of including high-risk wildlife-human interfaces for viral surveillance in JEE planning with Food and Agriculture Organization of the United Nations (FAO) partners during a meeting focused on aligning FAO's GHSA work plan to the JEE. PREDICT continues to support FAO objectives through workforce development, advanced viral detection of priority zoonotic diseases (if requested), and strengthening national laboratory capacity within the animal and public health laboratory systems.

Laboratory systems

PREDICT/Kenya is partnering with the Institute of Primate Research (IPR) and Kenya Medical Research Institute (KEMRI) laboratories for animal and human testing, respectively. The IPR lab has begun testing for one viral family (coronaviruses). The KEMRI lab is preparing to implement viral family testing for human samples.

Implementing partners

Smithsonian Institution, Institute of Primate Research, and Kenya Medical Research Institute

Contacts

Country Coordinator: Dr. Joseph Kamau, IPR (jkamau@primateresearch.org)

Global Point of Contact: Dr. Dawn Zimmerman, SI (zimmermand@si.edu)

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LIBERIA

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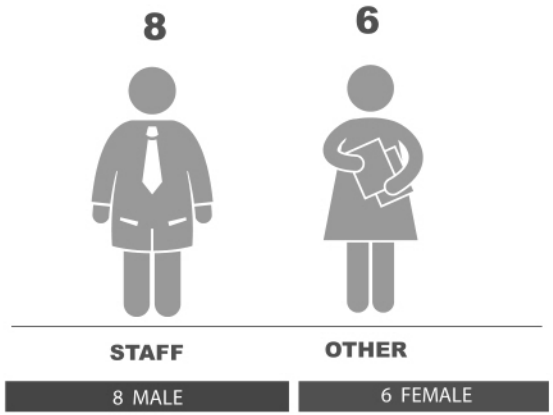
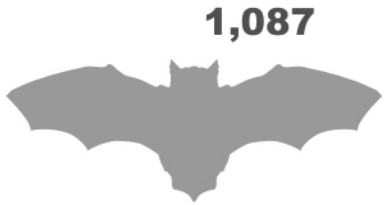
Global Health Security Agenda

WORKFORCE DEVELOPMENT

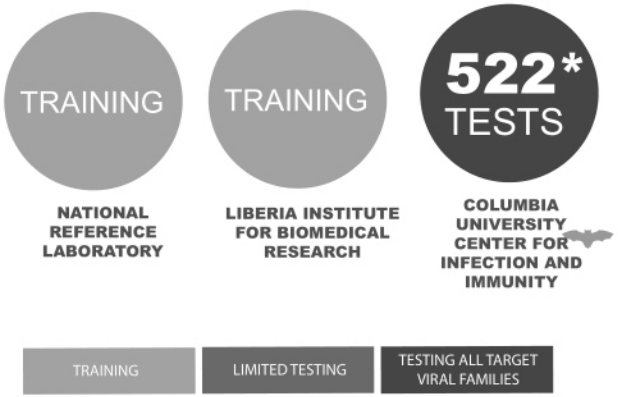


ONE HEALTH SURVEILLANCE



1,087 INDIVIDUALS
5,127 SPECIMENS

LAB STRENGTHENING



*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.

IMPACT

1,087 bats sampled

522 tests run for Ebola and other filoviruses

14 trained in One Health skills

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The PREDICT/Liberia team processes bat samples in a field tent as part of Ebola Host Project sampling activities. *Photo: PREDICT/-Liberia.*

PREDICT/Liberia*

**Liberia is implementing the Ebola Host Project along with PREDICT teams in Guinea and Sierra Leone.*

Success stories

Strengthening national partnerships for One Health

PREDICT/Liberia's country coordinator participated in weekly National Epidemic Preparedness and Response Committee meetings at the Ministry of Health and provided input and consultation on zoonotic disease issues. In addition, in an example of EPT and One Health partner collaboration, PREDICT's country coordinator assisted FAO in the development of their annual workplan, and ensured that it aligned with developing plans for the World Bank REDISSE project. PREDICT/Liberia also shared initial project test results with the Liberia Ministry of Health and Ministry of Agriculture and the Liberia Forestry Development Authority (all results pending approval for public release).

PREDICT furthered discussions with ministry partners at the Forest Development Authority (FDA) to formalize integration of FDA officers into Ebola Host Project field sampling activities. This collaboration will institutionalize core capacity for biological sampling for zoonotic surveillance within the Liberia Wildlife Authority. The FDA agreed to identify four officers for training and rotations with the PREDICT Society for Conservation for Nature for Liberia (SCNL) team, while SCNL and FDA continue to establish a working partnership mechanism.

PREDICT/Liberia staff process samples collected from bats in a field tent at night as part of Ebola Host Project activities. Photo: PREDICT/Liberia

Public-private partnerships for viral surveillance with the extractive industries

Through public-private partnerships, PREDICT/Liberia is working to break down barriers that could hinder surveillance in critical ecological zones and high-risk human-animal interfaces. For example, PREDICT is working with Arcelor Mittal in Liberia to explore collaborative opportunities that promote improved understanding of viral spillover and spread and mitigate risks for zoonotic disease transmission from extractive industry activities. With Arcelor Mittal, the team assisted with a bat translocation operation on a mining concession, successfully translocating over 1,500 bats from a developing mineshaft to an artificial roosting site. With company and ministry permission, PREDICT screened a portion of the bats for zoonotic viral threats, including Ebola and related viruses, to assist Arcelor Mittal and the

Government of Liberia in understanding the potential health risks associated with re-location efforts. All tests are pending interpretation and approval for public release.

Laboratory systems

PREDICT/Liberia is exploring partnerships with the National Reference Laboratory (NRL) and Liberia Institute for Biomedical Research (LIBR) to assess potential plans for strengthening laboratory capacity. 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.

Implementing partners

EcoHealth Alliance (EHA) and the Society for the Conservation of Nature, Liberia (SCNL)

Contacts

Country Coordinator: Dr. James Desmond, EHA (desmond@ecohealthalliance.org)

Global Point of Contact: Dr. Jon Epstein, EHA (epstein@ecohealthalliance.org)

Dashboard legend

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REPUBLIC OF CONGO

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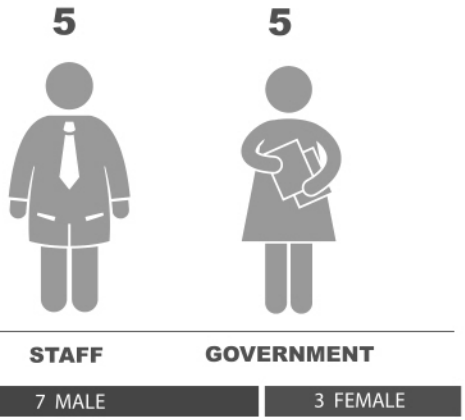
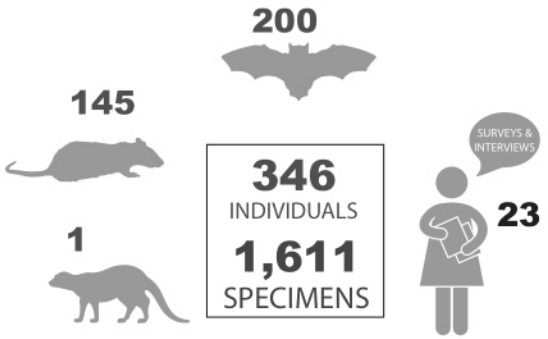
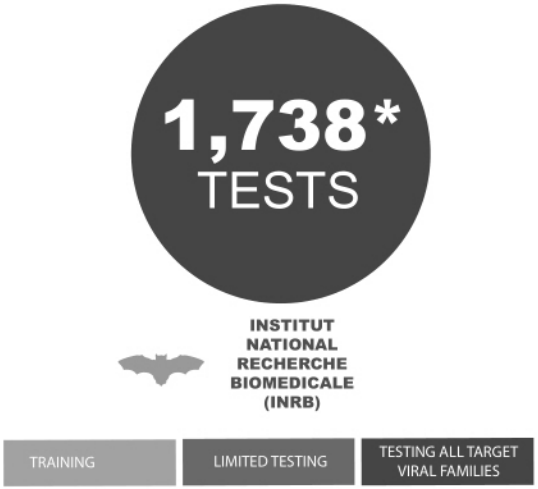
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



To date, animal specimen testing has been conducted by partners at the Institut National Recherche Biomédicale (INRB) lab in DR Congo.

IMPACT

346 individuals sampled (wildlife)

23 individuals interviewed in behavioral risk investigations

1,738 tests across 4 viral families

10 trained in One Health skills

PREDICT/RoC team samples rodents. *Photo: Global Viral*

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PREDICT/Republic of Congo

Success stories

Response to Monkeypox outbreak in Likouala

Following the outbreak of Monkeypox in Likouala province in the Republic of Congo (RoC) that started on the 27th of January 2017, PREDICT/RoC liaised with the Department of Epidemiology and Disease Control within the Ministry of Public Health to provide coordination support on surveillance and community sensitization on Monkeypox disease control and prevention. The outbreak resulted in a total of 61 suspected cases (six confirmed) and four deaths within the villages of Enyellé, Bétou, Manfouété, Dongou, and Impfondo among humans between 4-40 years of age. PREDICT rapidly responded to ministry partner requests to provide essential biosafety equipment (PPE such as gloves, goggles, N95 masks, protective coats and hand sanitizer) to outfit response teams.

Strengthening risk-based One Health surveillance through behavioral investigations

Following approval of the human surveillance protocol from the Ethical Committee for Health Science Research (CERSSA) in the Republic of Congo on the 13th of January 2017, two local team members were recruited and trained to conduct behavioral risk investigations in four bushmeat markets (Ouenze, Totale, Bourreau, and Mikalou) and bushmeat restaurants in Brazzaville, part of a multi-national and in-depth behavioral risk project investigating risks for zoonotic disease transmission in the bushmeat value chain in Central Africa. These markets constitute an important animal value chain interface, as hunted animals in the surrounding villages end up in these markets for sale. Both team members have significant experience in qualitative research through EPT's PREVENT project, a foundation PREDICT is building on to advance in-country capacity for mixed methods behavioral science and analytics through weekly training and mentorship from the global team. To date, trainings focused on how to conduct mixed methods behavioral risk work including ethnographic interviews, focus group discussions, human questionnaires, and data management, with the team launching activities in March-April 2017 and successfully completing 12 EIDITH questionnaires and 11 interviews.

Laboratory systems

To date, all animal specimen testing has been conducted by partners at the Institut National Recherche Biomédicale (INRB) lab.

Implementing partners

Metabiota Inc.

Contacts

Country Coordinator: Colonel Romain Bagamboula (robagampas12@yahoo.fr)

Global Point of Contact: James Ayukekbong, Metabiota (jayukekbong@metabiota.com)

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RWANDA

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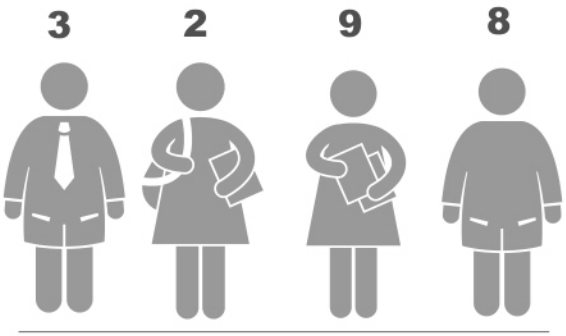
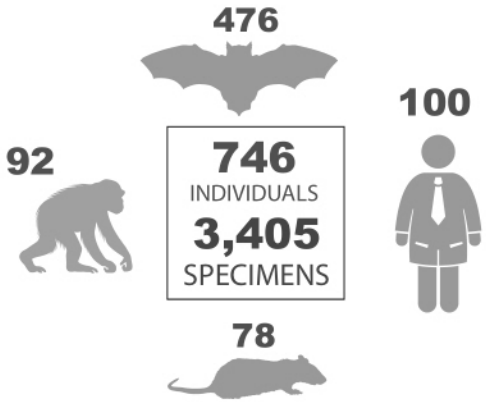
Global Health Security Agenda

WORKFORCE DEVELOPMENT

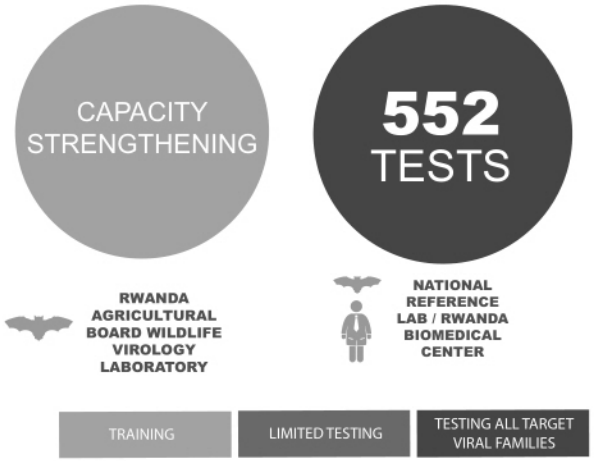


** Not mutually exclusive*

ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

746 individuals sampled (wildlife and people)

552 tests across 4 viral families

17 trained in One Health skills

Dr. Jean-Claude Tumushime describes the PREDICT project to community members in Kinigi, Rwanda.
Photo: PREDICT/Rwanda

PREDICT/Rwanda

Success stories

Successful launch of human surveillance at one hospital and three health centres

PREDICT/Rwanda successfully launched human syndromic surveillance in two local hospitals in December 2016. PREDICT's syndromic surveillance design involves biological sample collection coupled with a semi-structured human questionnaire to explore behaviors and practices that may be associated with exposure to zoonotic diseases. The team initiated surveillance by administering questionnaires and collecting samples from 67 febrile patients at Ruhengeri Referral Hospital and Kinigi Health Center. The team then expanded human surveillance activities to other health centres in January 2017, administering questionnaires to 159 febrile patients at the Shingiro Health Center and Bisate Health Center while continuing work at Ruhengeri Referral Hospital and Kinigi Health Center. To date, a total of 805 specimens were collected from patients at all sites.

Outbreak response and risk communication support

Following an outbreak of highly pathogenic avian influenza in neighboring Uganda and reports of a wild bird die-off in Rusizi District, PREDICT/Rwanda assisted the Ministries of Agriculture and Health and the Rwanda One Health Steering Committee with a field investigation targeting wild birds in Western Province. Though no dead birds were observed or sampled during the trip, PREDICT contributed to the government's public sensitization campaign on avian influenza by informing local communities about disease prevention through local and national radio shows. In addition, PREDICT

PREDICT/Rwanda collects samples from a bat during field surveillance activities. Photo: PREDICT/Rwanda.

participated in a two-day workshop organized by the Ministry of Agriculture (January 26-27, 2017) to update the national contingency plan for Avian Influenza.

Strengthening regional One Health networks for improved zoonotic disease surveillance

As part of PREDICT's strategy for strengthening regional networks for One Health and zoonotic disease surveillance across Africa, the PREDICT/Rwanda team in Musanze, Northern Rwanda, hosted PREDICT team members from Senegal for an intensive field training to share best practices. During the training, the visiting PREDICT teams received hands-on instruction in critical skills required for implementation of zoonotic disease surveillance activities. The trainings focused on biosafety, safe wildlife capture and sampling, human syndromic surveillance, cold chain, sample storage and transport, and data management. As a result, the PREDICT/Senegal team has increased their capacity to

conduct planned field activities at surveillance sites and plans to transfer these skills and knowledge to local partners and government staff.

Laboratory systems

PREDICT/Rwanda is partnering with Rwanda Agriculture Board (RAB) Wildlife Virology Laboratory and the National Reference Lab at the Rwanda Biomedical Center to implement viral family testing.

Implementing partners

UC Davis, Mountain Gorilla Veterinary Project (MGVP), Inc., Rwanda Agriculture Board, and Rwanda Biomedical Center

Contacts

Country Coordinator: Julius Nziza, MGVP (jnziza@gorilladoctors.org)

Global Points of Contact: Kirsten Gilardi, UC Davis (kvgilardi@ucdavis.edu) and Michael Cranfield, UC Davis (mrcranfield@gorilladoctors.org)

Dashboard legend

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PREDICT/Senegal

Success stories

Risk characterization for One Health surveillance

In February 2017, a collaborative team including PREDICT human and wildlife partners, the Food and Agriculture Organization (FAO) of the United Nations, the USAID/One Health Workforce/OCHEA country coordinator, the Direction of Parks, and regional and departmental representatives from the Ministry of Livestock travelled to the Bandia Reserve and surrounding communities within the Popenguine district. The team jointly assessed the wildlife inhabitants within the private reserve, visited multiple health centers including the Sindia Health Post in Popenguine, and FAO partners met with the head of the local farmer's association. During this visit, the PREDICT team identified and characterized multiple animal-human high-risk interfaces including agricultural intensification, hunting (animal value chain), and ecotourism. Given the close proximity of these interfaces to heavily populated areas and potential pathogen spillover and spread, partners collectively agreed to focus animal-human surveillance efforts in and around the Bandia Reserve and surrounding villages.

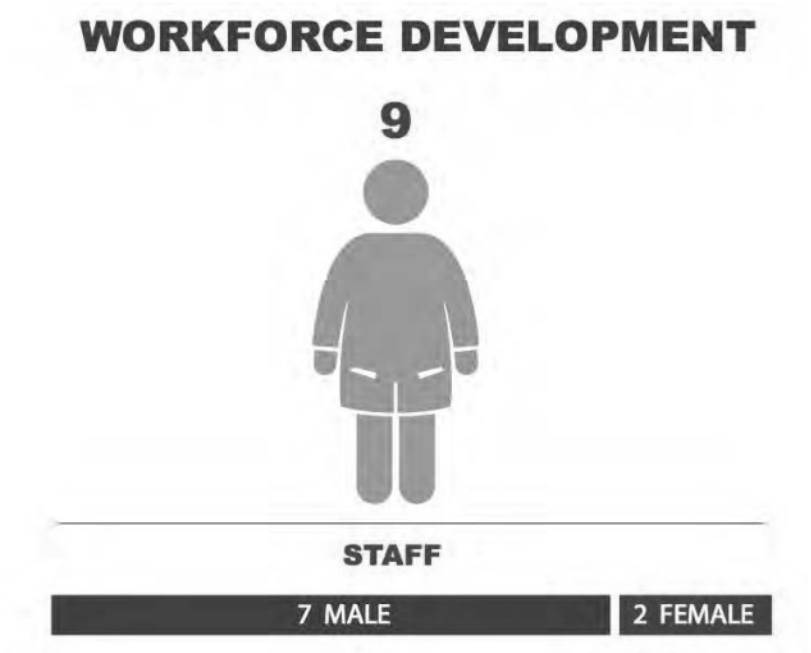
PREDICT/Senegal then participated in scoping and assessment visits to further characterize the sites and prepare for launch. The team travelled to the field site of Sindia and surrounding villages and conducted site characterization and assessments to further develop joint human and animal surveillance plans in collaboration with local focal points. During the visit, the team jointly identified and characterized potential priority surveillance sites and conducted site assessments for human surveillance, including establishing a relationship with Sindia Health Post personnel as well as

The PREDICT/Senegal and Rwanda team samples bats in a cave during a field training in Muzanse, Rwanda. Photo: PREDICT/Senegal.

Community Health Workers. The team also carried out community sensitization and engagement to prepare for fieldwork. Collectively, the team assessed three villages: Sindia, Kiniammbour and Bandia Bambara, and prioritized sampling sites, potential high-risk nodes, and animal-human interfaces for further investigations.

Strengthening One Health networks in Africa

PREDICT/Senegal's country coordinator from Inter State School of Veterinary Science and Medicine of Dakar and the human surveillance lead and data manager from the University of Cheikh Anta Diop (UCAD) travelled to Kigali, Rwanda (in separate visits) to attend an intensive field training with the PREDICT/Rwanda team in Muzanse, as part of PREDICT's



strategy for strengthening regional networks for One Health and zoonotic disease surveillance in Africa. During the training the PREDICT/Senegal team received hands-on instruction in critical skills required for implementation of zoonotic disease surveillance activities. The trainings focused on biosafety, safe wildlife capture and sampling, human syndromic surveillance, cold chain, sample storage and transport, and data management. As a result, the PREDICT/Senegal team is better equipped to conduct field activities and to transfer core One Health skills and knowledge to local partners and government staff, in addition to benefiting from a broad and collective network of global One Health professionals fostered by PREDICT.

Partnerships and workforce development

Sub-award agreements were established with three key partners in Senegal to formalize PREDICT's One Health team: the Inter State School of Veterinary Science and Medicine (EISMV), the Senegalese Agriculture Research Institute (ISRA), and the University Cheikh Anta Diop (UCAD). A total of 13 PREDICT team members have, or are currently undergoing training in up to 20 project protocols including biosafety and biosecurity, safe wildlife capture and sampling, human syndromic surveillance methods, sample storage and transport, cold chain, data management, and viral detection techniques. The PREDICT/Senegal country coordinator has successfully completed all trainings and is now qualified to train others.

Laboratory systems

PREDICT/Senegal is partnering with laboratories at the Senegalese Institute of Agriculture Research (ISRA – animal testing) and the University of Cheikh Anta Diop (UCAD – human testing). Both labs are preparing for training for viral family testing.

Implementing partners

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

Contacts

Country Coordinator: Dr. Ismaila Kane, EISMV
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Global Point of Contact: Dr. Corina Monagin, UC Davis
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SIERRA LEONE

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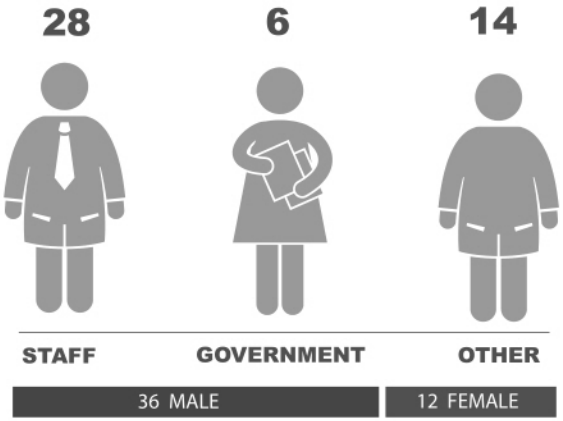
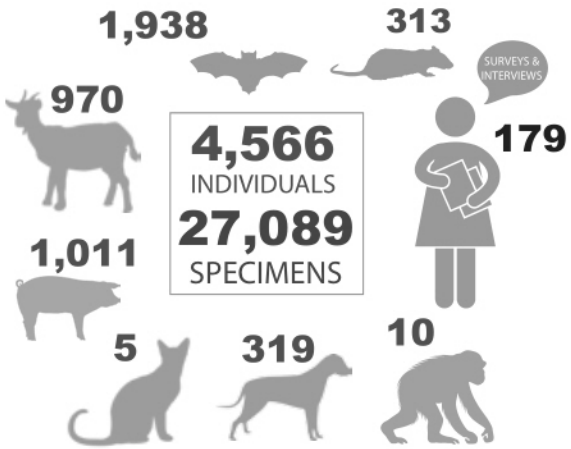
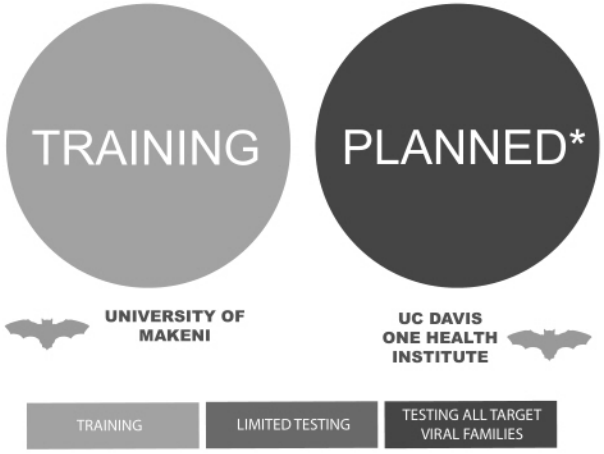
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



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

IMPACT

4,566 individuals sampled (wildlife and domestic animals)

179 individuals interviewed in behavioral risk investigations

Training initiated for viral testing

48 trained in One Health skills

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Pigs rooting in garbage, Salone, Sierra Leone, where PREDICT is collecting samples as part of the Ebola Host Project.
Photo: Corina Monagin/PREDICT Sierra Leone

PREDICT/Sierra Leone

**Sierra Leone is implementing the Ebola Host Project along with PREDICT teams in Guinea and Liberia.*

Success Stories

Strengthening One Health platforms from the district to national level

PREDICT, alongside USAID's Preparedness & Response (P&R) project, has taken direct action to promote the One Health platform in Sierra Leone. In support of a multi-sectorial approach to zoonotic disease surveillance, prevention and response, PREDICT organized seven district-level One Health platform initiation meetings in Kono (November 15), Koinadugu (November 21), Kambia (November 28), Bombali (February 13), the Western Area urban area (February 21), Kono (March 13), and Koinadugu (March 20). Meetings were well attended by local, district, and national-level government, including representatives from the Ministry of Health and Sanitation and the Ministry of Agriculture, Forestry, and Food Security, as well as officials from USAID, World Health Organization, and the Food and Agriculture Organization. These meetings facilitated awareness, discussions, and consequent widespread support of the One Health approach in-country and worked towards defining key next steps to form coordination mechanisms for zoonotic disease surveillance and strengthen the platform at the district level. PREDICT's initiatives and involvement in promoting the One Health platform in seven districts, as well as participating in the national technical committee, are contributing to the operationalization of key next steps to establish the One Health strategy in Sierra Leone.

USAID Country Coordinator Khadijat Mojidi speaks during a PREDICT community stakeholders meeting, alongside GHSA Advisor Dorothy Peprah and PREDICT staff, in Masuba, Bombali District. Photo: James Bangura, PREDICT Sierra Leone

Exemplifying One Health through community engagement

From March 27-29th, PREDICT hosted the USAID GHSA Advisor in Freetown, the Guinea/SL Country Program Coordinator, and a representative from USAID/Washington for field visits to the Bombali (Masuba and Robuya) sites. The team observed one of PREDICT's community meetings, met with District Officials (DAO, Veterinary Officer, Livestock Officer), and observed bat capture and sampling activities. In addition, the team gained a better understanding of PREDICT's behavioral risk investigation work through observation of a focus group discussion and ethnographic interviews. According to participants: *"this trip was very*

successful. PREDICT continues to exemplify some of the best examples of USAID's work in Sierra Leone by effectively engaging communities to deliver EHP [the Ebola Host Project]. James and Dr. Gbakima [PREDICT/Sierra Leone leads] continue to demonstrate highest level of expertise in understanding, implementing, and conveying the project." The USAID team also provided guidance on improving communications with communities and the wider public. As a result, the PREDICT team began working with ministry partners to develop effective outreach strategies including development of printed posters with pictorial explanations of animal handling and sampling activities, as well as more frequent inclusion of ministry partners in community visits to educate people on safe animal handling practices.

Laboratory systems

PREDICT/Sierra Leone is exploring partnership with the University of Makeni to assess potential plans for strengthening laboratory capacity. 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.

Implementing partners

Metabiota, Inc. and the University of Makeni

Contacts

Country Coordinator: Professor Aiah Gbakima (gbakimaaa2009@gmail.com)

Global Point of Contact: Frantz Jean Louis (fjeanloius@metabiota.com)

Dashboard legend

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TANZANIA

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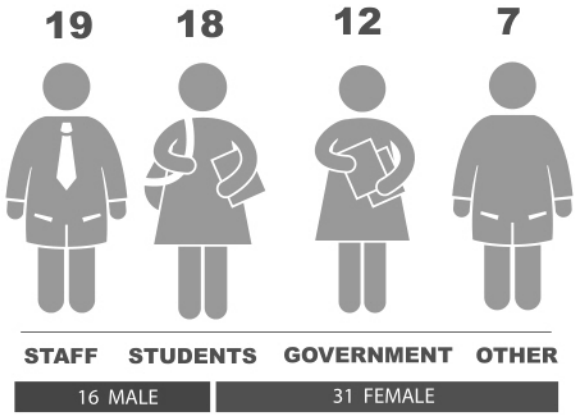
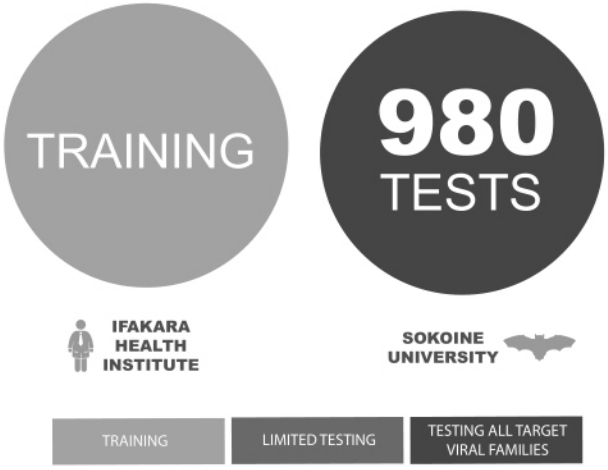
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE

LAB STRENGTHENING



IMPACT

555 individuals sampled (wildlife)

147 individuals interviewed in behavioral risk investigations

980 tests across 5 viral families aimed at detecting Ebola, Marburg, and zoonotic influenza viruses

56 trained in One Health skills

PREDICT's Tanzania country coordinator describes the liquid nitrogen cold chain to the PREDICT/Ethiopia team during a training in Morogoro, Tanzania. *Photo: PREDICT/Ethiopia.*

PREDICT/Tanzania

Success stories

Supporting national prioritization of zoonotic diseases

PREDICT/Tanzania's Principal Investigator helped facilitate the multi-sectoral One Health zoonotic disease prioritization workshop held March 23-24, 2017 in Dar es Salaam. In addition to workshop facilitation, PREDICT worked together with US interagency partners (USAID and CDC) and the Tanzania One Health Coordination Unit in preparation and planning for the workshop and provided technical assistance, expertise, and informational resources on endemic and emerging zoonotic viral threats in Tanzania and the greater Africa region to workshop organizers. As a result of the workshop, Tanzania identified rabies, Rift Valley Fever and other hemorrhagic fevers (Marburg and Ebola), zoonotic influenza virus, anthrax, human African trypanosomiasis, and Brucellosis as priority zoonotic diseases and will be developing surveillance and lab capacities as relevant.

One Health capacity strengthening

PREDICT continued to strengthen in-country capacity to tackle zoonotic diseases through in-service training for local and government animal health staff, including district veterinary officers and community-based stakeholders. These trainings aimed to enhance core One Health professional skills required for conducting field investigations (outreach on zoonotic disease risks, biosafety and PPE, safe sample collection from wildlife and people, cold chain, safe sample storage and transport, behavioral risk investigations, and data management).

Dr.Grace Mwangoka leads a training for Ujiji Health Centre staff, a clinic where PREDICT/Tanzania will be conducing syndromic surveillance. Photo: PREDICT/Tanzania.

To date, 56 individuals have received in-service training in One Health skills in Tanzania including 12 government personnel and 18 students.

PREDICT also conducted trainings for 12 Ujiji Health Centre staff in the Lake Zone region (photo above) in ethics, safe sample collection, cold chain, and data management in preparation for launch of syndromic surveillance targeting patients with undiagnosed fevers of likely viral origin that may be associated with priority zoonotic diseases. Community sensitization meetings were also held at PREDICT sites in the

Lake Zone, where 188 community leaders from eight villages were introduced to PREDICT's One health approach to surveillance. In addition to creating awareness of PREDICT activities in the community, the relevance of appropriate biosafety and biosecurity practices was discussed with the community members.

Laboratory systems

PREDICT/Tanzania is partnering with the Sokoine University of Agriculture (SUA) for animal testing and the Ifakara Health Institute (IHI) for human testing. SUA is implementing viral family testing for all five priority viral families and using techniques that can detect priority zoonotic diseases (Rift Valley Fever and other hemorrhagic fevers and zoonotic influenza virus). IHI is preparing to implement viral family testing.

Implementing partners

UC Davis, Sokoine University of Agriculture (SUA), and Ifakara Health Institute (IHI)

Contacts

Principal Investigator: Professor Rudovick Kazwala, SUA (Kazwala@gmail.com)

Country Coordinator: Dr. Zikankuba Sijali, SUA (zikankubasijali@gmail.com)

Global Point of Contact: David Wolking, UC Davis (djwolking@ucdavis.edu)

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UGANDA

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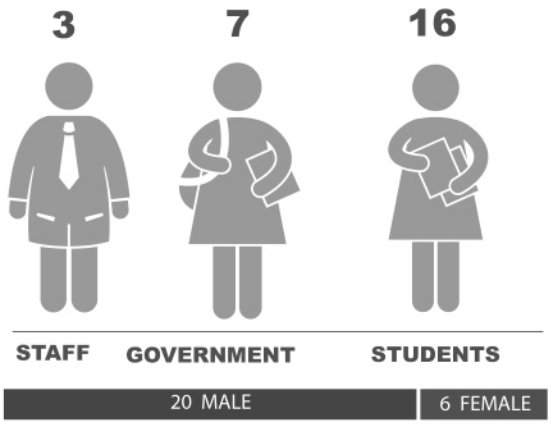
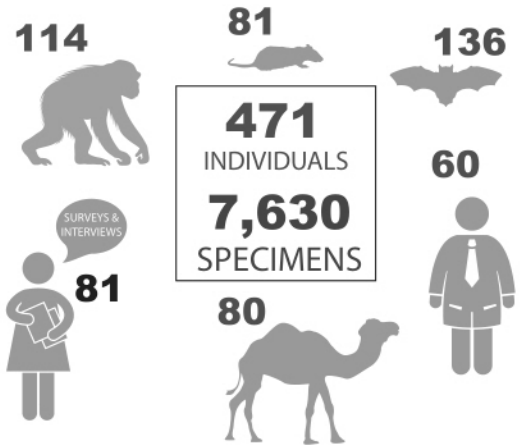
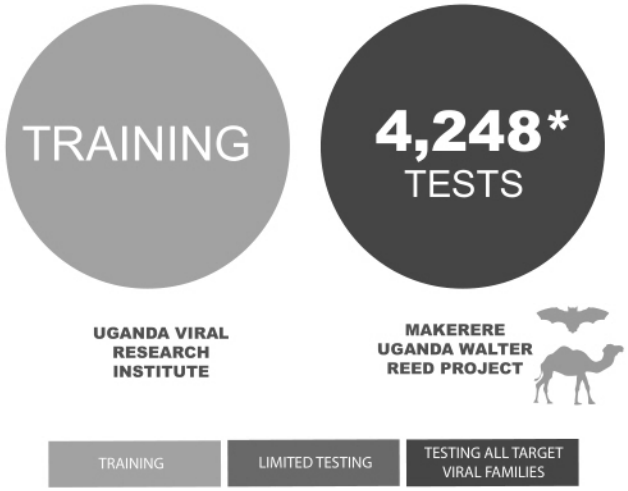


ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



*No longer actively engaged.

IMPACT

471 individuals sampled (wildlife and domestic animals)

81 individuals interviewed in behavioral risk investigations

4,248 tests across 10 viral families aimed at detecting hemorrhagic fevers (Ebola, and Marburg), and zoonotic influenza

12 trained in One Health skills

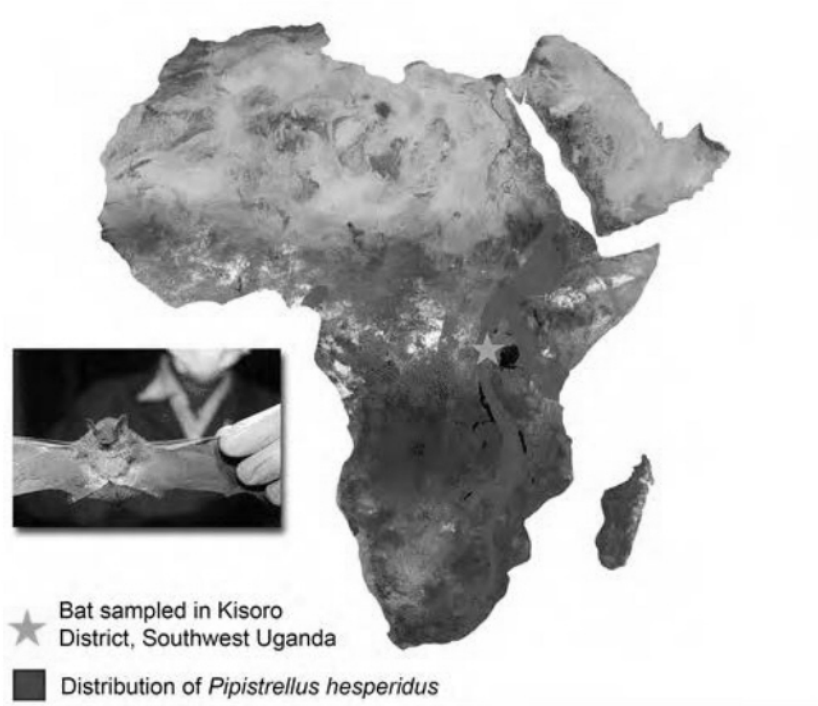
The PREDICT team handles a bat before sampling.
Photo: PREDICT/Uganda.

PREDICT/Uganda

Success stories

Identification of a new coronavirus closely related to MERS CoV

Based on work conducted by the PREDICT/Uganda team, a new publication featuring PREDICT/Uganda team members as co-authors was released by the journal *mBio*. The article, titled "Further evidence for bats as the evolutionary source of MERS Coronavirus", describes a new coronavirus detected in a bat and sheds light on bats as the potential reservoir for emerging infectious diseases like Middle Eastern Respiratory Syndrome (MERS) Coronavirus *(for more information, please click the link to the full article under the figure caption*).



A map showing the distribution of the bat species from which the new coronavirus closely related to MERS-CoV was detected. Source: mBio http://mbio.asm.org/content/8/2/e00373-17

Supporting national prioritization of zoonotic diseases

PREDICT/Uganda participated in the One Health zoonotic disease prioritization workshop in Kampala on March 2-3, 2017 facilitated by the US Centers for Disease Control, where five priority zoonotic diseases were selected by the government ministries of Health, Agriculture, and the Environment with support from partners: anthrax, viral hemorrhagic fevers (Ebola, Marburg, CCHF, and RVF), brucellosis, trypanosomiasis, and zoonotic Influenza viruses. In collaboration with government partners, PREDICT/Uganda is working to strengthen detection and response capacity from district to national levels for viral hemorrhagic fevers and zoonotic influenza viruses.

One Health surveillance at high-risk interfaces

PREDICT/Uganda launched human syndromic surveillance at Bwindi Community Hospital (BCH) in Buhoma, Kanungu District, southwestern Uganda, an area considered high-risk for human-animal contact and zoonotic disease transmission. BCH receives patients with febrile illnesses, many of which go undiagnosed and are potentially the result of zoonotic infections. PREDICT's syndromic surveillance design involves biological sample collection coupled with a semi-structured

human questionnaire to explore behaviors and practices that may be associated with exposure to zoonotic diseases. At BCH, PREDICT conducted in-service trainings for clinic staff in ethics, biosafety, safe sample collection, cold chain, data management, and administration of the behavioral questionnaire. Following training, clinic staff sampled over 100 febrile patients and obtained behavioral risk data from members of Buhoma community. In addition, PREDICT/Uganda continued wildlife surveillance at high-risk animal-human interfaces on the fringes of Bwindi Impenetrable National Park in Rubanda and Kanungu districts in targeted communities that rely on BCH for health services. Between October 2016 and March 2017, the team sampled 136 bats, 81 rodents, and 35 non-human primates, collecting over 1,400 samples in and around human dwellings. In addition, the team also sampled primates and collected fecal specimens from 44 individual human habituated mountain gorillas resulting in 244 specimens. All samples (animal and human) are stored to await testing for viral families to detect priority zoonotic diseases. One Health surveillance activities will continue monthly in these communities.

Strengthening the National One Health Platform

PREDICT/Uganda participated in the inaugural meeting of the National One Health Technical Working Group (OHTWG) on October 11, 2016 in Kampala, a prelude to the formal launch of the National One Health Platform (NOHP). PREDICT also attended the official signing of the Memorandum of Understanding and the launch of the National One Health Platform (NOHP) in Kampala on November 3, 2016. The NOHP is a multisectoral and multidisciplinary collaboration between the Ministry of Agriculture, the Ministry of Health, the Ministry of Water and Environment, and the Uganda Wildlife Authority. The NOHP was established to provide technical guidance to the government in the implementation of the One Health approach to strengthen cross-sectoral collaboration to prevent, detect, and respond to zoonotic and other emerging health threats.

Laboratory systems

PREDICT/Uganda is preparing to implement viral family testing for human and animal samples with the Uganda Viral Research Institute (UVRI).

Implementing partners

UC Davis, Mountain Gorilla Veterinary Project (MGVP), Inc., and the Uganda Viral Research Institute (UVRI)

Contacts

Country Coordinator: Benard Ssebide, MGVP (bssebide@gorilladoctors.org)

Global Points of Contact: Kirsten Gilardi, UC Davis (kvgilardi@ucdavis.edu) and Michael Cranfield, UC Davis (mrcranfield@gorilladoctors.org)

Dashboard legend

Workforce Development. Numbers represented are from the life of project (September 2014 to March 31, 2017).

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BANGLADESH

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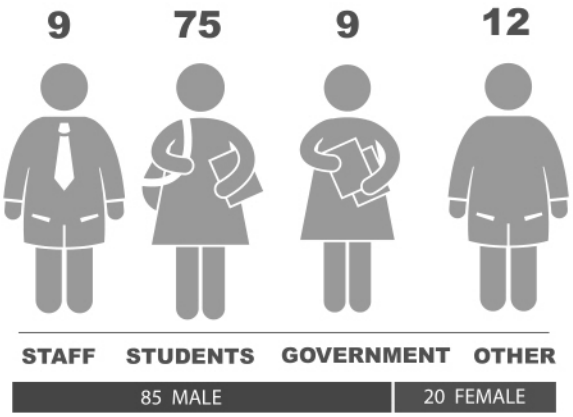
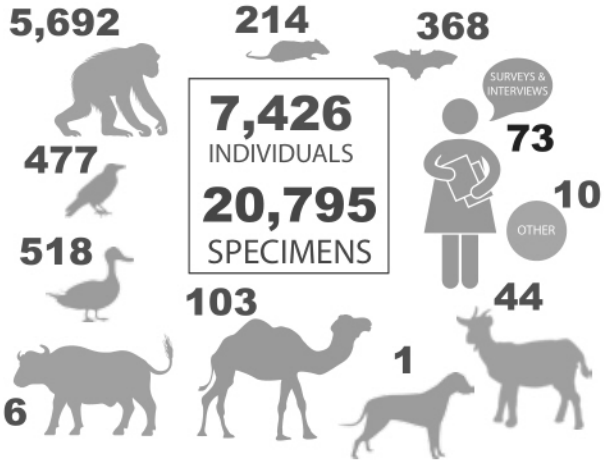
Global Health Security Agenda

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

IMPACT

7,426 individuals sampled (wildlife and domestic animals)

73 individuals interviewed in behavioral risk investigations

1,122 tests across 5 viral families

105 trained in One Health skills

PREDICT/Bangladesh team samples a crow during a die-off of unknown origin. *Photo: PREDICT/Bangladesh*

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PREDICT/Bangladesh

Success stories

Outbreak response support

PREDICT/Bangladesh plays a critical role in outbreak response support to the Government of Bangladesh's national health system through field-based zoonotic disease investigations and viral detection at partner laboratories. In addition to regularly planned One Health surveillance activities, the PREDICT team was engaged by ministry partners multiple times over a four-month period to help identify the cause of disease outbreaks in wildlife and in humans, as described below. In addition to providing rapid response support, PREDICT's involvement in these investigations contributes to preparedness and prevention, as information collected through response efforts helps improve our broader understanding of the sources and causal agents of disease emergence, helps identify risk factors associated with an outbreak, and contributes to the identification of potential mitigation and control strategies for informed decision making.

Unusual crow-die offs confirmed as H5

On January 12th, 2017, the Director of the Rajshahi Medical College Hospital (RMCH) officially notified the Director of the Institute of Epidemiology, Disease Control and Research (IEDCR) about an unusual crow die-off in the vicinity of Rajshahi Medical College Hospital (RMCH) and requested PREDICT support for a field investigation. The clinical signs displayed by the crows included suddenly falling from trees, torticollis, circling movement, white watery diarrhea, inability to fly, and subsequent mortality. Concurrently, on January 14th,

A field investigation team member inspects a dead crow during the unusual die off investigation. Photo: PREDICT/Bangladesh.

2017, while PREDICT's team was on a bat sampling trip in Dhaka the country coordinator observed sick and dying crows and notified the director of IEDCR about the second crow die-off. IEDCR subsequently requested that PREDICT expand the outbreak investigation from Rajshahi to Dhaka. IEDCR expressed interest in understanding the geographical distribution, cause, and extent of this outbreak and in finding any epidemiological links between the two outbreaks in Dhaka and Rajshahi.

From the start of both outbreak investigations, PREDICT provided technical guidance, collected samples, and conducted some laboratory testing (in conjunction with the Department of Livestock Services' (DLS) federal reference lab at the Bangladesh Livestock Research Institute (BLRI)). PREDICT also surveyed nearby crow roosts in an effort to

understand the geographic circulation of the outbreak. PREDICT's participation continued through the end of the response in an effort to improve the understanding of avian influenza viral diversity in a key wild bird species and to assess the risk of zoonotic disease emergence across disease transmission pathways.

During the investigations, PREDICT collected wild bird and feral dog samples, environmental crow fecal samples from under roosts, samples from poultry offal at local markets, and environmental poultry fecal samples from some poultry farms. The team also conducted qualitative interviews, transported personnel, and transported samples from the field to the lab.

All collected samples were sent to the PREDICT lab (icddr,b), on January 18th, 2017 (Rajshahi samples) and February 20th, 2017 (Dhaka samples), where they were screened by real time PCR for Influenza A. A duplicate set of samples was also sent to BLRI for testing. On January 22nd, 2017 PREDICT received preliminary laboratory test results from icddr,b and confirmatory results from BLRI lab for the crow samples from Rajshahi; while test results on some samples are still pending, the Chief Veterinary Officer of the Department of Livestock Services (DLS) officially reported the results from 17 crows from Rajshahi as H5N1 positive to OIE on January 21st. DLS later reported the samples from Dhaka as H5 positive.

Suspected Nipah virus investigation

On March 2, 2017, the Director of the Institute of Epidemiology, Disease Control & Research (IEDCR) notified PREDICT/Bangladesh of three human encephalitis cases suspected to be associated with Nipah virus infection. Although the government had not officially announced Nipah virus as the cause of the outbreak, IEDCR working under the assumption that it involved Nipah virus, had initiated an outbreak investigation in the two areas with cases, Faridpur and Pabna. As the reservoir for Nipah virus is flying foxes (*Pteropus* bats), IEDCR requested PREDICT's assistance in a One Health investigation for wildlife and domestic animal sampling. PREDICT subsequently provided recommendations for the animal component of the investigation and sent a small team to collect samples from bats in Faridpur.

All animal samples were transferred to labs for testing, which is being conducted at the icddr,b lab using specific PCR tests for Nipah virus, PREDICT's paramyxovirus family testing, and other priority viral families. All findings will be released when approved by Government of Bangladesh partners.

Strengthening the wildlife health workforce and improving One Health networks in South Asia

In March 2017, to support improved workforce capacity for wildlife disease surveillance in the South Asia region, the PREDICT/Bangladesh team organized and facilitated a five-day field training (March 24th-29th) on techniques for rhesus macaque disease surveillance. The team trained two Forestry Officers from the Government of Bangladesh, one PREDICT global team member, and one partner from the PREDICT/India team (part of PREDICT's strategy to foster active One Health networks among professionals globally) on safe rhesus macaque capture, immobilization, handling, and sampling methods; and the proper use of personal protective equipment while in the field to ensure the safety of both field researchers and animals.

Laboratory systems

PREDICT/Bangladesh is partnering with the laboratory at icddr,b for animal testing, with human testing led by the Institute of Epidemiology, Disease Control and Research (IEDCR). icddr,b is implementing the viral family protocols for five priority families (corona, filo, flavi, influenza, and paramyxo viruses).

Implementing partners

EcoHealth Alliance, icddr,b, and the Institute of Epidemiology, Disease Control and Research (IEDCR)

Contacts

Country Coordinator: Dr. Ariful Islam, EcoHealth Alliance (arif@ecohealthalliance.org)

Global Point of Contact: Jon Epstein, EcoHealth Alliance (epstein@ecohealthalliance.org)

Dashboard legend

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CAMBODIA

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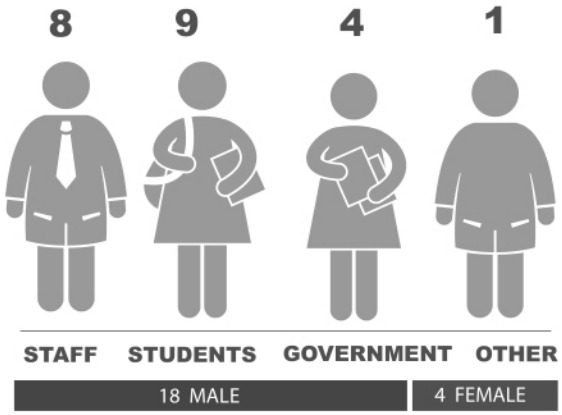
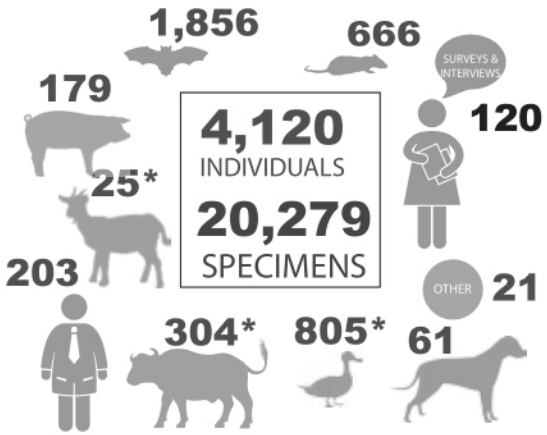
Global Health Security Agenda

WORKFORCE DEVELOPMENT

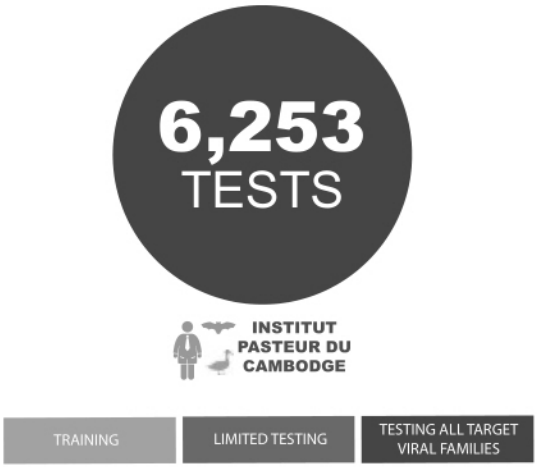


ONE HEALTH SURVEILLANCE



*Samples collected in collaboration with FAO

LAB STRENGTHENING



IMPACT

4,120 individuals sampled (humans and animals)

120 individuals interviewed in behavioral risk investigations

6,253 tests across 8 viral families

22 trained in One Health skills

The PREDICT team collects bat, urine and fecal samples at dawn at a bat guano farm. *Photo: PREDICT/Cambodia*

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PREDICT/Cambodia

Success stories

One Health surveillance of people, livestock, and wildlife at high-risk interfaces for zoonotic disease transmission

PREDICT/Cambodia launched the first coordinated wildlife, domestic animal, and human field sampling effort in Cambodia. Using the One Health approach, PREDICT, in close coordination with government human and animal health partners from National Animal Health and Production Research Institute (NAHPRI), the Cambodia Communicable Disease Control Department (CDC), and the Forestry Administration (FA) conducted concurrent sampling of wildlife, domestic animals, and humans at a cross-border rodent trading hub in Kandal Province, on the border with Vietnam. Sampling occurred with the participation of students from the Royal University of Agriculture (RUA) and the University of Health Sciences (UHS). Samples were collected from 87 rats transported from different provinces to the trade hub for sale and from domestic animals around the rodent trade hub. Swab samples were collected from 32 dogs and cats with the assistance of their owners. In addition, 343 samples were collected from livestock including cattle in the vicinity of the rodent trade hub and a nearby village where trappers and traders live; swine at local back-yard farms and a small-scale abattoir where pigs from nearby houses are taken for slaughter; and poultry from flocks on small farms nearby and from backyard poultry in the rodent-trade hub area. Concurrently, 110 humans working or living in and around the rodent trade hub were interviewed and sampled.

PREDICT's One Health field team samples ducks during the first ever concurrent sampling trip targeting wildlife, domestic animals, and people in Cambodia. Photo: Kathy West/PREDICT

Strengthening risk-based surveillance with partners at three hospitals

PREDICT initiated syndromic surveillance by collecting samples and surveys from sick people at three hospitals: Kantha Bopha pediatric hospital in Phnom Penh, which receives sick children from across the country; Koh Thom district hospital in Kandal province close to the PREDICT rodent trade field sampling site; and Prey Chhor district hospital in Kampong Cham province, adjacent to the bat guano farming community where PREDICT conducts sampling. The PREDICT team visited the hospitals to provide training to medical doctors and nurses on inclusion criteria, how to fill out questionnaires and how to collect and store clinical samples for viral testing.

PREDICT also provided the hospitals with necessary consumables and materials for sampling and appropriate cold chain storage for transportation of samples to the Institut Pasteur du Cambodge, PREDICT's partner laboratory for testing. As of April 2017, 17 patients have been interviewed and sampled at Kantha Bopha: nine at Prey Chhor district hospital and 51 at Koh Thom district hospital. The team plans to revisit the hospitals regularly to provide guidance and replenish supplies.

Workforce training for improved viral detection

In-service Royal Government of Cambodia laboratory staff from the National Animal Health and Production Research Institute (NAHPRI) and the National Institute of Public Health (NIPH) are now being trained at the Institut Pasteur, Cambodia laboratory to perform priority PREDICT viral family testing protocols. The aim is for some of the viral family protocols to be transferred to their National laboratories in the future. In addition, veterinary students from the Royal University of Agriculture and medical students from the University of Health Sciences are also participating in the laboratory training to strengthen the future workforce.

Laboratory systems

PREDICT/Cambodia is partnering with the Institut Pasteur du Cambodge (IPC), which is actively testing animal and human samples and training staff from the National Animal Health and Production Research Institute (NAHPRI) and the National Institute of Public Health (NIPH), in addition to PREDICT partners from labs in the neighboring Southeast Asia region.

Implementing partners

UC Davis, Institut Pasteur du Cambodge (IPC)

Contacts

Country Coordinator: Veasna Duong, IPC (dveasna@pasteur-kh.org)

Global Points of Contact: Tracey Goldstein (tgoldstein@ucdavis.edu) and Lucy Keatts (lkeattsconmed@gmail.com), UC Davis

Dashboard legend

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CHINA

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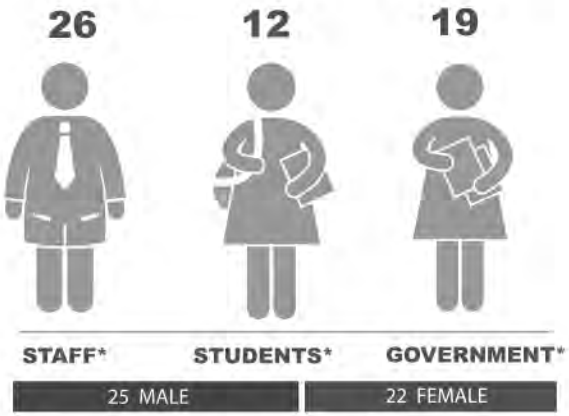
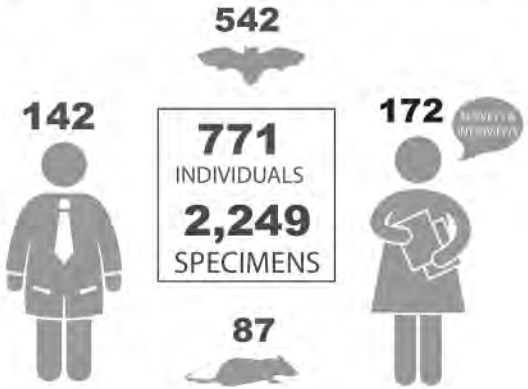
WORKFORCE DEVELOPMENT

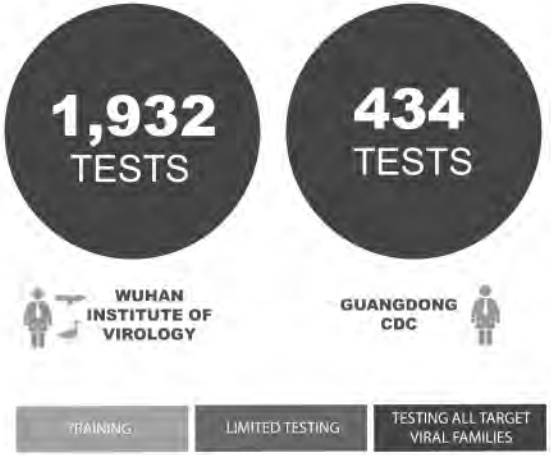


** Some trainees fall under multiple categories*

ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

771 individuals sampled (wildlife and people)

172 individuals interviewed in behavioral risk investigations

2,366 tests across 6 viral families

47 trained in One Health skills

A woman prepares a chicken at a live market where PREDICT/China has been collecting samples for viral detection. *Photo: Jonathan Goley/EHA*

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PREDICT/China

Success stories

One Health in Action: Concurrent wildlife and human surveillance

PREDICT/China initiated targeted surveillance of syndromic patients at two hospitals in Guangdong Province, First Affiliated Hospital of Shantou Medical School and Tungwah Hospital of Dongguan. These hospitals were selected due to significant patient traffic from surrounding communities containing wet markets, live poultry markets, high density livestock facilities, and small-scale farming with an abundance of rodents living in and around barns and homes. Biological specimens and ethnographic data were collected from over 200 enrolled patients from October 2016 through March 2017. Wild animal samples were also collected around the area of Tungwah Hospital of Dongguan, with 348 specimens from 87 individual rodents collected. These rodents are representative of wildlife that share space with symptomatic humans, and results from PREDICT viral family testing of both rodents and hospital patients will contribute to our understanding of viral spillover in the area.

The PREDICT/China team with hospital staff members selected for training in human surveillance methods and behavioral risk investigations. Photo: PREDICT/China.

Workforce development

PREDICT/China hosted a human surveillance training session in Guangzhou in October 2016 with members of Guangdong CDC, Guangdong Institute of Public Health (GDIPH), the First Affiliated Hospital of Shantou Medical School, Tungwah Hospital of Dongguan, as well as local prefecture CDC representatives from both Shantou and Dongguan. Selected hospital staff were trained to identify patients presenting with syndromes of interest, carry out the consent process, collect biological samples, and administer a behavioral risk questionnaire.

In addition, six staff members from Wuhan Institute of Virology of the Chinese Academy of Sciences and six members of the PREDICT/China field team were trained on core PREDICT competencies such as biosafety and PPE use, laboratory safety, and responding to a disease outbreak in February and March of 2017.

Finally, PREDICT/China's Field Coordinator, Dr. Guangjian Zhu, was invited by the Institute of Pathogen Biology, Chinese Academy of Medical Sciences and Peking Union Medical College to provide PPE, biosafety, and animal sampling trainings to their field staff from China and Africa.

New Publications: Fruit bats as reservoirs for filoviruses and Bat SARS-like Coronaviruses

PREDICT expertise and surveillance activities contributed to the publication of a new article in the journal *Emerging Infectious Diseases*. The article entitled "Genetically Diverse Filoviruses in *Rousettus* and *Eonycteris* spp. Bats, China, 2009 and 2015" provides further evidence that fruit bats are key reservoirs for filoviruses. In addition, PREDICT work and team members contributed to another article (in review) tentatively titled "An Epicenter of Bat SARS-like Coronaviruses with Frequent Recombination Events Promoting the Generation of the Pandemic SARS Coronavirus".

A lab technician with PREDICT/China prepares to label specimens for viral testing. Photo: Jonathan Goley/EHA.

Laboratory systems

PREDICT/China is partnering with the Wuhan Institute of Virology of the Chinese Academy of Sciences for wildlife and human testing, and Guangdong Institute of Public Health at Guangdong CDC for specimens collected from hospital-based syndromic surveillance activities. Both labs are trained and are actively testing human and wildlife samples for the five priority viral families (corona, filo, flavi, influenza, and paramyxo viruses). PREDICT/China is also conducting trainings at the Institute of Microbiology of the Chinese Academy of Sciences for wildlife testing, and Yunnan Institute of Endemic Diseases Control and Prevention for human testing.

Implementing partners

EcoHealth Alliance, Wuhan Institute of Virology, Chinese Academy of Sciences

Contacts

Country Coordinator: Zhengli Shi, Wuhan Institute of Virology, Chinese Academy of Sciences (zlshi@wh.iov.cn)

Global Point of Contact: Jon Epstein, EcoHealth Alliance (epstein@ecohealthalliance.org)

Dashboard legend

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PREDICT/India

Success stories

Partnerships in support of the Global Health Security Agenda

On November 30th, 2016 PREDICT presented an overview of its global and India-specific objectives during the India Global Health Security Agenda (GHSA) Annual Meeting. The meeting was coordinated by the US CDC India office and included high-level officials from various departments within the Government of India's Ministry of Health and the Indian Medical Research Council. PREDICT emphasized its One Health approach to surveillance and partnerships, described plans to conduct concurrent wildlife and human surveillance, and conducted outreach to human (National Institute of Virology, Indian Council of Medical Research (ICMR)) and animal (Indian Veterinary Research Institute, Indian Council of Agricultural Research (ICAR)) Government of India institutions, as well as Uttar Pradesh state health and wildlife agencies.

Strengthening South Asia's One Health Network

As part of PREDICT's regional approach to capacity strengthening and developing One Health networks among active professionals, the PREDICT/India team trained with project partners in Nepal and Bangladesh, enhancing regional coordination and building skills and competencies for zoonotic disease surveillance.

Participants at the Zoonotic Disease Pandemic Preparedness for South Asia, Using One Health Platform workshop in Nepal. Photo: PREDICT/Nepal.

Pandemic preparedness workshop in Nepal

In March 2017, PREDICT/India's Field Coordinator and Laboratory Lead attended a regional workshop entitled *Zoonotic Disease Pandemic Preparedness for South Asia, Using One Health Platform* in Kathmandu, Nepal organized by PREDICT/Nepal. There, the PREDICT/India team was able to build upon the existing expertise of the PREDICT/Bangladesh and Nepal teams, as well as experts from Bhutan. At the workshop, participants presented updates on the status of One Health platforms and activities in the South Asia region, shared information on ways to prevent the spread of infectious diseases between animals and people, and identified roles and responsibilities for effective multi-sectoral communication and coordination during outbreaks, especially transboundary disease events. The workshop also served to highlight gaps in current zoonotic disease surveillance and outbreak preparedness and response programs. The India Field Coordinator presented PREDICT/India's progress to date, and participated in a round table discussion on implementing One Health projects in India.

Safe wildlife handling and sampling in Bangladesh

From late March through April, the PREDICT/India Field Coordinator travelled to Dhaka to be trained by the PREDICT/Bangladesh team in live-capture, handling, and sampling of macaques, bats, and rodents in a unique transboundary training opportunity in PREDICT surveillance protocols. Together the PREDICT/India and Bangladesh teams trapped and sampled Rhesus Macaque monkeys. The teams will continue to train together throughout April on PREDICT sampling protocols for bats and rodents.

Laboratory systems

PREDICT/India is partnering with the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), the planned lab for testing animal and human samples. PREDICT has transferred protocols to SGPGIMS, and they are preparing to implement viral family testing for all five priority viral families.

Implementing partners

EcoHealth Alliance and the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS)

Contacts

Country Coordinator: Dr. Tapan N. Dhole, Sanjay Gandhi Postgraduate Institute of Medical Sciences, SGPGIMS

Global Point of Contact: Jon Epstein, EcoHealth Alliance (epstein@ecohealthalliance.org)

INDONESIA

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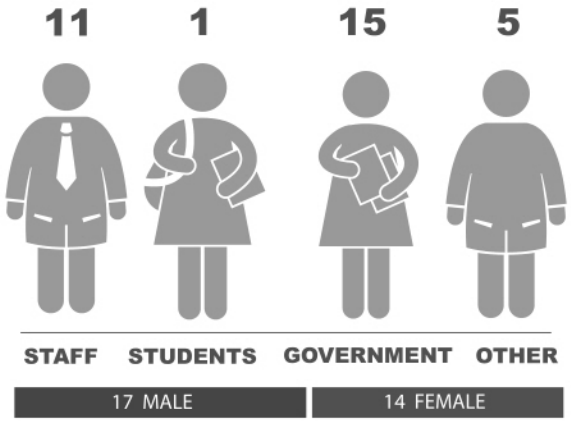
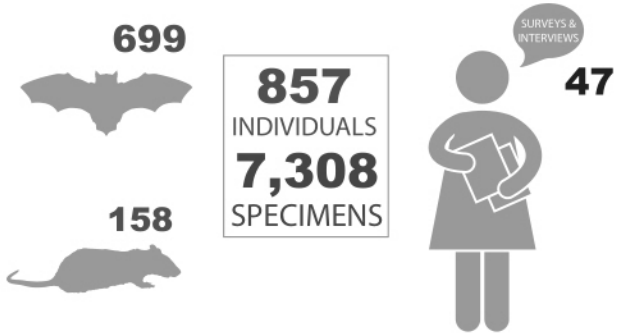
Global Health Security Agenda

WORKFORCE DEVELOPMENT

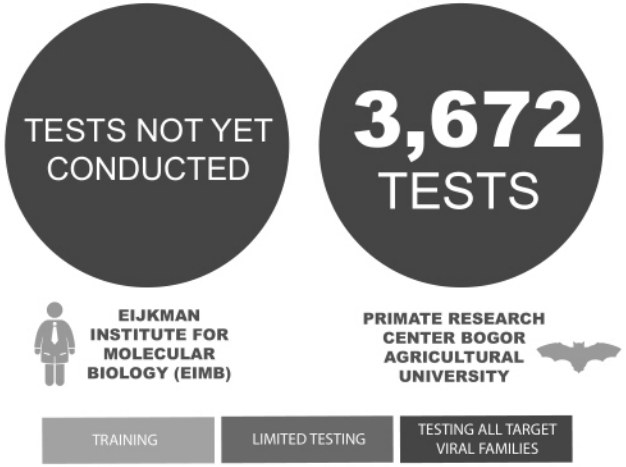


, *One individual of undeclared gender

ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

857 individuals sampled (wildlife)

47 individuals interviewed in behavioral risk investigations

3,672 tests across 10 viral families

32 trained in One Health skills

PREDICT/Indonesia is conducting surveillance at live animal markets, which are considered to be a high-risk interface for zoonotic disease transmission. *Photo: PREDICT/Indonesia.*

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PREDICT/Indonesia

Success stories

Strengthening national laboratory systems at the provincial/subnational level

PREDICT/Indonesia completed the final series of four trainings on detection of known and emerging viral threats with Animal Disease Investigation Center (DIC) laboratory staff. The trainings began in 2014 with the goal of equipping all eight of Indonesia's DICs with this capacity.

This final training series consisted of a multi-day training session for lab staff from the DICs of Subang-West Java and Bukittinggi-West Sumatera (two males and two females) on training others ("Training of the Trainers") in use of the PREDICT's viral family protocols that detect priority zoonotic diseases of public health concern. The training was held at the Primate Research Center at Bogor Agricultural University in coordination with FAO on February 6th-14th, 2017. The second training session on March 13th, 2017 focused on results analysis, equipping the trainees with the bench skills required for running viral detection tests and the knowledge to interpret them. The PREDICT/Indonesia team also accompanied the participants as they presented results reports to the FAO-ECTAD Indonesia team on March 14th, 2017.

With continued technical assistance from PREDICT and PRC-IPB and support from FAO-ECTAD Indonesia, we expect that all eight DICs will now have the capability to implement PREDICT viral family detection protocols and conduct routine testing of livestock and poultry specimens for improved zoonotic disease surveillance. Moving forward, the DIC at Maros (South Sulawesi Province) will conduct PREDICT viral family testing for domestic animal samples (livestock and poultry) collected concurrently with wildlife from the Island of Sulawesi. In addition to training the DIC at Maros staff, PREDICT/Indonesia and PRC-IPB helped to improve the physical design and flow of the laboratory at DIC at Maros to avoid potential contamination of the universal positive control and ensure biosafety and biosecurity.

A Disease Investigation Centre (DIC) at Maros staff member trains on viral detection protocols with PREDICT/Indonesia. Photo: PREDICT/Indonesia.

The other five DIC laboratories trained for the implementation of viral family detection protocols are the DIC at Wates (Special Province of Yogyakarta, central part of Java), DIC at Lampung (Province of Lampung, southern part of Sumatera), DIC at Banjarbaru (Province of South Kalimantan), DIC at Denpasar (Province of Bali), and DIC at Medan (Province of North Sumatera).

Non-human primate seminar

The PREDICT/Indonesia team conducted a one-day national seminar in collaboration with the Primate Research Center at Bogor Agricultural University and the Indonesian Wildlife, Aquatic, and Exotic Animal Veterinarian Association entitled "Current Issues in Conservation Medicine of Indonesian Nonhuman Primates and Other Wildlife to Support Human and Animal Welfare Practices" on November 29th, 2016 at the Salak Tower Hotel in Bogor. Around 130 participants from across Indonesia took part in the seminar; participants included veterinarians, biologists, conservationists, and researchers from governments and private sectors. PREDICT/Indonesia presented their wildlife surveillance activities in the seminar.

Poster and group photo from the "Current Issues in Conservation Medicine of Indonesian Nonhuman Primates and Other Wildlife to Support Human and Animal Welfare Practices" seminar.

Laboratory systems

PREDICT/Indonesia is partnering with the Institute for Primate Research, Bogor (IPB), which is implementing viral testing of samples collected from wild animals for priority viral families to detect priority zoonotic diseases.

The Eijkman Institute for Molecular Biology (EIMB) lab will be the implementing lab for human sample testing.

Eight animal Disease Investigation Center (DIC) labs have been trained to implement viral family testing.

Implementing partners

EcoHealth Alliance (EHA), Primate Research Center of the Institut Pertanian Bogor (PRC-IPB), Metabiota, and the Eijkman Institute for Molecular Biology (EIMB)

Contacts

Country Coordinator: Dr. Joko Pamungkas, PRC-IPB (jpi-pssp@indo.net.id)

Global Point of Contact: Kevin Olival, EHA (olival@ecohealthalliance.org)

Dashboard legend

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LAO PDR

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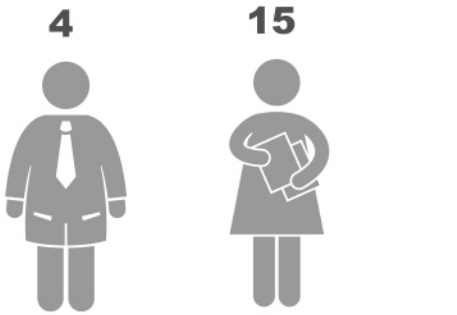
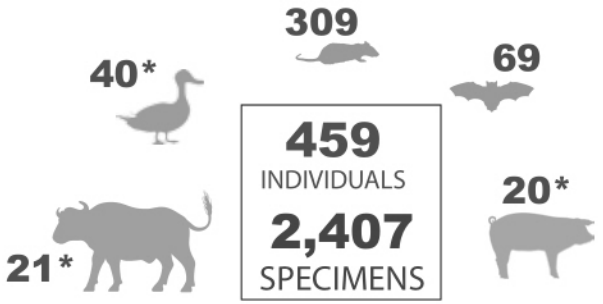
Global Health Security Agenda

WORKFORCE DEVELOPMENT

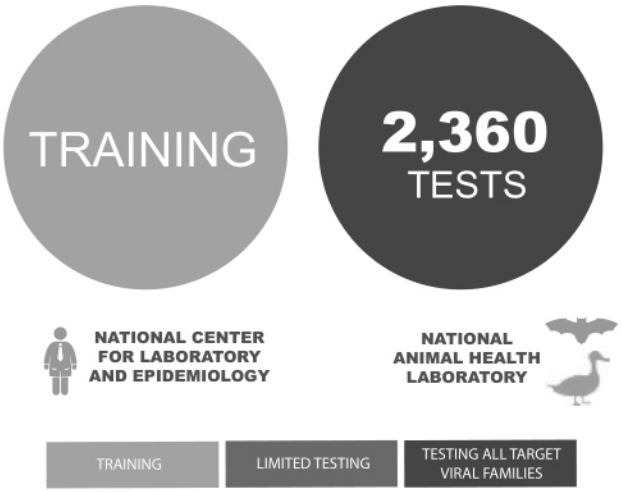


ONE HEALTH SURVEILLANCE



*Samples collected in collaboration with FAO

LAB STRENGTHENING



IMPACT

459 individuals sampled (wildlife and domestic animals)

2,360 tests across 5 viral families

19 trained in One Health skills

The PREDICT/Lao PDR team speaks with villagers at a meeting at Na Pa Kieb Temple
Photo: PREDICT/Lao PDR

PREDICT/Lao PDR

Success stories

From partnerships to practice: Concurrent One Health surveillance

In January 2017, the government of Lao approved the synchronized and concurrent One Health surveillance plan that was developed by PREDICT and the Food and Agriculture Organization (FAO) of the United Nations, in consultation with the National Animal Health Laboratory and the National Center for Laboratory and Epidemiology. PREDICT has created a strong foundation in-country for successful coordination of partner efforts, working to ensure concurrent longitudinal surveillance of wild animal and livestock populations at the same sites, which were selected as high-risk interfaces for zoonotic disease transmission between wildlife, livestock, and people.

PREDICT and FAO staff discuss site characterization with village leaders prior to sampling wildlife and livestock in Na Pa Kieb, Khong District, Lao PDR. Photo: PREDICT/Lao PDR.

In January-February 2017, PREDICT and FAO held joint community engagement meetings and launched activities collecting wildlife and livestock samples in Na Pa Kieb, Khong District, Champasack Province. Training was also conducted for the FAO team on the use of PREDICT's data management system, the Emerging Infectious Disease Information Hub (EIDITH) as Lao PDR was chosen as one of three countries to pilot the use of EIDITH for livestock data management to enable improved information sharing across partners. By working together on field-based surveillance activities and through sharing data, these partnerships are increasingly strengthened, as is the core technical capacity of Lao's institutions and health workforce for conducting sampling and surveillance activities across populations. Through these ongoing efforts, PREDICT and FAO are committed to working with government partners to improve their knowledge of how key viral pathogens may be co-circulating and/or changing in populations at interfaces where there is frequent contact between wildlife, livestock, and humans, and to strengthening their capabilities for zoonotic disease detection and response.

Laboratory systems

PREDICT/Lao PDR is partnering with the National Animal Health Laboratory, Department of Livestock and Fisheries, Ministry of Agriculture and Forestry (NAHL) for implementation of viral family protocols for five priority families (corona, filo, flavi, influenza, and paramyxo viruses). Human specimen testing will take place at the National Center for Laboratory and Epidemiology (NCLE), Department of Communicable Disease control, Ministry of Health.

Implementing partners

Metabiota, Inc., National Animal Health Laboratory, and the National Center for Laboratory and Epidemiology

Contacts

Country Coordinator: Soubanh Silithammavong, Metabiota, Inc. (ssilithammavong@metabiota.com)

Global Point of Contact: David McIver, Metabiota, Inc. (dmciver@metabiota.com)

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MALAYSIA

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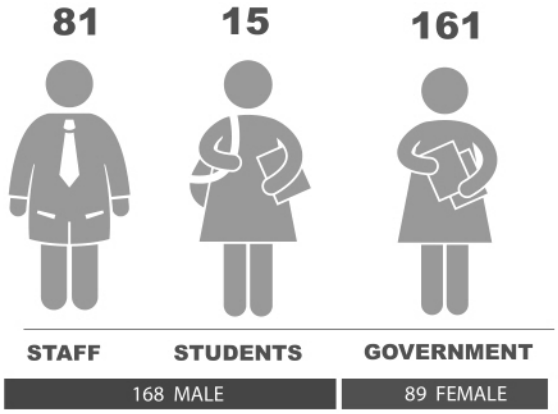
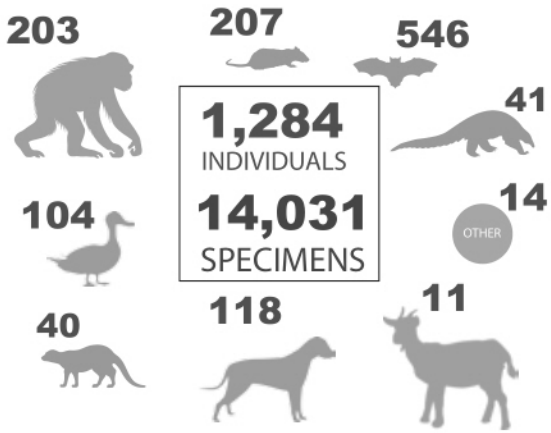
Global Health Security Agenda

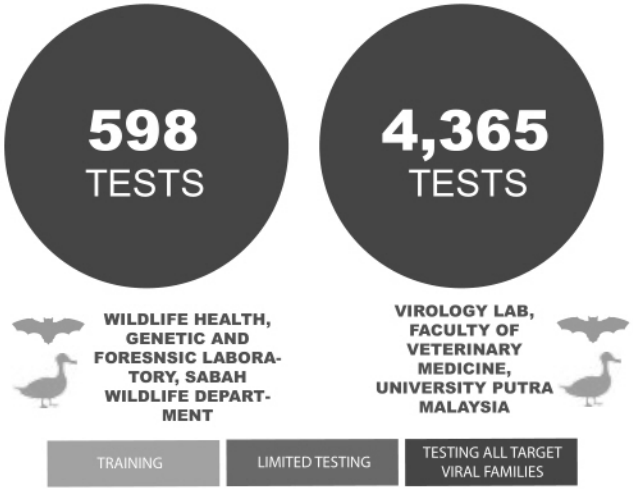
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

1,284 individuals sampled (wildlife and domestic animals)

4,963 tests across 8 viral families

257 trained in One Health skills

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Bats safely hang in cloth bags as they await sampling.
Photo: PREDICT/Malaysia

PREDICT/Malaysia

Success stories

Strengthening biosecurity in the national laboratory system

In March 2017, the molecular zoonosis laboratories at Department of Wildlife and National Parks, Peninsular Malaysia (PERHILITAN) National Wildlife Forensic Laboratory, a PREDICT partner, were certified as a BSL-2 laboratories according to the United States' standards for laboratory specifications. This achievement represents a significant capacity gain for the Peninsular Malaysia Department of Wildlife and National Parks, and as well as a fruitful collaboration between local government and the PREDICT project.

In addition, in November 2016, the PREDICT/Malaysia lab manager attended the Asia-Pacific Biosafety Association's biosafety training and passed the biosafety management test, a major capability gain for the country's laboratory system. As a result, PREDICT/Malaysia's standard operating procedures and biosafety practices for laboratories have been improved accordingly, and partner labs in Malaysia have directly benefitted from a trained onsite expert.

Policy change to improve occupational health

As a result of PREDICT/Malaysia capacity strengthening efforts and engagement with government partners, for the first time, the Ministry of Natural Resources and Environment (MNRE) provided funding for vaccinations to PERHILITAN. MNRE provided funding to vaccinate 100 PERHILITAN Research Officers and Rangers and PREDICT was invited to

PREDICT/Malaysia's lab manager Mei Ho Lee pipettes inside a biosafety cabinet. Mei Ho Lee is now certified for biosafety management and is contributing to improved biosafety practices in Malaysia's laboratory system. Photo: Jonathan Goley/EHA.

advise on this process, a major step toward reducing occupational health hazards for people working on the front lines of high-risk human-animal interfaces.

Community-based One Health surveillance

PREDICT/Malaysia has been working closely with the Ministry of Health and PERHILITAN to conduct coordinated surveillance in Orang Asli villages where livestock are raised and wildlife hunting for subsistence occurs. These villages are considered a potential high-risk interface where people,

livestock and wildlife have frequent contact. PREDICT's One Health surveillance teams have collected biological samples from wildlife, domestic animals, and people who have frequent contact with animals, as well as behavioral data to help characterize risk of spillover. The samples are being screened for targeted viral families at partner labs.

Workforce development

PREDICT/Malaysia continued to enhance the laboratory workforce in Malaysia by training numerous staff from government and university partners on laboratory procedures. The team trained nine National Public Health Lab staff members on PREDICT lab protocols for cloning and sequencing; one PERHILITAN Research Officer on NucliSens MiniMag extraction, cDNA synthesis and PREDICT PCR protocols while processing wildlife samples; two virology staff, three bacteriology staff, and three graduate students from the University of Peninsular Malaysia (UPM), and one PERHILITAN staff member and their student trainee from Management and Science University on cloning to plasmid DNA extraction of PCR products. In addition, the team trained an undergraduate student from UCSI University on PREDICT lab and field protocols and biosafety best practices, and provided an orientation to the Wildlife Health, Genetics, and Forensics Lab (WHGFL) along with practical training on MiniMag extraction, PCR master mix set up, cloning, and plasmid DNA extraction. PREDICT/Malaysia also trained 11 PERHILITAN staff and two students in man-down drills and the use of 'glo-germ' and key laboratory safety procedures.

PREDICT/Malaysia also conducted trainings on biosafety, human and animal safety during sampling, lab safety, PPE, and sample storage for two veterinarians from the Wildlife Rescue Unit in Sabah, a private entity that works closely with Sabah wildlife department; as well as trainings in biosafety, PPE use, and lab safety with a focus on lab and field settings for 20 PERHILITAN staff (veterinarians, research officers and wildlife rangers/enforcers), two practical students, and six UPM staff.

One Health partnerships

PREDICT/Malaysia advanced its collaboration with USAID's One Health Workforce project, the only other EPT partner active in Malaysia. The team met regularly with representatives from UPM Faculty of Veterinary Medicine, part of the SEAHOUN network, to discuss livestock sample testing at the UPM FVM Virology Lab to prepare for further livestock testing, and to discuss possibilities for cross-training and UPM student involvement with PREDICT field work. Staff and students from UPM FVM have been trained on laboratory techniques in the course of performing PREDICT livestock and domestic animal sample testing.

Sharing knowledge to improve viral surveillance

In December 2016, the PREDICT/Malaysia Lab and Field managers presented posters on PREDICT's wildlife surveillance work at the 4th International One Health Congress & The 6th Biennial Conference of the International Association for Ecology and Health (OHEH 2016) congress in Melbourne, Australia. Their presentations were entitled "Assessing Viral Diversity in Non-human Primates and Bats of Peninsular and Bornean Malaysia" and "Zoonotic Viruses Surveillance for the Confiscated Pangolin in Malaysia." In January, PREDICT prepared slides on field and lab work with Malaysian government partners for Dr. Chong, Director of Disease Control Division to present at GHSA meeting "Enhancing Joint Collaborative Efforts for Lab Preparedness" February 8-10, 2017, in Bangkok, Thailand.

Laboratory systems

PREDICT/Malaysia partners with the PERHILITAN National Wildlife Forensic Laboratory and the Sabah Wildlife Department (SWD) Wildlife Health and Genetic and Forensic Laboratory for wildlife sample testing. Both labs are implementing viral family testing for the five families. The University of Peninsular Malaysia (UPM) Faculty of Veterinary Medicine is the laboratory partner for livestock testing and is currently in training. The National Public Health Laboratory Peninsular Malaysia and National Public Health Laboratory Sabah are the laboratories for human testing: NPHL Peninsular Malaysia is implementing viral testing, while NHPL Sabah is in training. NPHL Peninsular Malaysia is continuing to use PREDICT viral family testing techniques for its own disease investigations.

Implementing partners

EcoHealth Alliance, Conservation Medicine, Ltd., PERHILITAN National Wildlife Forensic Laboratory, Sabah Wildlife Department Wildlife Health and Genetic and Forensic Laboratory, University of Peninsular Malaysia, the National Public Health Laboratory Peninsular Malaysia, and the National Public Health Laboratory Sabah

Contacts

Country Coordinator: Tom Hughes, EHA (tom.hughes@ecohealthalliance.org)

Global Point of Contact: Jon Epstein, EHA (epstein@ecohealthalliance.org)

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MONGOLIA

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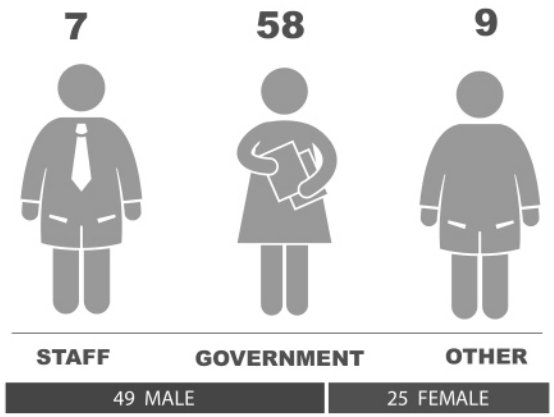
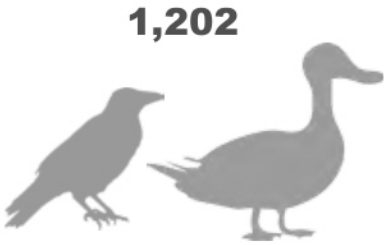
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



1,202 INDIVIDUALS
2,444 SPECIMENS

LAB STRENGTHENING

1,212 TESTS

STATE CENTRAL VETERINARY LABORATORY

TRAINING | LIMITED TESTING | TESTING ALL TARGET VIRAL FAMILIES

IMPACT

1,202 wild birds sampled

1,212 tests for influenza viruses

74 trained in One Health skills

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The PREDICT surveillance team in Mongolia performs wild bird identification and counts at Khukh Lake in Eastern Mongolia in April 2017. *Photo: WCS/Mongolia*

PREDICT/Mongolia

Success stories

Wild bird surveillance for highly pathogenic avian influenza

PREDICT/Mongolia has launched influenza surveillance in wild birds after a three-year gap in global efforts to collect samples from wild birds for influenza virus detection and sequencing at this important stopover country in Asia's migratory bird flyways. PREDICT/Mongolia completed the first sampling year in October 2016 with the collection of samples from 1,195 individual wild birds at surveillance sites in Central, Western, and Eastern Mongolia.

National Laboratory Strengthening

Viral detection activities were launched at the partner lab, the Mongolian State Central Veterinary Laboratory (SCVL), which performed 1,212 tests between October 2016 and March 2017. PREDICT results are pending sequence confirmation and will be publicly released following ministry approval.

Laboratory systems

PREDICT/Mongolia is partnering with the Mongolian State Central Veterinary Laboratory (SCVL), which is actively testing for influenza viruses with the potential to expand to additional viral families. The National Influenza Center (NIC) at the Mongolian National Center for Communicable Diseases (NCCD) has also received PREDICT protocols through an existing link between NCCD and SCVL.

Laboratory staff at the State Central Veterinary Laboratory in Mongolia test PREDICT wild bird samples with viral family level protocols. Photo: State Central Veterinary Laboratory

Implementing partners

Wildlife Conservation Society (WCS), Mongolian State Central Veterinary Laboratory (SCVL)

Contacts

Country Coordinator: Enkhtuvshin Shiilegdamba, WCS (eshiilegdamba@wcs.org)

Global Point of Contact: Amanda Fine, WCS (afine@wcs.org)

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MYANMAR

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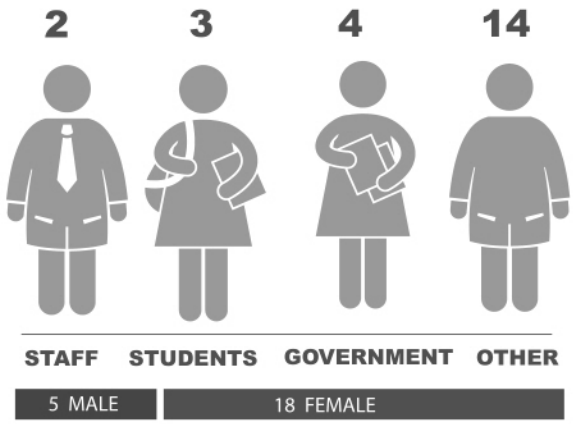
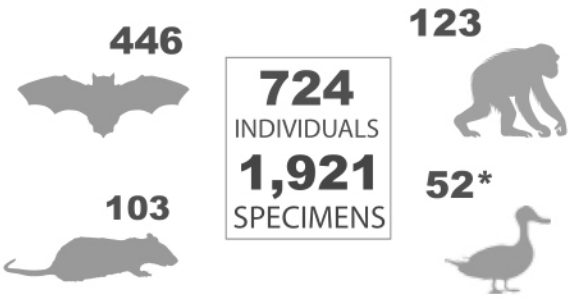
WORKFORCE DEVELOPMENT

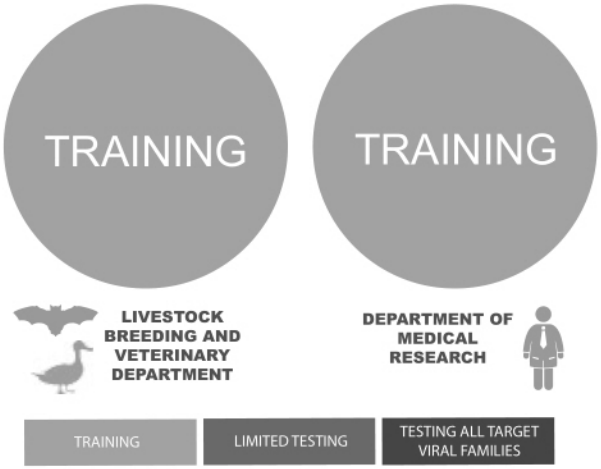


ONE HEALTH SURVEILLANCE



*Samples collected in collaboration with FAO

LAB STRENGTHENING



IMPACT

724 individuals sampled (wildlife and domestic animals)

Training planned for viral testing

23 trained in One Health skills

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PREDICT staff weigh a rat prior to collecting samples at Linno Cave, Hpa-an. *Photo: PREDICT/Myanmar.*

PREDICT/Myanmar

Success stories

Leading risk-based One Health Surveillance

Through key partnerships, training, and field-based zoonotic disease surveillance activities, PREDICT/Myanmar is building the foundation for applying the One Health approach in-country, including strengthening lab systems and advancing viral detection capability. Risk-based wildlife surveillance was successfully conducted at the Hpa-an caves of Kayin State and areas surrounding Hlawga National Park of Northern Yangon (see "*Where we work"* below) and teams collected over 1,200 samples from over 200 animals. In addition, through these field-based surveillance and sampling activities, PREDICT provided hands-on training for two new project staff members, five field assistants, and a Ministry of Natural Resources and Environmental Conservation (MONREC) Range Officer in biosafety, safe capture, handling, and sampling of multiple wildlife species considered high-risk for viral spillover, cold chain, safe sample storage and transport, and data management. Finally, to ensure long-term sustainability of surveillance operations, PREDICT committed to sourcing the majority of project field supplies from private Yangon-based small businesses, contributing to the local economy and linking our partner institutions with vendors to strengthen supply chains.

PREDICT/Myanmar team measuresa captured rodent used for viral disease surveillance in Hpa-an, Kayin State. Photo: PREDICT/Myanmar.

Building collaborative multisectoral partnerships

In January, PREDICT attended a signing ceremony for the Letter of Agreement (LoA) with the Livestock Breeding and Veterinary Department (LBVD) enabling planning for training for viral testing. In March, the Ethics Review Committee (ERC) at the Department of Medical Research (DMR), of the Ministry of Health and Sports (MOHS) signaled approval for launch of human surveillance activities.

Where we work

Hpa-an

Hpa-an is a major tourist attraction with caves that are sacred Buddhist temples managed by resident monks. At the caves, visitors are exposed to bat guano from overhead droppings and/or directly walking through piles of feces with bare feet. In addition, PREDICT is investigating zoonotic disease spillover risk at bat guano farms, including one three-generation family business where bat guano has been hand collected from Linno Cave for use as fertilizer. PREDICT has evaluated the entire guano collection process through informal discussion with many of the people involved, and confirmed guano collection as a priority for surveillance activities, as some collectors report various clinical signs of illness directly following collection days.

Hlawga National Park (HNP)

HNP is a large and popular wildlife park and refuge visited mostly by Myanmar nationals, with a large and vibrant tourist industry based just outside of the park, where PREDICT is investigating the potential zoonotic disease transmission risks among tourists, community members, vendors and local wildlife (nonhuman primates, rodents, and bats). PREDICT has held preliminary discussions with stakeholders in villages surrounding the park including individuals with direct contact with wildlife.

PREDICT/Myanmar's field team stands with a Buddhist monk outside of a religious and tourist site in Hpa-an where the team conducts surveillance on nonhuman primates, bats, and rodents. Photo: PREDICT/Myanmar.

Laboratory systems

PREDICT/Myanmar is partnering with the Department of Medical Research of the Ministry of Health & Sports (DMR) for human specimen testing, and the Livestock Breeding and Veterinary Department Laboratory of the Ministry of Livestock, Agriculture & Irrigation (LBVD) for wildlife and livestock testing. Both laboratories are preparing for training to implement viral family testing.

Implementing partners

Smithsonian Institution, Department of Medical Research (DMR) of the Ministry of Health & Sports, and the Livestock Breeding and Veterinary Department Laboratory of the Ministry of Livestock, Agriculture & Irrigation (LBVD)

Contacts

Country Coordinator: Dr. Ohnmar Aung, Smithsonian (ohnmara@gmail.com)

Global Point of Contact: Dr. Marc Valitutto, Smithsonian (valituttom@si.edu)

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NEPAL

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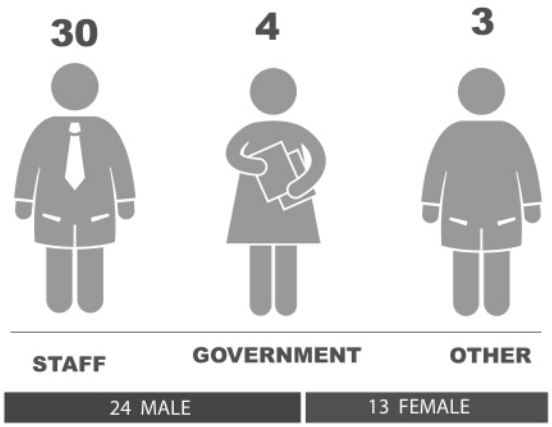
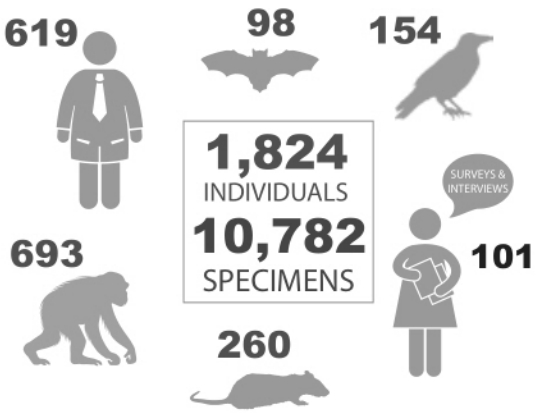
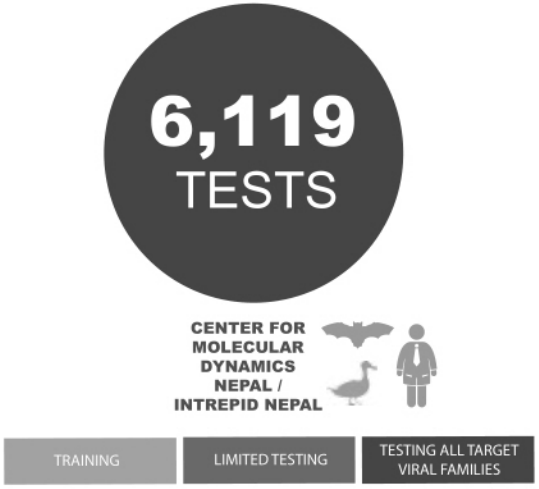
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING



IMPACT

1,824 individuals sampled (animals and people)

101 individuals interviewed in behavioral risk investigations

6,119 tests across 8 viral families

37 trained in One Health skills

PREDICT conducts human surveillance in the Silinge community, a targeted surveillance area with high-risk human-bat interfaces, by working with local medical outreach teams from Katmandu.
Photo: PREDICT/Nepal

PREDICT/Nepal

Success stories

Rapid detection of H5N8 during an influenza outbreak

PREDICT/Nepal provided technical support to ministry partners in March 2017 during the H5N8 influenza outbreak. According to the World Organization for Animal Health (OIE), the outbreak was first detected at a poultry (chicken) layer farm in the Koshi zone in the southeastern part of the country The virus killed 3,650 of the 6,200 susceptible birds and authorities culled the remaining birds to contain the spread of the disease as surveillance was heightened in the surrounding area. The cause of the outbreak was confirmed by the Nepal Central Veterinary Laboratory (CVL) as highly pathogenic avian influenza A virus. Influenza A testing conducted at CVL was followed by H and N sub-typing on the tracheal tissue samples collected during postmortem to confirm subtype H5N8. Rapid subtype characterization was facilitated by the PREDICT/Nepal team at the Center for Molecular Dynamics, Nepal (CMDN) by sharing expertise and readily available supplies, in this case test primers, with CVL and the national laboratory network. PREDICT is working to strengthen One Health platforms in Nepal through collaborative efforts that require multi-sectoral partnerships and coordination in advance of outbreaks. The rapid detection and confirmation of H5N8 demonstrates that functional One Health networks can be successfully leveraged for improved outbreak response and zoonotic disease control efforts.

PREDICT/Nepal's Tarka Raj Bhatta prepares a gel for electrophoresis as part of viral family testing. Photo: PREDICT/Nepal.

Regional workshop on zoonotic disease pandemic preparedness for South Asia

PREDICT/Nepal led efforts to organize *Nepal's Zoonotic Disease Pandemic Preparedness for South Asia, Using a One Health Platform* meeting (March 13-15, 2017), which brought together government and non-government stakeholders from the animal, human, and environmental health sectors to highlight the importance of the One Health approach for cross-sector collaboration. The regional workshop, which included participants from Bhutan, Bangladesh, India, Nepal and the US, along with

representatives from FAO (Regional Office-Thailand), WHO (Nepal), and CDC (India), allowed for sharing best practices for emerging zoonotic diseases surveillance and pandemic preparedness, strengthening national/regional zoonotic disease surveillance and research capacity, and encouragement of multi-disciplinary collaborations to expand One Health practices in the region. PREDICT/Nepal was highlighted as an example of a successful One Health surveillance project, as project activities are designed to: strengthen local capacity to characterize zoonotic disease risks; improve understanding of disease transmission by laying the groundwork for disease surveillance systems for wildlife; assist the country in recognizing zoonotic spillover events; and prepare for rapid response to zoonotic disease outbreaks in people. The workshop was supported by the Regional Environment, Science, Technology and Health (ESTH) Office for South Asia (US State Department) in partnership with PREDICT and the One Health Institute at UC Davis.

Building collaborative bridges with in-country government partners

An institutional level MoU was signed between the Nepal Agricultural Research Council (NARC) and PREDICT/Nepal's implementing partner CMDN to establish national cooperation and enhance agriculture and biodiversity research in Nepal. This collaboration will provide a strong research platform to strengthen environment, plant, and animal biodiversity research, animal health and bio-medical research and development, including disease surveillance, anti-microbial resistance research, and policy analysis. The signing parties will work together to strengthen in-country partnerships and establish study sites targeting animal species of interest. PREDICT/Nepal plans to work very closely with NARC on various projects and will contribute to workforce development through laboratory and field training exercises that enhance national capacity to engage in priority disease research and detection, specifically on diseases of concern in the agriculture and livestock sectors.

Laboratory systems

PREDICT/Nepal is partnering with the Center for Molecular Dynamics (CMDN) the project lab actively testing animal and human samples for priority viral families and providing training support for staff from the Central Veterinary Laboratory.

Implementing partners

UC Davis, Center for Molecular Dynamics (CMDN)

Contacts

Country Coordinator: Dibesh Karmacharya, Center for Molecular Dynamics Nepal (Dibesh@cmdn.org)

Global Point of Contact: Dr. Christine Johnson, UC Davis (ckjohnson@ucdavis.edu)

Dashboard legend

Workforce Development. Numbers represented are from the life of project (September 2014 to March 31, 2017).

One Health Surveillance. Individuals refers to the number of unique animals or humans from which samples were collected. Specimens indicates the total number of samples collected from all individuals. All numbers shown are from the life of project (September 2014 to March 31, 2017).

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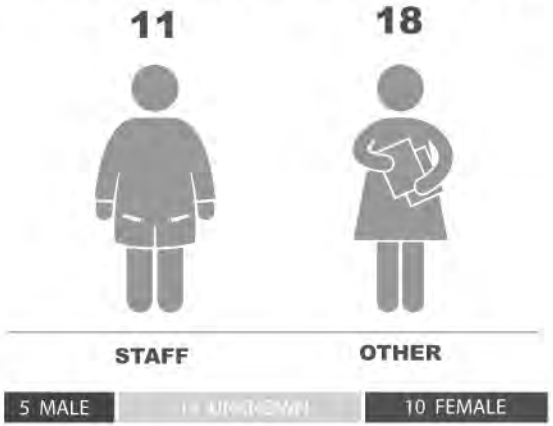
THAILAND

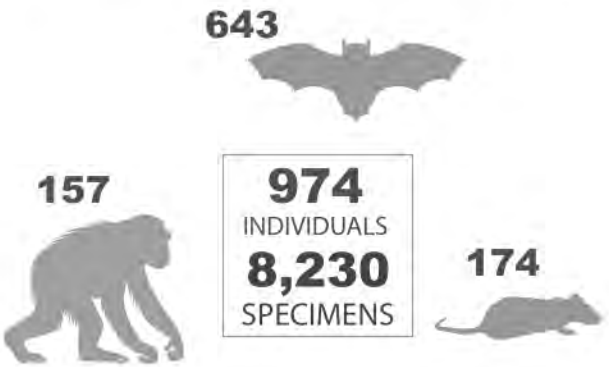
USAID | PREDICT
FROM THE AMERICAN PEOPLE

Global Health Security Agenda

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

IMPACT

974 individuals sampled (wildlife)

3,918 tests across 8 viral families

29 trained in One Health skills

An urban macaque eats fruit in the road. PREDICT/Thailand is sampling non-human primates at high-risk human-animal interfaces. *Photo: Jonathan Goley/EHA.*

PREDICT/Thailand

Success stories

Advocating for a Global Virome Project

On January 31st, 2017, the PREDICT/Thailand team organized a Global Virome Project (GVP) seminar at Chulalongkorn University Hospital. Dr. Dennis Carroll (USAID) presented on the GVP project to more than 200 participants from governmental and academic sectors in Thailand. The seminar was part of broader efforts to garner interest in the GVP and EPT projects, as well as zoonotic pathogens and emerging infectious disease in Thailand, and information presented at the seminar was first shared with the public including individuals from the human and animal health sectors.

Strengthening influenza surveillance and reporting

PREDICT/Thailand collaborated with the Department of Disease Control, Ministry of Public Health to initiate efforts to strengthen influenza surveillance and reporting. These efforts are specifically directed towards improving the national influenza reporting system by strengthening the capacity of diagnostic laboratories at the regional level. PREDICT/Thailand organized a hands-on training workshop, sponsored by the National Science and Technology Development Agency of Thailand, on real-time PCR diagnostics for influenza virus infection from human specimens. The workshop was organized for 14 laboratories from the Department of Disease Control in March 2017.

A macaque forages discarded fruit in an urban area with her baby at a site where PREDICT/Thailand is conducting One Health surveillance. Photo: Jonathan Goley/EHA.

EPT Partner collaboration for triangulated One Health surveillance

Putting One Health in action, PREDICT/Thailand continued to coordinate with FAO and the Department of Livestock Development to conduct triangulated human, wildlife, and domestic animal surveillance in Chonburi province. PREDICT collected samples from wildlife (a fruit bat colony where individuals were previously found to be Nipah virus-positive) and pigs in May and November 2016 and February 2017. Human sample collection along with behavioral risk investigations among healthy humans living, working, or visiting targeted high-risk communities is planned for May 2017.

Laboratory systems

PREDICT/Thailand partners with the WHO Collaborating Centre for Research and Training on Viral Zoonoses, Chulalongkorn University Hospital Bangkok, which is actively testing wildlife and human samples. PREDICT also collaborates with the National Institute of Animal Health laboratory (NIAH) for livestock sample testing.

PREDICT viral testing protocols have been shared with NIAH, as well as the Monitoring and Surveillance Center for Zoonotic Diseases in Wildlife and Exotic Animals (MOZWE), Mahidol University. The NIAH has been conducting viral testing in pigs for five priority viral families (results currently pending confirmation).

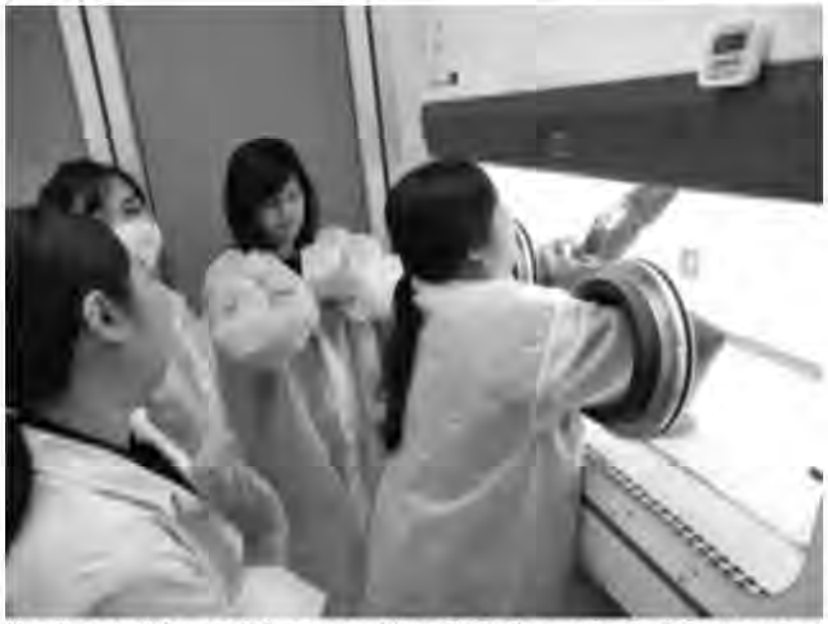
Implementing partners

EcoHealth Alliance (EHA) and Chulalongkorn University Hospital

Contacts

Country Coordinator: Supaporn Wacharapluesadee, WHO Collaborating Centre for Research and Training on Viral Zoonoses, Chulalongkorn University, Bangkok (spwa@hotmail.com)

Global Point of Contact: Kevin Olival, EHA (olival@ecohealthalliance.org)



Hands-on training workshop on real-time PCR diagnostics for Influenza virus infection from human specimens at the PREDICT Lab, Chulalongkorn. Photo: PREDICT/Thailand.

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VIET NAM

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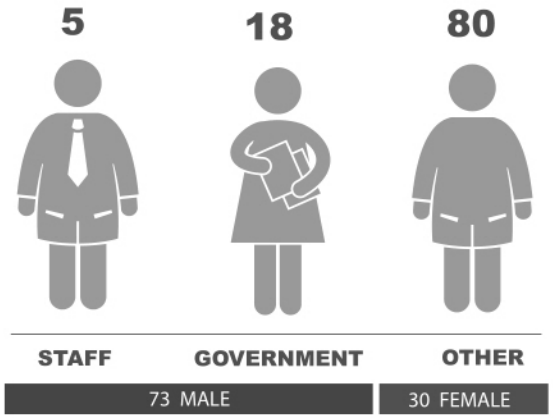
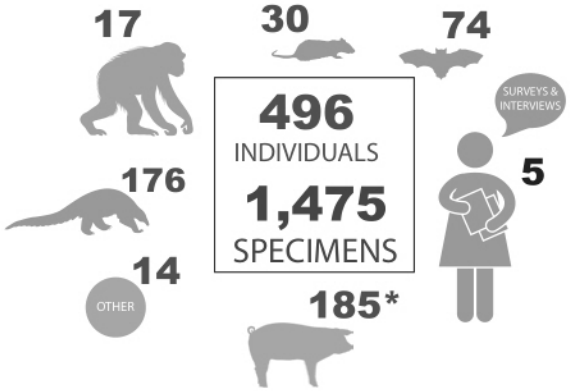
Global Health Security Agenda

WORKFORCE DEVELOPMENT

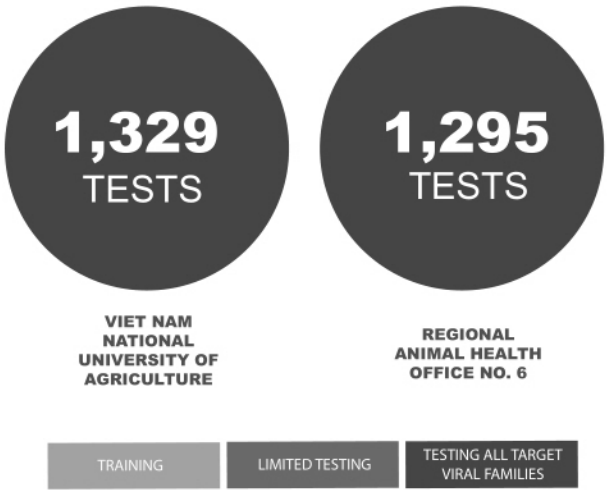


ONE HEALTH SURVEILLANCE



*Samples collected in collaboration with FAO

LAB STRENGTHENING



IMPACT

496 individuals sampled (wildlife and domestic animals)

5 individuals interviewed in behavioral risk investigations

2,625 tests across 5 viral families

103 trained in One Health skills

A pangolin is sampled by the PREDICT/Vietnam team, which is conducting surveillance of pangolins in the wildlife value chain, a high-risk human-animal interface for zoonotic disease transmission. Photo: PREDICT/Vietnam.

www.predict.global

PREDICT/Viet Nam

Success stories

Building One Health partnerships

The Viet Nam National Institute of Hygiene and Epidemiology (NIHE), the Ministry of Health's lead public health institution, is now an official PREDICT partner in Viet Nam. The Ministry of Health approved NIHE's role in the PREDICT project in November 2016. On March 23, 2017, PREDICT and NIHE gathered 51 key stakeholders representing the hospitals, provincial Departments of Health, and provincial Preventive Medicine Centers, who will be involved in human surveillance activities (biological sampling and behavioral risk investigations) for a workshop that included consultation with these key stakeholders regarding the details of the project work plan and clarification of mechanisms of cooperation. Representatives from the Food and Agriculture Organization (FAO) of the United Nations and the US CDC also attended the meetings. The PREDICT One Health approach and the importance of triangulated surveillance to characterize viral spillover and sharing were highlighted and project goals were enthusiastically endorsed by all stakeholders present. As a result, the government, international, and US partners represented confirmed their commitment to working collaboratively to address zoonotic disease emergence and pandemic threats.

*PREDICT staff in Viet Nam prepare to collect oral swabs from a juvenile Sunda pangolin (*Manis javanica*) confiscated from the illegal wildlife trade. Photo: WCS/Viet Nam*

Advancing techniques for the surveillance of critical species in the animal value chain

Pangolins are the most trafficked mammal in the world. PREDICT surveillance of the wildlife trade and animal value chain in Viet Nam has focused on collecting specimens from pangolins confiscated from the illegal trade to understand the potential for viral presence and spillover at this important wildlife/human interface. Between October 2016 and March 2017, PREDICT collected a total of 372 specimens (142 oral swabs, 148 rectal swab/fecal samples, 10 serum/blood samples, two urine samples, and 70 tissue samples) from 87 individual pangolins. To date, PREDICT Viet Nam has collected samples from 176 individual pangolins confiscated from the illegal wildlife trade. Viral testing for Flavi-, Paramyxo-, Corona-, Influenza-, and Filoviridae has been completed for 76 samples from 88 animals at the PREDICT partner

laboratory at the Viet Nam National University of Agriculture (results pending sequence confirmation). PREDICT/Viet Nam has also contributed to the development of the project's Pangolin Sampling Guide, part of PREDICT's *Standard Operating Procedures* e-book, an important resource supporting the safe handling of this critical species and providing other partners, projects, and the surveillance community at large with the knowledge to conduct zoonotic disease investigations of pangolin populations across the globe.

Laboratory systems

PREDICT/Viet Nam is partnering with three animal laboratories: the Viet Nam National University of Agriculture (VNUA) in Hanoi, and two Department of Animal Health (DAH) Regional Animal Health Office Laboratories in southern Viet Nam, RAHO6 in Ho Chi Minh City and RAHO7 in Can Tho City. Currently VNUA and RAHO6 are implementing viral family testing. PREDICT/Viet Nam is partnering with two human health focused laboratories: the National Institute of Hygiene and Epidemiology (NIHE) in Hanoi and the Pasteur Institute (PI-HCM) in Ho Chin Minh City. NIHE and PI-HCM are preparing to implement viral family testing.

Implementing partners

Wildlife Conservation Society (WCS), Viet Nam National University of Agriculture (VNUA), and the Regional Animal Health Office Laboratories RAHO6 and RAHO7

Contacts

Country Coordinators: Nguyen Thi Thanh Nga (nnga@wcs.org) and Nguyen Van Long, WCS (nvlong@wcs.org)

Global Point of Contact: Amanda Fine, WCS (afine@wcs.org)

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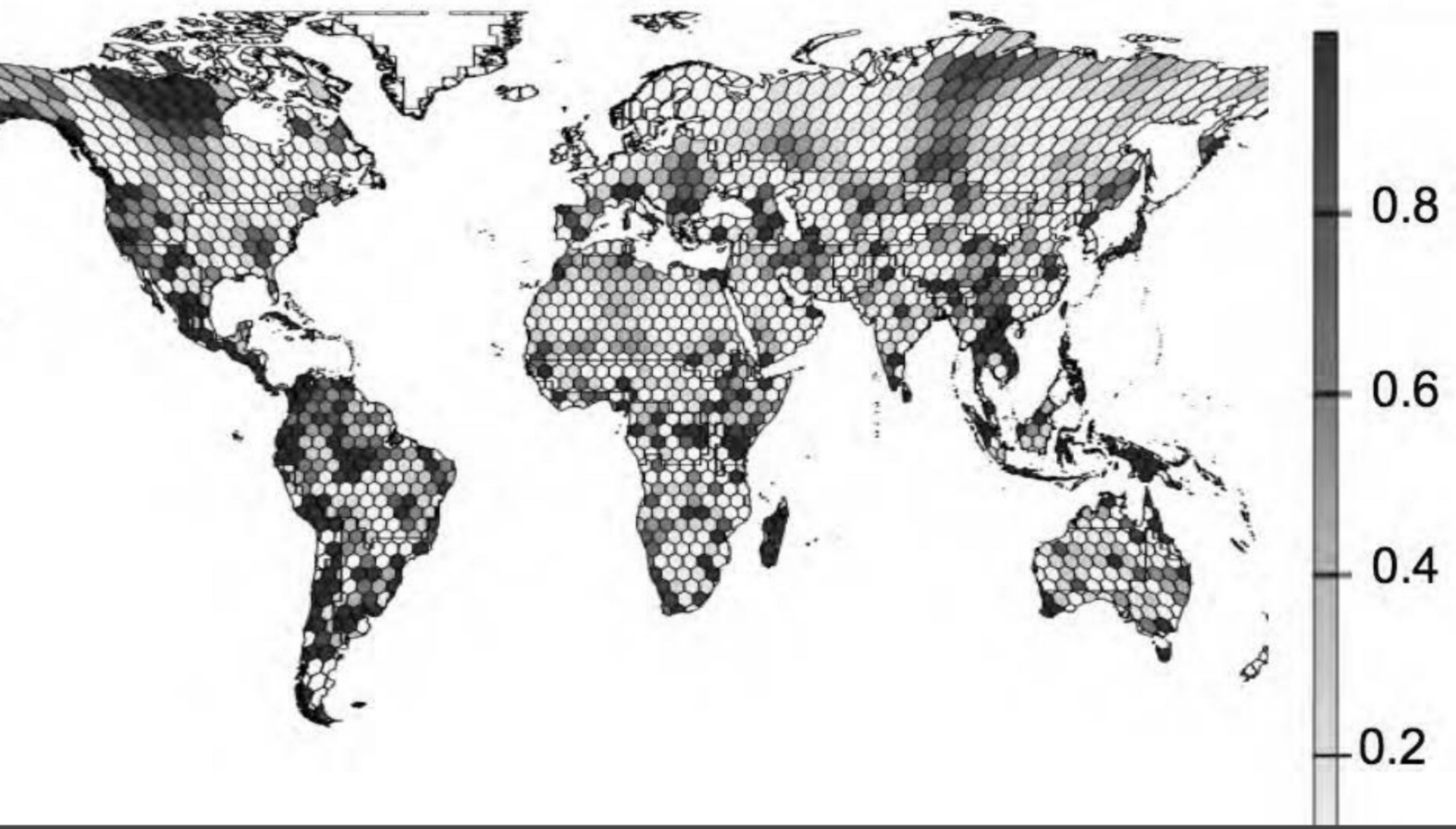
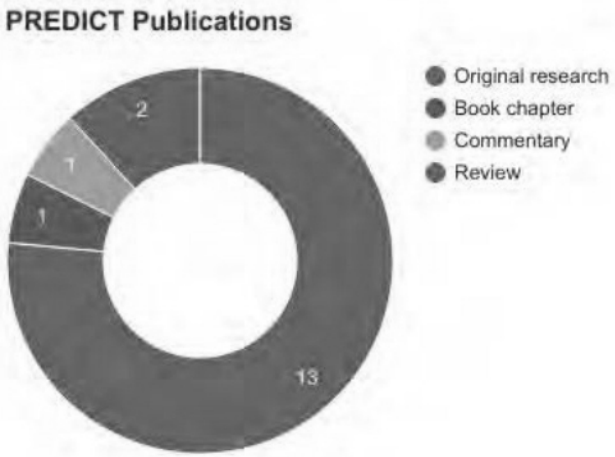


V. PUBLICATIONS & PRODUCTS

Publications and Products

From October 2016 to March 2017, PREDICT research led to 17 publications, including 13 original research articles. Articles appeared in many top-tier journals including *The Philosophical Transactions of the Royal Society B, Emerging Infectious Diseases,* and *The Lancet Global Health.* A bibliography of all publications over the reporting period is provided below, sorted by type of publication. For a comprehensive bibliography containing all PREDICT publications to date, please visit: www.publications.predict.global



Locations of co-author institutions for publications presented in the bibliography. Figure: S. Tatge/UC Davis.

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Garland-Lewis, G., Whittier, C., Murray, S., Trufan, S., & Rabinowitz, P. M. (2017). Occupational Risks and Exposures Among Wildlife Health Professionals. *EcoHealth*, *14*. https://doi.org/10.1007/s10393-017-1208-2

Kelly T., Karesh, W., Johnson, C., Gilardi, K., Anthony, S., Goldstein, T., Olson, S., Machalaba, C., PREDICT Consortium, Mazet, J. (2017). One Health proof of concept: Bringing a transdisciplinary approach to surveillance for zoonotic viruses at the human-wild animal interface. *Journal of Preventive Veterinary Medicine:* 137(B): 112–118.

Lacroix, A., Duong, V., Hul, V., San, S., Davun, H., Omaliss, K., . . . Buchy, P. (2017). Diversity of bat astroviruses in Lao PDR and Cambodia. *Infection, Genetics and Evolution*, 47, 41-50. doi:10.1016/j.meegid.2016.11.013

Mardones, F., Hernandez-Jover, M., Berezowski, J., Lindberg, A., Mazet, J., Morris, R. (2017). Veterinary epidemiology: Forging a path toward one health. *Preventive Veterinary Medicine*, 137(B): 147-150.

Smith, K. M., Machalaba, C. M., Jones, H., Cáceres, P., Popovic, M., Olival, K. J., . . . Karesh, W. B. (2017). Wildlife hosts for OIE-Listed diseases: considerations regarding global wildlife trade and host-pathogen relationships. *Veterinary Medicine and Science*. doi:10.1002/vms3.57

Smith, K. M., Zambrana-Torrelio, C., White, A., Asmussen, M., Machalaba, C., Kennedy, S., . . . Karesh, W. B. (2017). Summarizing US Wildlife Trade with an Eye Toward Assessing the Risk of Infectious Disease Introduction. *EcoHealth*, 14(1), 29-39. doi:10.1007/s10393-017-1211-7

Sotomayor-Bonilla, J., Abella-Medrano, C. A., Chaves, A., Álvarez-Mendizábal, P., Rico-Chávez, Ó., Ibáñez-Bernal, S., … Suzán, G. (2017). Potential Sympatric Vectors and Mammalian Hosts of Venezuelan Equine Encephalitis Virus in Southern Mexico. *Journal of Wildlife Diseases*. doi:10.7589/2016-11-249

Wray, A. K., Olival, K. J., Morán, D., Lopez, M. R., Alvarez, D., Navarrete-Macias, I., … Anthony, S. J. (2016). Viral Diversity, Prey Preference, and Bartonella Prevalence in Desmodus rotundus in Guatemala. *EcoHealth*, *13*(4), 761–774. doi:10.1007/s10393-016-1183-z

Yang, X. L., Zhang, Y. Z., Jiang, R. D., Guo, H., Zhang, W., Li, B., … & Li, S. Y. (2017). Genetically Diverse Filoviruses in Rousettus and Eonycteris spp. Bats, China, 2009 and 2015. *Emerging Infectious Diseases*, 23(3), 482.

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Olival, K. J., & Willoughby, A. R. (2017). Prioritizing the "Dormant" Flaviviruses. *EcoHealth*, *14*(1), 1–2. doi:10.1007/s10393-017-1220-6

Stoett, P., Daszak, P., Romanelli, C., Machalaba, C., Behringer, R., Chalk, F., . . . Swain, A. (2016). Avoiding catastrophes: seeking synergies among the public health, environmental protection, and human security sectors. *The Lancet Global Health*, 4(10). doi:10.1016/s2214-109x(16)30173-5

Review

Baum, S. E., Machalaba, C., Daszak, P., Salerno, R. H., & Karesh, W. B. (2017). Evaluating one health: Are we demonstrating effectiveness? *One Health*, 3, 5-10. doi:10.1016/j.onehlt.2016.10.004

In the Media

PREDICT was featured in a number of films/videos, radio programs, news articles, and press releases, further extending the project's global reach. Links to news and other media are found on the PREDICT website and Twitter.

PREDICT news:
http://www.vetmed.ucdavis.edu/ohi/predict/predict_news_and_impact.cfm

@PREDICTProject: https://twitter.com/predictproject

Featured stories

60 Minutes: *Veterinarians Help Save Africa's Endangered Mountain Gorilla*

The CBS program 60 Minutes aired an episode entitled "Gorilla Doctors" featuring members of the PREDICT/Uganda, Rwanda, and DRC teams on October 9, 2016.

From left: Lara Logan, Mike Cranfield and Eddy Kambale - CBS NEWS

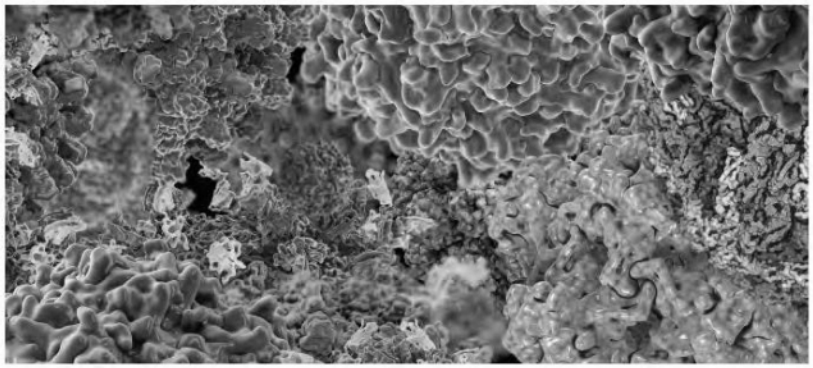
National Public Radio's All Things Considered: *The Next Pandemic Could be Dripping on your Head*

On February 21, 2017, PREDICT's Kevin Olival was interviewed on NPR about PREDICT/Indonesia's work with bats in caves at the high-risk ecotourism interface.

National Public Radio's All Things Considered: *Why Killer Viruses Are on the Rise*

On February 14, 2017, PREDICT's Kevin Olival was interviewed on NPR about his work in Borneo with the PREDICT/Indonesia team at high-risk sites where pandemics may emerge.

The Week (produced by STAT News): *There are more than 1 million viruses that we know absolutely nothing about*



Members of USAID's Emerging Pandemic Threats program, PREDICT, and the Global Virome Project were featured in this article exploring risks of responding to infectious disease threats after they have emerged, and highlighting work to "let data drive a much more robust line of investment against risk, not just what it is that's kicking the door in at the moment."

STAT News: What's the next global disease threat? Some predictions

In this article, PREDICT's Kevin Olival discusses our work to "figure out what might cause future disease outbreaks before spread ignites, so the world can develop vaccines or drugs with which to respond."

Scientific American: *The Next Zika*

PREDICT's Brian Bird, was featured in an article in *Scientific American* related to mutations of Rift Valley virus on October 11, 2016.


SCIENTIFIC AMERICAN.

CIENCES MIND HEALTH TECH SUSTAINABILITY EDUCATION VIDEO PODCASTS BLOGS S

PUBLIC HEALTH

The Next Zika

Four insect–and tick-borne viruses that you may not have heard about are now worrying researchers

Film and video

Emerging Pathogen Surveillance

On January 13, 2017, PREDICT's Global Director Jonna Mazet, was interviewed by Vincent Racaniello from Columbia University at the Emerging Infectious Diseases A to Z (EIDA2Z) conference hosted by the National Emerging Infectious Diseases Laboratories.

Tusk Award for Conservation in Africa Finalist

Olivier Nsengimana, a veterinarian trained by the PREDICT and Gorilla Doctors programs, is now on a one-man mission to save the grey crowned cranes in Rwanda.

Radio

MicrobeTalk Podcast

The Microbiology Society, which is based in Europe and interviews researchers about viruses, bacteria, and parasites, spoke to PREDICT's Jonna Mazet about capacity building in areas of the world most at risk for disease emergence and spillover events.

To prevent future disease epidemics, we need a better understanding of the nature of spillover events, and the viruses involved in them. In this month's podcast, we spoke to Professor Jonna Mazet, Director of the One Health Institute at the University of California, Davis. Jonna is also the Global Director of PREDICT, an ambitious project that is trying to identify any pathogens that might pose a threat to human health, and working to build capacity in areas of the world that are at risk of disease emergence.

News articles

FRONTLINES – USAID

The PREDICT/Nepal team was featured in an in-depth story on the USAID frontlines publication.

Zoetis Award for Research Excellence

PREDICT's Global Director Dr. Jonna Mazet was honored by the UC Davis School of Veterinary Medicine with the Zoetis Award for Research Excellence.

CIFOR Day at USAID: Integrating Biodiversity and Forests into Key Development Objectives

USAID's Office of Forestry and Biodiversity (FAB) and the Center for International Forestry Research (CIFOR) teamed up with PREDICT team members in October 2016 to discuss areas for collaboration in Central Africa, specifically focusing on bushmeat and the bushmeat value chain.

Finding the worlds unknown viruses – before they find us

The Global Virome Project (GVP), a novel and innovative effort influenced by work conducted by PREDICT and featuring many PREDICT team members is featured in this article, which highlights how GVP is seeking to identify the majority of the world's viruses likely to infect humans.

Smithsonian's National Zoo & Conservation Biology Institute

In three separate articles, PREDICT's work in Myanmar is highlighted along with many facets of the project and PREDICT/Myanmar team members. Earth Optimism, Bats in Myanmar, Predicting Future Global Health

Press releases

Good emergency management practices (GEMP) workshop in Tanzania. FAO. February 24, 2017.

Celebrity Vet Promotes USAID Counter Wildlife Trafficking Efforts. USAID. March 15, 2017.

$28.8 million for PREDICT-2" from the United States Agency for International Development. University News. October 31, 2016.

From: (b)(6)
Sent: Wed, 12 Jun 2019 16:33:37 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Requests

Thanks

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Jun 12, 2019, at 6:10 PM, (b)(6)@ucdavis.edu> wrote:

Hi all,

I have reached out to EHA to confirm Peter's travel dates, and will follow-up as soon as I receive their response.

Thank you,
(b)(6)

On Wed, Jun 12, 2019 at 1:23 AM (b)(6)@usaid.gov> wrote:
(b)(6): please confirm travel dates are correct. Thanks!

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Jun 12, 2019, at 10:13 AM, (b)(6)@usaid.gov> wrote:

Hi (b)(6),

I don't think that these dates are correct. I was just told yesterday that Peter will be coming from Liberia and plans to land in Abidjan on the 21st.
Please confirm the travel information and let me know.

Thanks,
(b)(6)

[redacted]
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
US Embassy - Abidjan, Côte d'Ivoire
T: [redacted] M: [redacted]
From the US: [redacted]
USAID.gov | [redacted]@usaid.gov | @USAIDWestAfrica

On Tue, Jun 11, 2019 at 9:21 PM [redacted]@usaid.gov> wrote:
Hello team CDI,

the following travel approval requests have come in from PREDICT. We appreciate your concurrence and welcome any questions you may have. *Please note: All travelers should be prepared to provide an in/out brief during the duration of their travel.*

1. EcoHealth Alliance would like to request travel approval for Peter Daszak to travel from Newark, NJ to Abidjan, Cotê 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 [redacted].

[redacted]
Emerging Threats Division
U.S. Agency for International Development (USAID)
Telephone: [redacted] ***Cell:*** [redacted] | [redacted]**@usaid.gov**

---------- Forwarded message ---------
From: [redacted]@usaid.gov>
Date: Tue, Jun 4, 2019 at 2:33 AM
Subject: Re: PREDICT International Travel Requests
To: [redacted]@ucdavis.edu>
Cc: PREDICTMGT <predictmgt@usaid.gov>, Predict inbox <predict@ucdavis.edu>, [redacted] [redacted]@ucdavis.edu>

Approved subject to mission concurrence.

[redacted]
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6) *@usaid.gov*

On Jun 3, 2019, at 10:22 PM, (b)(6) @ucdavis.edu> wrote:

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!*

(b)(6)

(b)(6)

1. Daszak (CIV): $14,800 airfare **business class* $344 (Abidjan) max daily per diem
2. (b)(6) Dascak (China): $1900 (Economy)/$5208 (Business) **business class required for Dr. Daszak* $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, Cotê 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 13th 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.

--
(b)(6)
One Health Institute
(b)(6)

--
You received this message because you are subscribed to the Google Groups "PREDICTMGT" group.
To unsubscribe from this group and stop receiving emails from it, send an email to predictmgt+unsubscribe@usaid.gov.
To post to this group, send email to predictmgt@usaid.gov.
To view this discussion on the web visit
(b)(3):6 U.S.C. § 133 (Critical Infrastructure Information Act of 2002)

<Laos TDY (b)(6) June 28 - July 6,2019.docx>

--
You received this message because you are subscribed to the Google Groups "PREDICTMGT" group.
To unsubscribe from this group and stop receiving emails from it, send an email to predictmgt+unsubscribe@usaid.gov.
To post to this group, send email to predictmgt@usaid.gov.
To view this discussion on the web visit
(b)(3):6 U.S.C. § 133 (Critical Infrastructure Information Act of 2002)

--
(b)(6)
One Health Institute
(b)(5)

From: (b)(6)
Sent: Thu, 15 Dec 2016 11:37:52 +0000
To: (b)(6)
Cc:
Subject: Re: PREDICT International Travel Requests

Thanks

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Dec 15, 2016, at 11:55 AM, (b)(6)@usaid.gov> wrote:

I think it is ok for them to pay for (b)(6) travel and per down but not salary or any salary supplements

Sent from my iPhone

On Dec 15, 2016, at 5:46 AM, (b)(6) <(b)(6)@usaid.gov> wrote:

I'm assuming that the DRC travel warning goes for 30 days so I will let them know that that part of the trip is/is very likely a no-go.

I will ask for more information on (b)(6) role in the semi-annual meeting since that is not obvious.

Is it okay to have predict pay for the travel of another partner (I.e. (b)(6))?

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)

Begin forwarded message:

From: (b)(6)@ucdavis.edu>
Date: December 15, 2016 at 12:52:24 AM GMT+1
To: (b)(6)@usaid.gov>
Cc: "(b)(6) (GH/HIDN)" <(b)(6)@usaid.gov>, "(b)(6) (GH/HIDN)"

<(b)(6) @usaid.gov>, (b)(6) @usaid.gov>, (b)(6)
<(b)(6) @ucdavis.edu>, "(b)(6) @ucdavis.edu>, (b)(6)
<(b)(6) @ucdavis.edu>

Subject: PREDICT International Travel Requests

Please find below international travel requests for your review and approval. Please note that #4 for (b)(6) is a late submission necessitated by staffing changes in Rwanda. Please let me know if you have any questions. Thanks!!

1. Multiple – PREDICT Semi-Annual Meeting (USA): airfare varies (see below)/$268 (Pacifica) max daily per diem
2. (b)(6) (Sierra Leone, Guinea): $2,473 airfare/ $282 (Freetown), $327 (Conakry) max daily per diems
3. (b)(6) (Cambodia): $3,000 airfare/$236 (Phnom Penh) max daily per diem
4. (b)(6) (Rwanda, Uganda, DRC): $2,500 airfare/$299 (Kigali), $340 (Kampala), $406 (Kinshasa) max daily per diems
5. (b)(6) (RoC, DRC): $1,202 airfare/$302 (Brazzaville), $394 (Kinshasa) max daily per diems
6. (Cote d'Ivoire): $857 airfare/$327 (Abidjan) max daily per diem
7. Cote d'Ivoire): $1,117 airfare/$327 (Abidjan) max daily per diem
8. (b)(6) (Cote d'Ivoire, Sierra Leone, Guinea): $1,695 airfare/$327 (Abidjan), $282 (Freetown), $327 (Conakry) max daily per diems
9. (b)(6) (China): $1,522 airfare/$407 (Guangzhou), $377 (Beijing), $268 (Guilin), $241 (Kunming) max daily per diems

Travel Requests:

1. UC Davis would like to request travel approval for **the individuals listed below** to travel from **their respective departure locations (listed below)** to Pacifica, California, USA from January 9-12, 2017 to attend the PREDICT-2 Semi-Annual Consortium meeting from January 10-11, 2017.

Trip purpose: All travelers will be attending the Semi-Annual Consortium Meeting in Pacifica, California. In support of Global Health Security Agenda, this meeting will provide participants an opportunity to discuss work plans, budgets, and strategies for implementation of Year 3 activities with project partners. Max daily per diem for Pacifica is $268.

Traveler Name		Departure Location	Airfare Cost
(b)(6)		Manchester, England	$1,700
		Nanaimo, British Colombia, Canada	$888
		Nanaimo, British Columbia, Canada	$888
		Rome, Italy	$2,400
		Perth, Australia	$4,000

(b)(6) will initiate (b)(6) travel for this trip in Manchester, England, due to pre-existing person travel plans. After the meeting, (b)(6) will return from San Francisco, California, USA to (b)(6) home base in Hanoi, Vietnam.

2. Metabiota would like to request travel approval for [redacted] for Metabiota, to travel from Nuremberg, Germany to Freetown, Sierra Leone from January 10-20, 2017, then from Freetown, Sierra Leone, to Conakry, Guinea from January 20-28, 2017 to train field staff in bat capture and identification for implementation of project activities.

Trip purpose: Sierra Leone and Guinea - [redacted] will provide training for field staff on bat capture and identification. Training will include field and classroom activities, and discussion of challenges and best practices. Field training activities will coincide with regular sampling trips for year 3.

3. UC Davis would like to request approval for [redacted] to travel from Davis, California, USA to Phnom Penh, Cambodia from January 12-21, 2017 to join the PREDICT/Cambodia team in field and lab activities and document our work for communications and reports.

Trip Purpose: [redacted] will travel to Cambodia to meet [redacted] and the PREDICT-2 team in Cambodia and to document the team's One Health approach to zoonotic disease surveillance, including a planned concurrent sampling event targeting human, livestock, and wildlife at the rodent trade hub in Kandal, on the Vietnam border (the project's first official concurrent surveillance event). A professional [redacted] is donating [redacted] services to the project, though PREDICT will cover all [redacted] travel expenses.

4. UC Davis would like to request travel approval for [redacted] to travel from Baltimore, MD, USA to Kigali, Rwanda and Uganda and DRC from December 29, 2016-March 2, 2017 to meet with PREDICT staff and partners.

Trip purpose: *This trip will enable [redacted] to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat. [redacted] will again be visiting each country to oversee the coordination with FAO and the human surveillance and wildlife sampling as we ramp up for a year of intense sample collection. [redacted] will be aiding [redacted] to capture and sample bats in the Bukima Caves, as well as sample and transfer baboons from Rumangabo. [redacted] will be traveling to Lwiro sanctuary to help collect samples from the chimps and other primates at the facility, as well as personnel. In Uganda, [redacted] will aid [redacted] with project sampling and working with staff to start making virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the internet bases histopathology program. In Rwanda, [redacted] will be following up on a bat die off that still remains a mystery after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.*

5. Metabiota would like to request travel approval for [redacted] to travel from Cape Town, South Africa to Brazzaville, Republic of Congo from January 8-11, 2017 to review human surveillance strategy with the in-country team and implement a plan for animal surveillance. From Brazzaville, Republic of Congo, [redacted] will travel to Kinshasa, Democratic Republic of Congo from January 11-13, 2017 to review human surveillance strategy with the in-country team and visit field surveillance sites.

Trip purpose: Republic of Congo - On December 12, 2016, the in-country team in Brazzaville, Republic of Congo, submitted the human surveillance protocol to the in-country ethics committee for final review. In order to begin human behavioral surveillance, and evaluate capacity for human syndromic surveillance, (b)(6) will work with the behavioral team on beginning human surveillance in bush meat markets and implement a plan for concurrent animal surveillance. The team will also visit a proposed human syndromic surveillance site in Brazzaville, to assess capacity and identify collaborating staff. DRC - (b)(6) will work closely with the in-country team to evaluate and revise the human and animal surveillance strategy, and visit human syndromic surveillance sites.

6. Metabiota would like to request travel approval for (b)(6) to travel from Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6), and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

7. Metabiota would like to request travel approval for (b)(6) to travel from Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) and (b)(6) (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

8. Metabiota would like to request travel approval for (b)(6) to travel from Nanaimo, British Columbia, Canada to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training. (b)(6) will then travel from Abidjan, Cote d'Ivoire to Freetown, Sierra Leone from February 25-28, 2017, and from Freetown, Sierra Leone to Conakry, Guinea from March 1-4, 2017, to accompany a team from UC Davis to assess laboratory plans.

Trip purpose: Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) (b)(6), and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

9. EcoHealth Alliance would like to request travel approval for (b)(6) to travel from New York, NY, USA to Guangzhou, Beijing, Kunming, and Guilin, China from January 15 to February 28, 2017 for meetings with in-country partners in China, and the Global Virome Project meeting in Beijing.

Trip purpose: (b)(6) will meet with local (b)(6) to assist with fieldwork in Yunnan, Guangxi, and Guangdong provinces. (b)(6) will also be coordinating and organizing the Global Virome Project Working Group Meeting, and the China National Virome Project event in Beijing.

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6)
Sent: Fri, 16 Dec 2016 18:42:57 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Requests

Thanks

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Dec 16, 2016, at 7:33 PM, (b)(6)@ucdavis.edu> wrote:

Thanks, (b)(6) I'll let Metabiota know. The ITA for (b)(6) will be revised to include only RoC and resubmitted.

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Friday, December 16, 2016 10:06 AM
To: (b)(6)
Cc: (b)(6) (GH/HIDN); (b)(6); (b)(6)
Subject: Re: PREDICT International Travel Requests

Just to be safe, don't plan on DRC for this trip. If however, we get an indication sometime soon that things are back to normal travel-wise AND there is still time to add back DRC as part of the ROC visit, we can try for an expedited approval.

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Dec 15, 2016, at 11:24 PM, (b)(6)@ucdavis.edu> wrote:

Thanks, (b)(6) Metabiota is carefully monitoring the political situation in DRC and will not send (b)(6) there if there are safety concerns. Ideally they want (b)(6) to scope out the sites, but if DRC travel is not allowed then, yes, key people can meet with (b)(6) in Brazzaville. The intelligence from the Metabiota team in-country is that they expect the political upheaval to be short lived, but if you think it is prudent for MB to remove DRC travel from (b)(6) itinerary completely, they will revise the ITA and submit ITA's for key people to meet with (b)(6) in Brazzaville instead. Please advise.

Thanks!
(b)(6)

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6) [mailto:(b)(6) @usaid.gov]
Sent: Thursday, December 15, 2016 1:58 PM
To: (b)(6)
Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)
Subject: Re: PREDICT International Travel Requests

Thanks, (b)(6)

All travel to Pacifica meeting approved.

All other travel (except DRC/(b)(6)) approved subject to mission concurrence.

DRC/(b)(6) travel to be reevaluated after further consultation.

(b)(6)

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6) *@usaid.gov*

On Dec 15, 2016, at 10:26 PM, (b)(6) @ucdavis.edu> wrote:

Hi (b)(6) You are correct. (b)(6) is a recent addition to the External Advisory Panel, so we would be attending the meeting in an advisory capacity. I'll touch base with Metabiota regarding the DRC portion of (b)(6) trip and follow up with you when I know more.

Thanks!

(b)(6)

(b)(5)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Thursday, December 15, 2016 3:59 AM
To: (b)(6)
Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)
Subject: Re: PREDICT International Travel Requests

Hi (b)(6)

Can you provide more information on the proposed role of (b)(6) in the Predict semi-annual meeting? Is (b)(6) like (b)(6), part of the advisory group?

For the proposed (b)(6) travel to DRC in January, it may not be possible. As you know there was a travel warning issued last week and those usually get updated every month. So we may not know for a while if the travel situation stays the same (i.e. no travel) or goes back to normal. Is it possible to postpone the DRC part or would it be possible to have key people from Kinshasa come over to Brazzaville to meet with (b)(6)? That would allow for at least discussing the surveillance strategy, but visiting surveillance sites would obviously not be possible.

Thanks!

(b)(6)

On Thu, Dec 15, 2016 at 12:52 AM, (b)(5)@ucdavis.edu> wrote:
Please find below international travel requests for your review and approval. Please note that #4 for (b)(6) is a late submission necessitated by staffing changes in Rwanda. Please let me know if you have any questions. Thanks!!

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6. [redacted] (Cote d'Ivoire): $857 airfare/$327 (Abidjan) max daily per diem

7. [redacted] (Cote d'Ivoire): $1,117 airfare/$327 (Abidjan) max daily per diem

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Traveler Name	Departure Location	Airfare Cost
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	Nanaimo, British Colombia, Canada	$888
	Nanaimo, British Columbia, Canada	$888
	Rome, Italy	$2,400
	Perth, Australia	$4,000

*[redacted] *will initiate* [redacted] *travel for this trip in Manchester, England, due to pre-existing person travel plans. After the meeting,* [redacted] *will return from San Francisco, California, USA to* [redacted] *home base in Hanoi, Vietnam.*

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Trip purpose: Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6), and (b)(6) will work with the hospital team

on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

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(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

--

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
E-mail: (b)(6) @usaid.gov

For more information on USAID's Emerging Pandemic Threats program, see: http://www.usaid.gov/ept2

From: (b)(6)
Sent: Fri, 16 Dec 2016 15:01:15 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Requests

Agree...better safe than sorry.

Sent from my iPhone

On Dec 16, 2016, at 9:12 AM, (b)(6) @usaid.gov> wrote:

What do you think? Definitely delay travel?

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6) @usaid.gov

Begin forwarded message:

From: (b)(6) @ucdavis.edu>
Date: December 15, 2016 at 11:22:37 PM GMT+1
To: (b)(6) @usaid.gov>
Cc: (b)(6) @usaid.gov>, "(b)(6) (GH/HIDN)" <(b)(6) @usaid.gov>, (b)(6) @usaid.gov>, (b)(6) <(b)(6) @ucdavis.edu>, (b)(6) @ucdavis.edu>, (b)(6) <(b)(6) @ucdavis.edu>
Subject: RE: PREDICT International Travel Requests

Thanks, (b)(6) Metabiota is carefully monitoring the political situation in DRC and will not send (b)(6) there if there are safety concerns. Ideally they want (b)(6) to scope out the sites, but if DRC travel is not allowed then, yes, key people can meet with (b)(6) in Brazzaville. The intelligence from the Metabiota team in-country is that they expect the political upheaval to be short lived, but if you think it is prudent for MB to remove DRC travel from (b)(6) itinerary completely, they will revise the ITA and submit ITA's for key people to meet with (b)(6) in Brazzaville instead. Please advise.

Thanks!
(b)(6)

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Thursday, December 15, 2016 1:58 PM
To: (b)(6)
Cc: (b)(6) (b)(6) (GH/HIDN); (b)(6) (b)(6) (b)(6) (b)(6)
Subject: Re: PREDICT International Travel Requests

Thanks, (b)(6)

All travel to Pacifica meeting approved.

All other travel (except DRC/(b)(6) approved subject to mission concurrence.

DRC/(b)(6) travel to be reevaluated after further consultation.

(b)(6)

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6)@usaid.gov

On Dec 15, 2016, at 10:26 PM, (b)(6)@ucdavis.edu> wrote:

Hi (b)(6) You are correct. (b)(6) is a recent addition to the External Advisory Panel, so we would be attending the meeting in an advisory capacity. I'll touch base with Metabiota regarding the DRC portion of (b)(6) trip and follow up with you when I know more.

Thanks!
(b)(6)

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Thursday, December 15, 2016 3:59 AM
To: (b)(6)
Cc: (b)(6) (b)(6) (GH/HIDN); (b)(6) (b)(6) (b)(6) (b)(6)
Subject: Re: PREDICT International Travel Requests

Hi (b)(6)

Can you provide more information on the proposed role of [(b)(6)] in the Predict semi-annual meeting? Is [(b)(6)] like [(b)(6)], part of the advisory group?

For the proposed [(b)(6)] travel to DRC in January, it may not be possible. As you know there was a travel warning issued last week and those usually get updated every month. So we may not know for a while if the travel situation stays the same (i.e. no travel) or goes back to normal. Is it possible to postpone the DRC part or would it be possible to have key people from Kinshasa come over to Brazzaville to meet with [(b)(6)]? That would allow for at least discussing the surveillance strategy, but visiting surveillance sites would obviously not be possible.

Thanks!

[(b)(6)]

On Thu, Dec 15, 2016 at 12:52 AM, [(b)(6)]@ucdavis.edu> wrote:
Please find below international travel requests for your review and approval. Please note that #4 for [(b)(6)] is a late submission necessitated by staffing changes in Rwanda. Please let me know if you have any questions. Thanks!!

1. Multiple – PREDICT Semi-Annual Meeting (USA): airfare varies (see below)/$268 (Pacifica) max daily per diem

2. [(b)(6)] (Sierra Leone, Guinea): $2,473 airfare/ $282 (Freetown), $327 (Conakry) max daily per diems

3. [(b)(6)] (Cambodia): $3,000 airfare/$236 (Phnom Penh) max daily per diem

4. [(b)(6)] (Rwanda, Uganda, DRC): $2,500 airfare/$299 (Kigali), $340 (Kampala), $406 (Kinshasa) max daily per diems

5. [(b)(6)] (RoC, DRC): $1,202 airfare/$302 (Brazzaville), $394 (Kinshasa) max daily per diems

6. [(b)(6)] (Cote d'Ivoire): $857 airfare/$327 (Abidjan) max daily per diem

7. [(b)(6)] (Cote d'Ivoire): $1,117 airfare/$327 (Abidjan) max daily per diem

8. [(b)(6)] (Cote d'Ivoire, Sierra Leone, Guinea): $1,695 airfare/$327 (Abidjan), $282 (Freetown), $327 (Conakry) max daily per diems

9. [(b)(6)](China): $1,522 airfare/$407 (Guangzhou), $377 (Beijing), $268 (Guilin), $241 (Kunming) max daily per diems

Travel Requests:

1. UC Davis would like to request travel approval for **the individuals listed below** to travel from **their respective departure locations (listed below)** to Pacifica, California, USA from January 9-12, 2017 to attend the PREDICT-2 Semi-Annual Consortium meeting from January 10-11, 2017.

Trip purpose: All travelers will be attending the Semi-Annual Consortium Meeting in Pacifica, California. In support of Global Health Security Agenda, this meeting will provide participants an opportunity to discuss work plans, budgets, and strategies for implementation of Year 3 activities with project partners. Max daily per diem for Pacifica is $268.

Traveler Name	Departure Location	Airfare Cost
(b)(6)	Manchester, England	$1,700
	Nanaimo, British Colombia, Canada	$888
	Nanaimo, British Columbia, Canada	$888
	Rome, Italy	$2,400
	Perth, Australia	$4,000

(b)(6) *will initiate* (b)(6) *travel for this trip in Manchester, England, due to pre-existing person travel plans. After the meeting,* (b)(6) *will return from San Francisco, California, USA to* (b)(6) *home base in Hanoi, Vietnam.*

2. Metabiota would like to request travel approval for (b)(6) for Metabiota, to travel from Nuremberg, Germany to Freetown, Sierra Leone from January 10-20, 2017, then from Freetown, Sierra Leone, to Conakry, Guinea from January 20-28, 2017 to train field staff in bat capture and identification for implementation of project activities.

Trip purpose: Sierra Leone and Guinea - (b)(6) will provide training for field staff on bat capture and identification. Training will include field and classroom activities, and discussion of challenges and best practices. Field training activities will coincide with regular sampling trips for year 3.

3. UC Davis would like to request approval for (b)(6) to travel from Davis, California, USA to Phnom Penh, Cambodia from January 12-21, 2017 to join the PREDICT/Cambodia team in field and lab activities and document our work for communications and reports.

Trip Purpose: (b)(6) will travel to Cambodia to meet (b)(6) and the PREDICT-2 team in Cambodia and to document the team's One Health approach to zoonotic disease surveillance, including a planned concurrent sampling event targeting human, livestock, and wildlife at the rodent trade hub in Kandal, on the Vietnam border (the project's first official concurrent surveillance event). A professional

(b)(6) is donating (b)(6) services to the project, though PREDICT will cover all (b)(6) travel expenses.

4. UC Davis would like to request travel approval for (b)(6) to travel from Baltimore, MD, USA to Kigali, Rwanda and Uganda and DRC from December 29, 2016-March 2, 2017 to meet with PREDICT staff and partners.

Trip purpose: *This trip will enable (b)(6) to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat. (b)(6) will again be visiting each country to oversee the coordination with FAO and the human surveillance and wildlife sampling as we ramp up for a year of intense sample collection. (b)(6) will be aiding (b)(6) to capture and sample bats in the Bukima Caves, as well as sample and transfer baboons from Rumangabo. (b)(6) will be traveling to Lwiro sanctuary to help collect samples from the chimps and other primates at the facility, as well as personnel. In Uganda, (b)(6) will aid (b)(6) with project sampling and working with staff to start making virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the internet bases histopathology program. In Rwanda, (b)(6) will be following up on a bat die off that still remains a mystery after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.*

5. Metabiota would like to request travel approval for (b)(6) to travel from Cape Town, South Africa to Brazzaville, Republic of Congo from January 8-11, 2017 to review human surveillance strategy with the in-country team and implement a plan for animal surveillance. From Brazzaville, Republic of Congo, (b)(6) will travel to Kinshasa, Democratic Republic of Congo from January 11-13, 2017 to review human surveillance strategy with the in-country team and visit field surveillance sites.

Trip purpose: Republic of Congo - On December 12, 2016, the in-country team in Brazzaville, Republic of Congo, submitted the human surveillance protocol to the in-country ethics committee for final review. In order to begin human behavioral surveillance, and evaluate capacity for human syndromic surveillance, (b)(6) (b)(6) will work with the behavioral team on beginning human surveillance in bush meat markets and implement a plan for concurrent animal surveillance. The team will also visit a proposed human syndromic surveillance site in Brazzaville, to assess capacity and identify collaborating staff. DRC - (b)(6) will work closely with the in-country team to evaluate and revise the human and animal surveillance strategy, and visit human syndromic surveillance sites.

6. Metabiota would like to request travel approval for (b)(6) to travel from Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the

national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

7. Metabiota would like to request travel approval for (b)(6) to travel from Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) (b)(6), and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

8. Metabiota would like to request travel approval for (b)(6) to travel from Nanaimo, British Columbia, Canada to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training. (b)(6) will then travel from Abidjan, Cote d'Ivoire to Freetown, Sierra Leone from February 25-28, 2017, and from Freetown, Sierra Leone to Conakry, Guinea from March 1-4, 2017, to accompany a team from UC Davis to assess laboratory plans.

Trip purpose: Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

9. EcoHealth Alliance would like to request travel approval for (b)(6) to travel from New York, NY, USA to Guangzhou, Beijing, Kunming, and Guilin, China from January 15 to February 28, 2017 for meetings with in-country partners in China, and the Global Virome Project meeting in Beijing.

Trip purpose: (b)(6) will meet with local (b)(6), to assist with fieldwork in Yunnan, Guangxi, and Guangdong provinces. (b)(6) will also be coordinating

and organizing the Global Virome Project Working Group Meeting, and the China National Virome Project event in Beijing.

(b)(6)
One Health Institute
University of California, Davis
(b)(6) (office)
(cell)

--

(b)(6)
Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
E-mail: (b)(6) @usaid.gov

For more information on USAID's Emerging Pandemic Threats program, see: http://www.usaid.gov/ept2

From: (b)(6)
Sent: Tue, 30 Jul 2019 17:12:06 +0000
To: (b)(6)
Subject: Fwd: PREDICT 2019 Semi-annual report
Attachments: P2 SAR2019-FINAL-compressed_v2.pdf

Hi (b)(6)!

Per our conversation yesterday, attached is the PREDICT 2 report where you'll find the country stories. If you end up printing the whole file out, whenever you're done reviewing, we'd appreciate it if you could share the printed report with (b)(6)! She sits on the 8th floor right next to (b)(6).

Enjoy the read!

(b)(6)
Bureau for Global Health, Office of Infectious Disease, Emerging Threats Division
Phone: (b)(6)

(b)(6)

---------- Forwarded message ---------
From: (b)(6)@ucdavis.edu>
Date: Wed, May 1, 2019 at 5:14 PM
Subject: Re: PREDICT 2019 Semi-annual report
To: (b)(6)@usaid.gov>
Cc: (b)(6) (GH/HIDN) <(b)(6)@usaid.gov>, (b)(6) Emerging Threats Division <(b)(6)@usaid.gov>, (b)(6)@usaid.gov>, predict@ucdavis.edu <predict@ucdavis.edu>, PREDICTMGT <predictmgt@usaid.gov>, (b)(6) <(b)(6)@ucdavis.edu>

Hi there,

Here is the updated report. We corrected the map in the preface to accurately depict PREDICT's GHSA countries. Coming next week
is the M&E Excel file for (b)(6) along with the appendix containing our project's maps and models for this period of performance.

Best,

(b)(6)

On Tue, Apr 30, 2019 at 4:26 PM (b)(6)@usaid.gov> wrote:
Hi (b)(6),

Thanks so much for sending, just confirming that this version came through!

Best,
(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 Tue, Apr 30, 2019 at 6:45 PM (b)(6) @ucdavis.edu> wrote:
Hi there,

Please find attached the final version of PREDICT's 2019 Semi-annual report. It's a pretty great edition, hope you like it.

Enjoy!

(b)(6)

USAID | PREDICT

FROM THE AMERICAN PEOPLE

SEMI-ANNUAL REPORT

2019

REDUCING PANDEMIC RISK, PROMOTING GLOBAL HEALTH

ACKNOWLEDGMENTS

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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 This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the PREDICT Consortium and do not necessarily reflect the views of USAID or the United States Government.

Special thanks to the governments of and partners in Bangladesh, Cambodia, Cameroon, China, Côte 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 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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FEATURED

ON THE COVER

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 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 monthlong 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

Photo: PREDICT/Myanmar team sampling a bat

PREFACE

The PREDICT Consortium: putting One Health in practice

USAID | PREDICT

FROM THE AMERICAN PEOPLE

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**.

USAID/PREDICT global-level consortium institutions

- **UC Davis' One Health Institute**, based in the highest 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** is 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

Highlights from our teams around the world

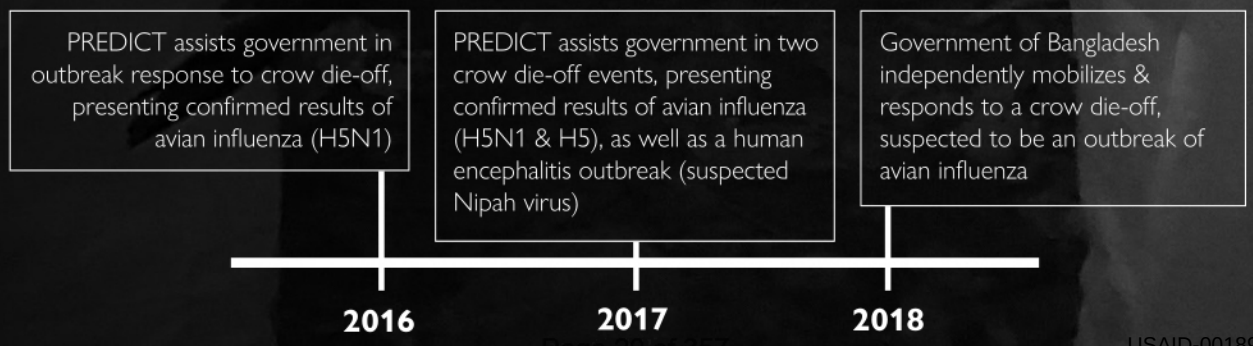
SUCCESS STORY

Strengthening National Capacity for Outbreak Response in Bangladesh

Live 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.



Recent PREDICT discoveries have identified bats as 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 the Smithsonian 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 (credit: PREDICT/Kenya), radio interview on "Health for All" (credit: PREDICT/Guinea)

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.

Photo: PREDICT/Kenya "Outbreak" exhibit in Laikipia County

SUCCESS STORY

Strengthening National Capacity to Detect & Prevent Priority Zoonotic Diseases

SIERRA LEONE

Finding viruses before they find us

For the first time in West Africa, scientists detected the deadly Marburg virus in five Egyptian rousette fruit bats in Sierra Leone. Marburg virus was identified by scientists at the same time 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, also stressing the importance of bats as a keystone species for healthy ecosystems.

LIBERIA

Liberia reaches a healthy security milestone

In Liberia, the PREDICT team reached a major milestone this year with the successful identification of *Zaire ebolavirus* in an insectorivorous 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 help 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 viral 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.

Photo: *Rousettus aegyptiacus* (credit: Getty Images)

SUCCESS STORY

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

Building the evidence base through new viral discoveries

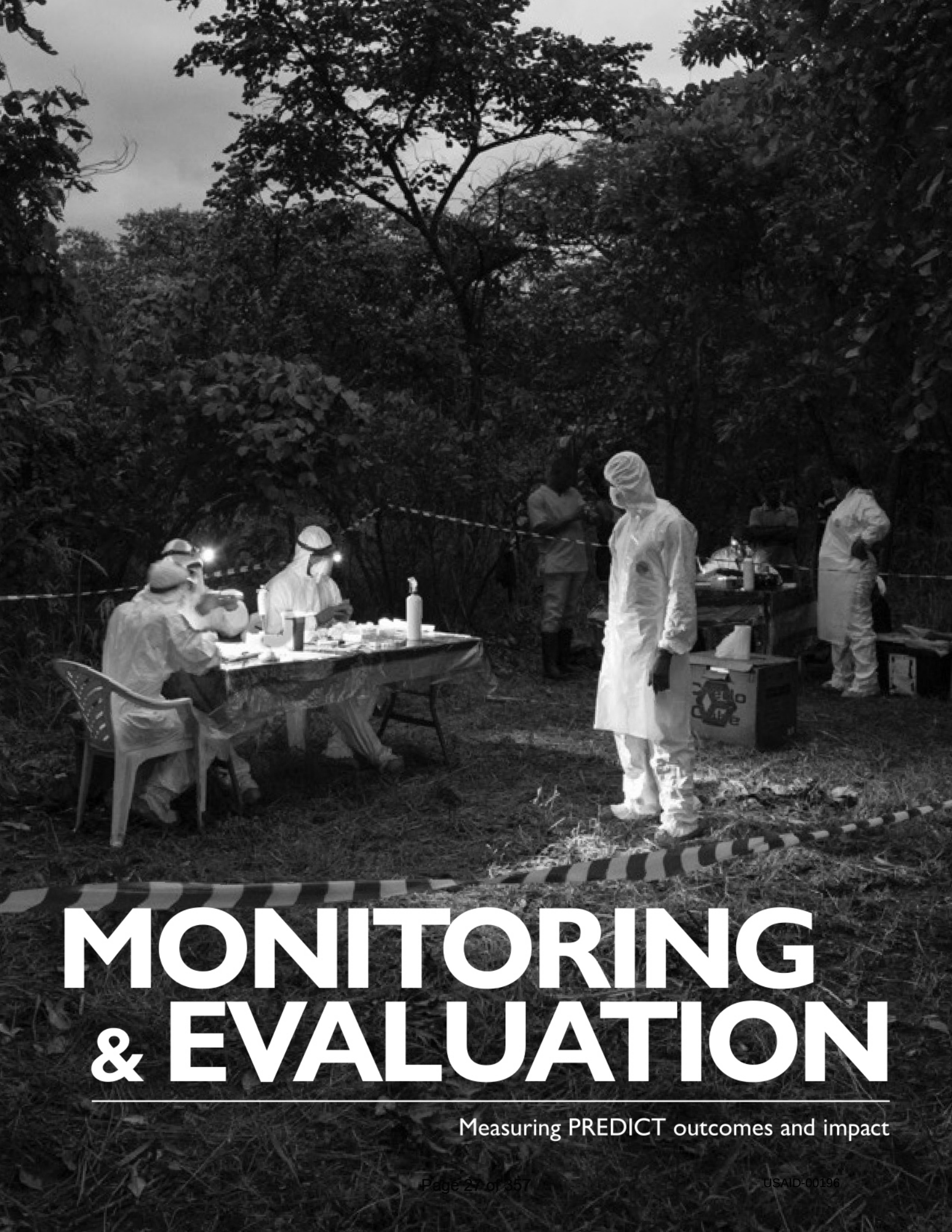
Global disease surveillance initiatives for novel, emerging viruses are an essential component of pandemic prevention efforts. PREDICT's surveillance strategy is focused on high-risk transmission interfaces, where people and wildlife come into contact and where viruses have the potential to spillover 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."

Photo: *Rousettus aegyptiacus* (credit: Minozig)

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

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 oubreak 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 sequeuncing 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

Photo: PREDICT/Sierra Leone team setting up field lab station (credit: Simon Townsley)

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; and 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 implementaiton and operationalization; evidence-based informational resources developed, including policy briefs, research papers, situational analysis/risk asssessment; 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

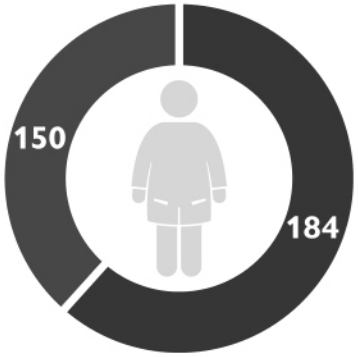
790K Tests performed

47 Labs able to perform PREDICT viral family testing

RISK MODELS & MAPS

34 Models or maps developed, refined, analyzed & described

ONE HEALTH WORKFORCE CAPACITY



#s trained

- Female
- Male

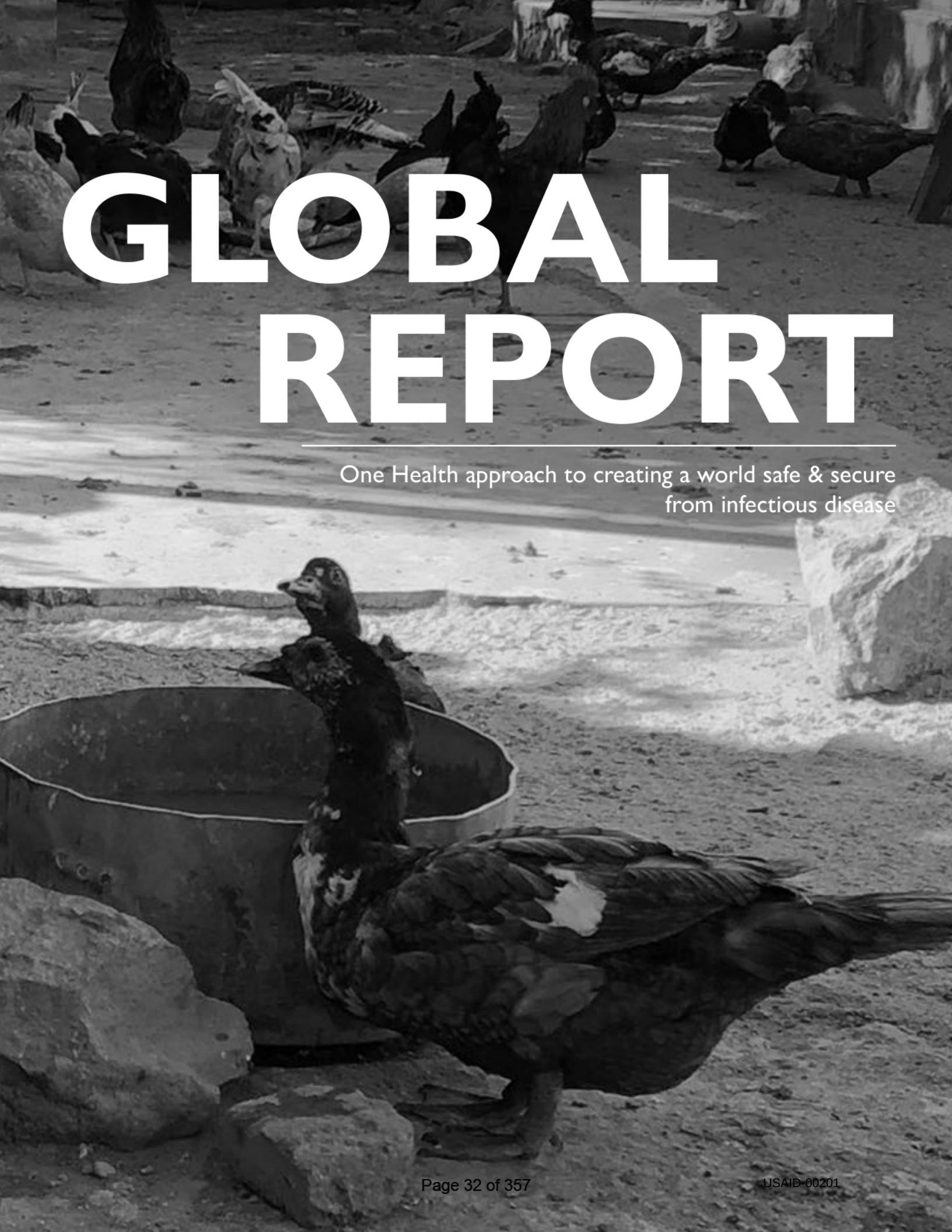
RISK FACTORS & RISK INTERFACES

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

Photo: Poultry farm in Tanzania (credit: Brooke Genovese)



GLOBAL REPORT

One Health approach to creating a world safe & secure from infectious disease

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 who 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.

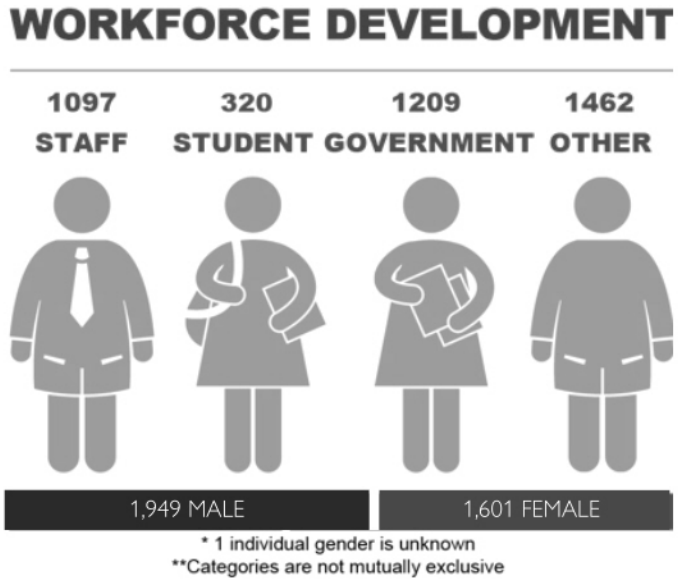


FIGURE 1. Since 2014, PREDICT-2 has trained over 3,500 individuals in One Health surveillance and disease detection in over 28 countries. Trained individuals include PREDICT staff, university students, government officials and others.

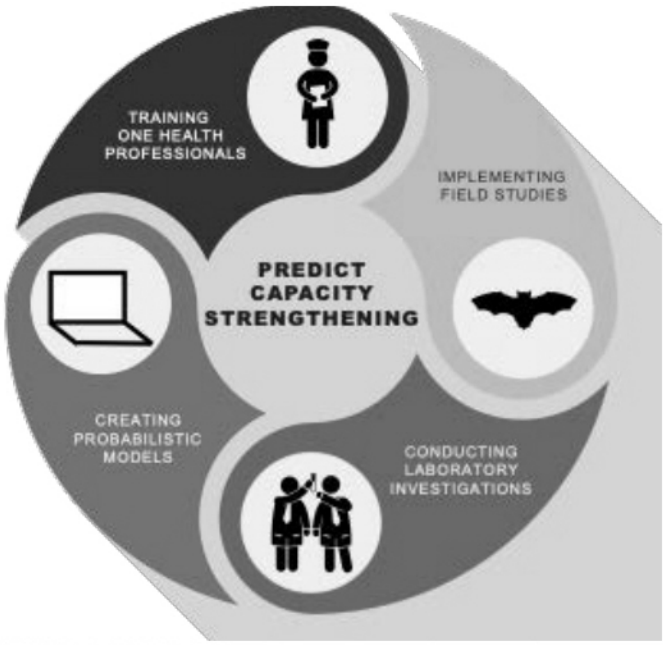


FIGURE 2. PREDICT-2 uses an integrated approach to train personnel in One Health competencies that enable field surveillance activities, laboratory testing for priority zoonotic diseases and other emerging threats, outbreak assistance, and informed behavior change that improves our understanding of zoonotic 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, which independently led a wildlife outbreak response in December 2018 (see Success Stories section 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.

FIGURE 3. PREDICT/Senegal hosted a two-day simulation exercise on detection and response to an Ebola Virus outbreak. The 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.

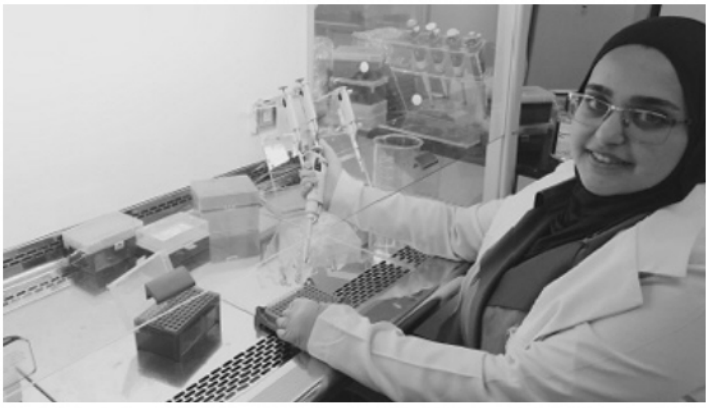


FIGURE 4. PREDICT/Jordan strengthens capacity in laboratory techniques by training graduate students who work as part-time research assistants. Master's student Ola Abebneh demonstrates laboratory techniques at the JUST Molecular and Virology Lab.

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 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

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

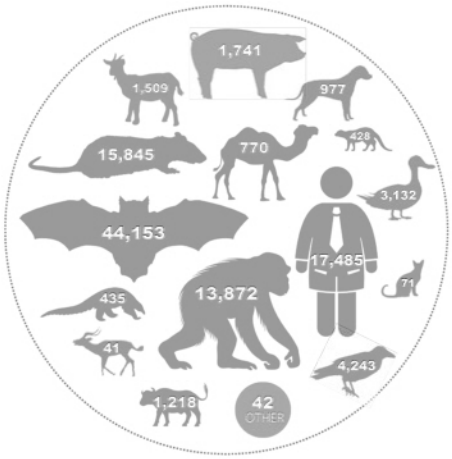
Overview

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 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, Côte 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.

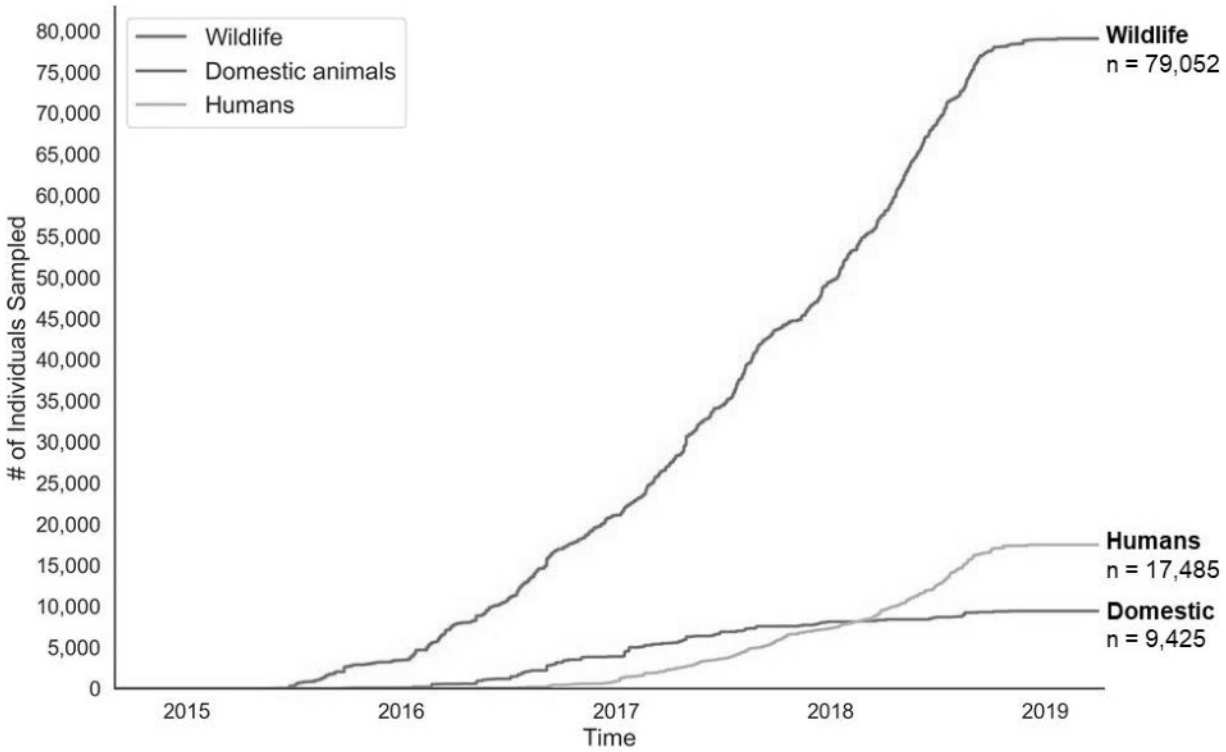


FIGURE 1. Number of individual wildlife, domestic animals and humans sampled.

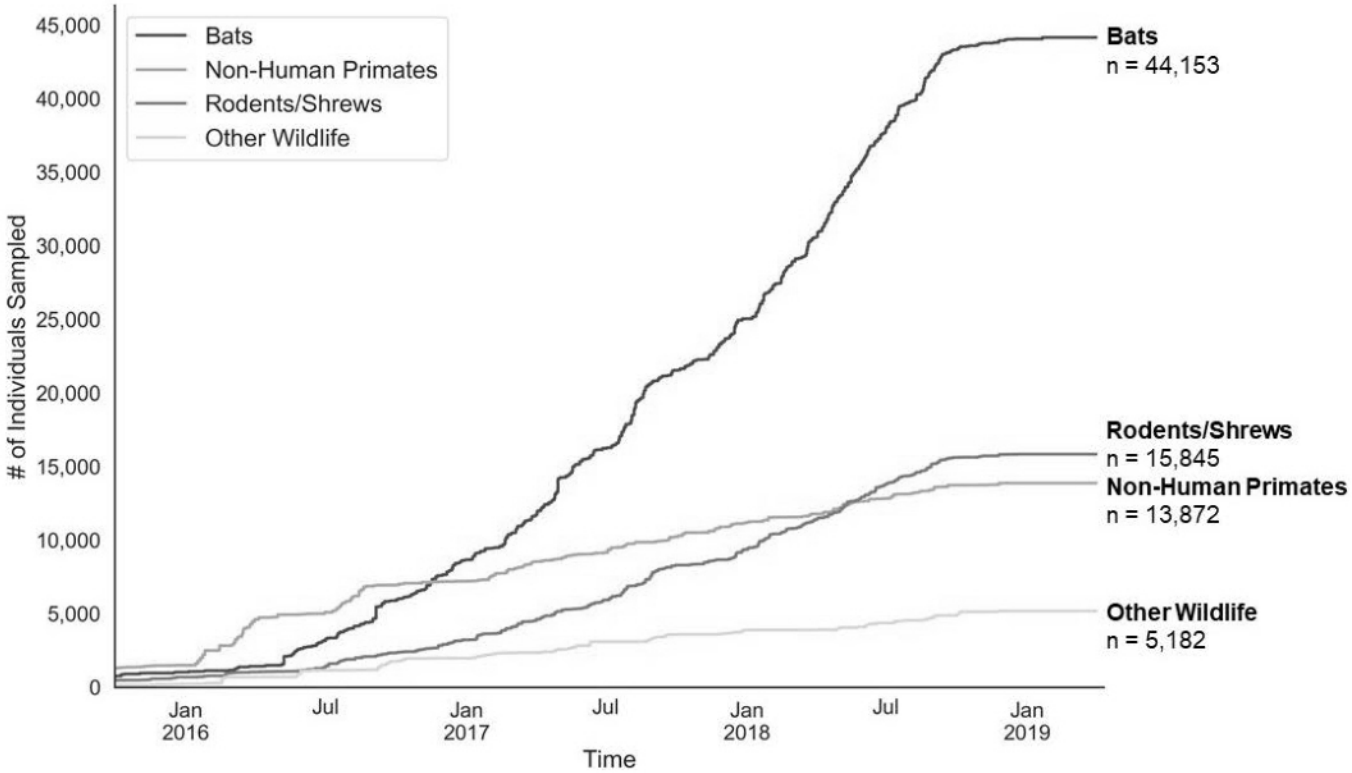


FIGURE 2. Number of individual wild animals sampled overall, by taxonomic group.*
**Depicts animals with data entered into the Emerging Infectious Disease Information Technology Hub (EIDITH), PREDICT's information and data management system.*

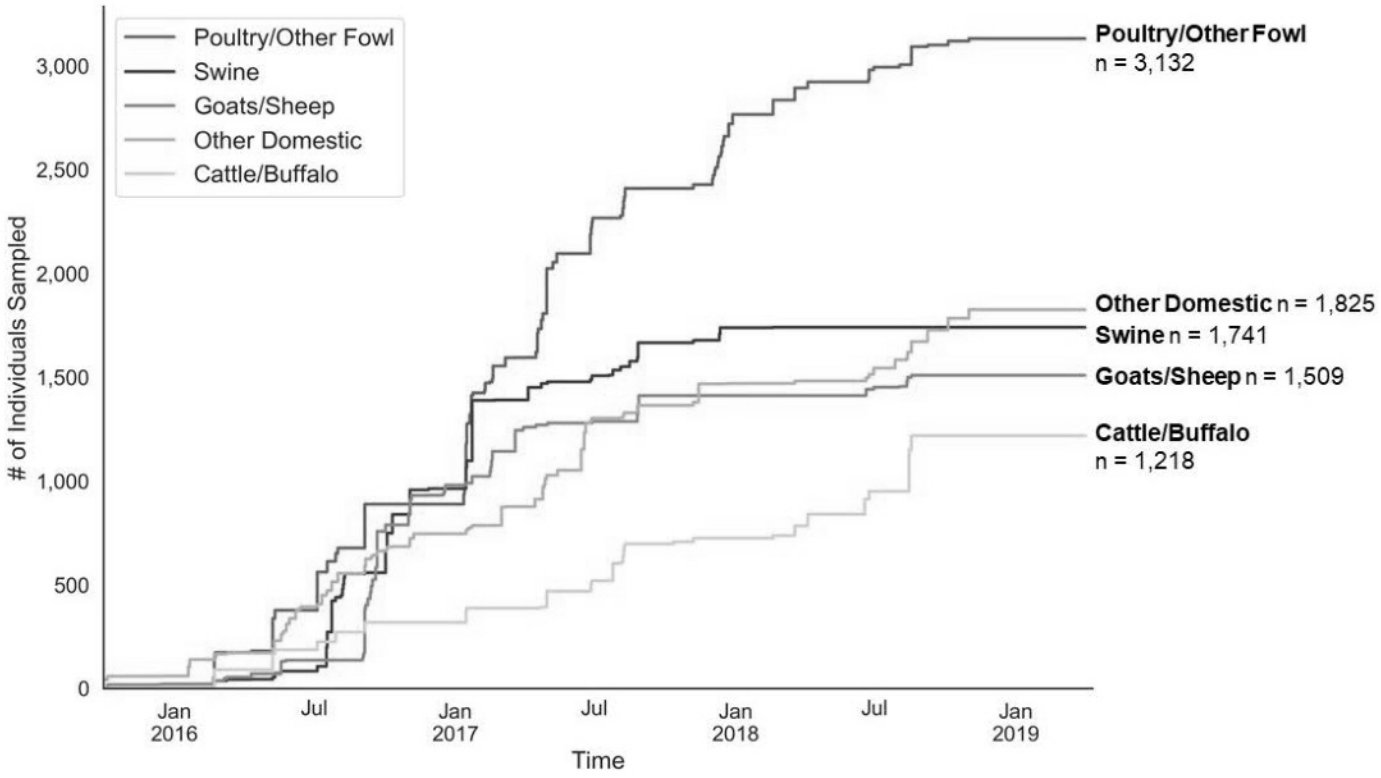


FIGURE 3. Number of individual domestic animals sampled overall, by taxonomic group.*
**Depicts animals with data in EIDITH.*

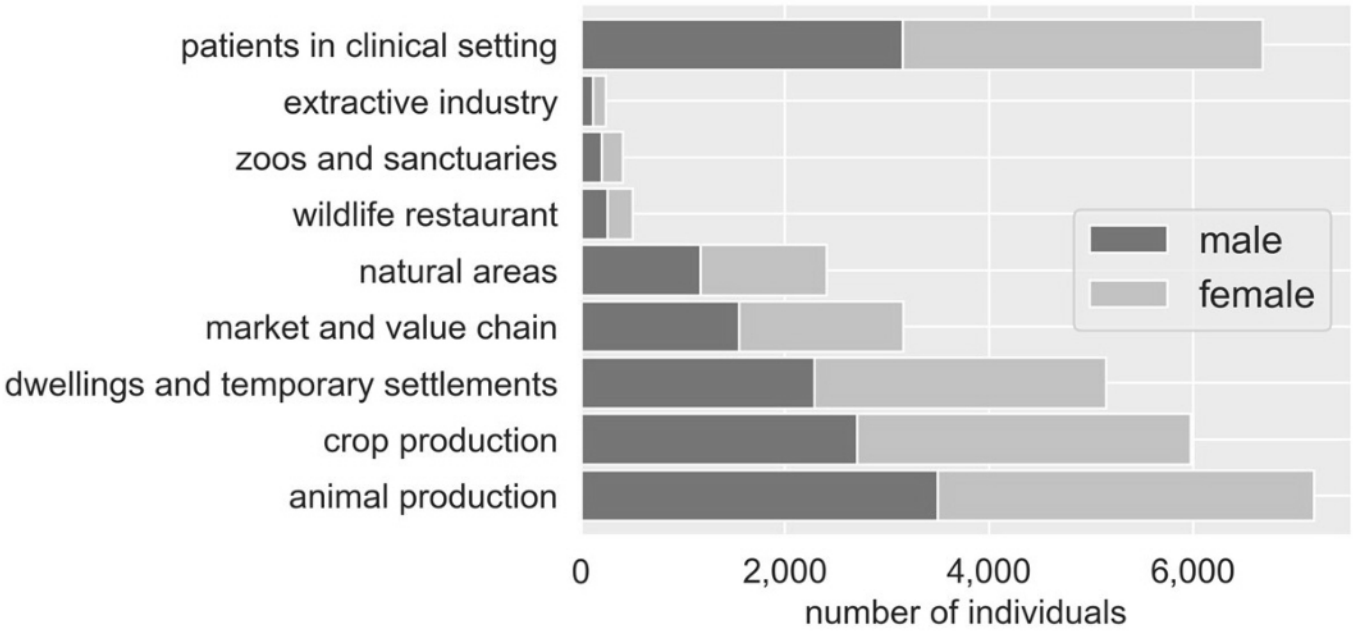


FIGURE 4. High-risk interface modules completed by individuals sampled in the community or patient clinical setting, aggregated by gender.*
**Many individuals sampled were identified with more than one disease transmission interface.*

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. 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 Indonesia (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.

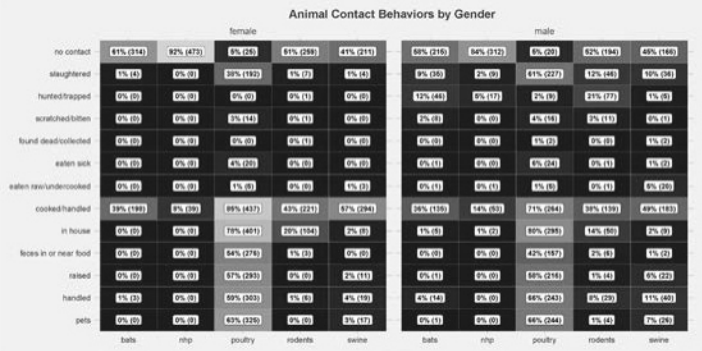


FIGURE 3. Behavioral Risk heatmap from Indonesia of the responses of the ecological, biological and behavioral risk surveillance questionnaires, by gender for various contact types by priority animal taxa.

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.

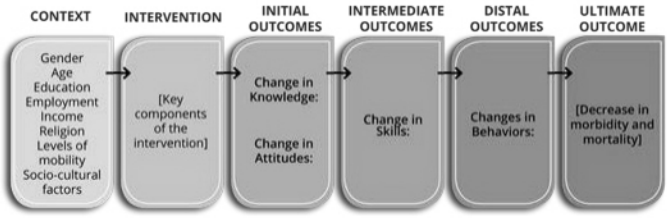


FIGURE 4. PREDICT's logic model for behavior change.

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).

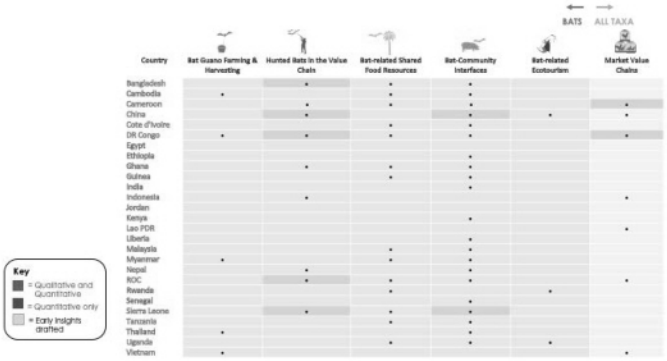


FIGURE 6. The multitude of ways that PREDICT-enrolled participants who completed the questionnaire experience contact with animals.

Select PREDICT Behavioral Risk Products

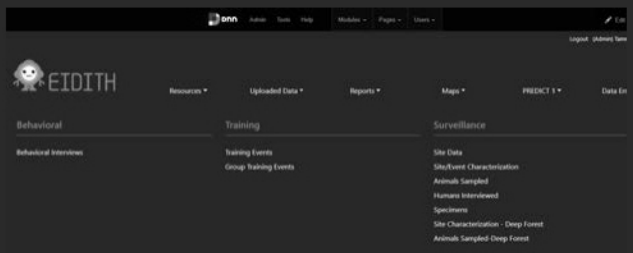
- 11 training decks to support capacity-building sustainability
- Data analysis planning resources
- Questionnaire analysis report
- Coding clarification log
- Questionnaire analysis matrix
- Real-time Interim Data Review (IDR) report
- Maps of behavioral data
- Intervention development tool
- Behavior change and risk communication resource *Living Safely with Bats* adapted to multiple contexts and translated in several languages

STRENGTHENING ONE HEALTH DATA PLATFORMS

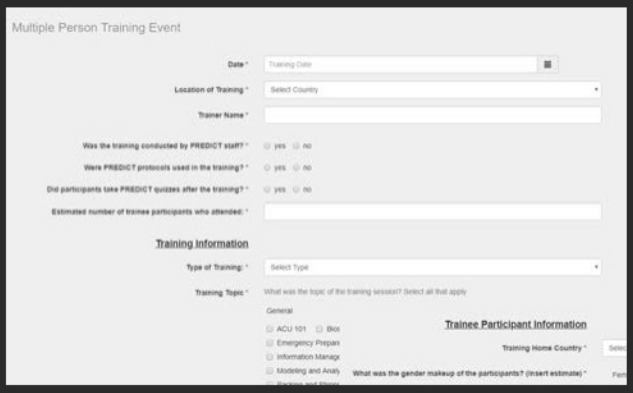
EIDITH

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 from the field by apps and pushed to our secured servers for data cleaning and validation.

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



EIDITH's new menu system for improved site navigation.



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** is updated every 24 hours and powers visualization and analysis of data for the entire life of the project.

Photo: PREDICT/Tanzania using EIDITH on a tablet

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. 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**.

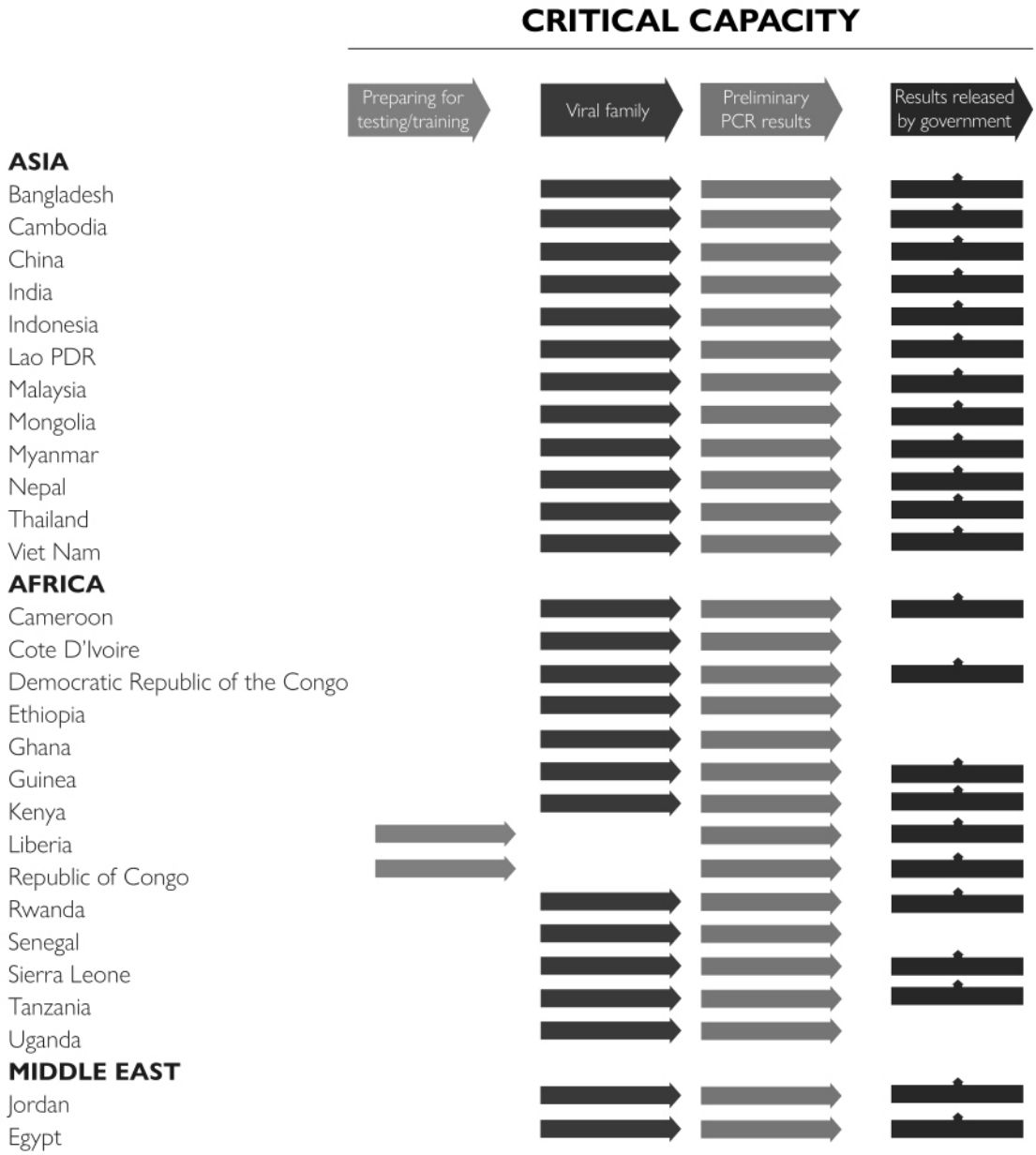


FIGURE 1. Major milestones and laboratory capacity gains toward viral detection

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).

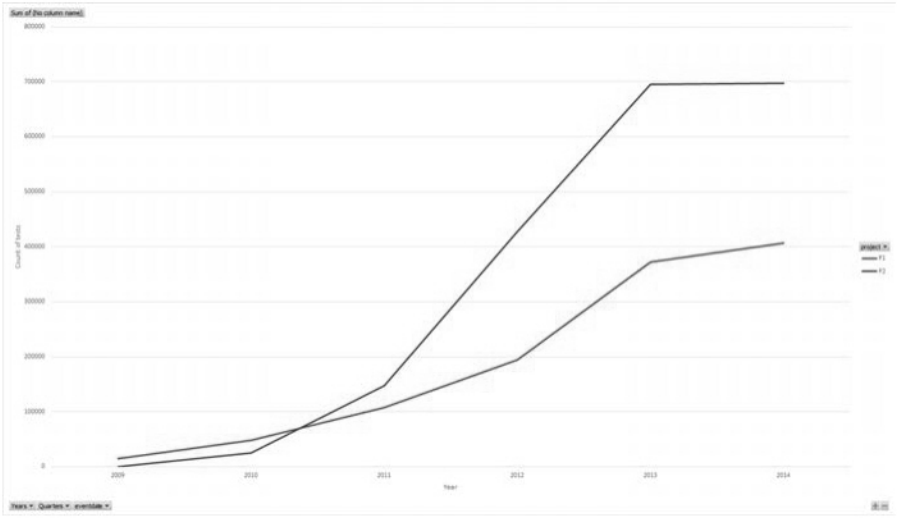


FIGURE 3. Total number of individuals tested in PREDICT-1 (red line) and PREDICT-2 (blue line).

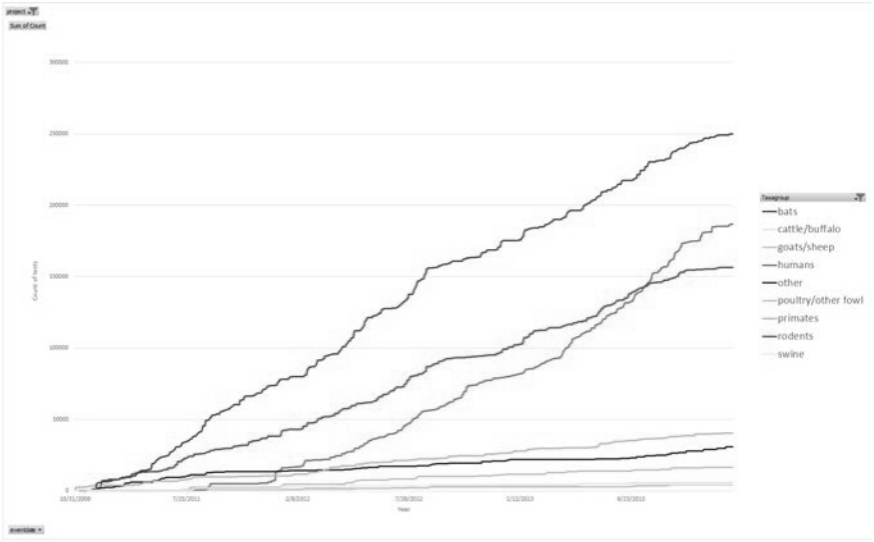


FIGURE 4. Total number of individuals tested to date, broken out by taxa.

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).*

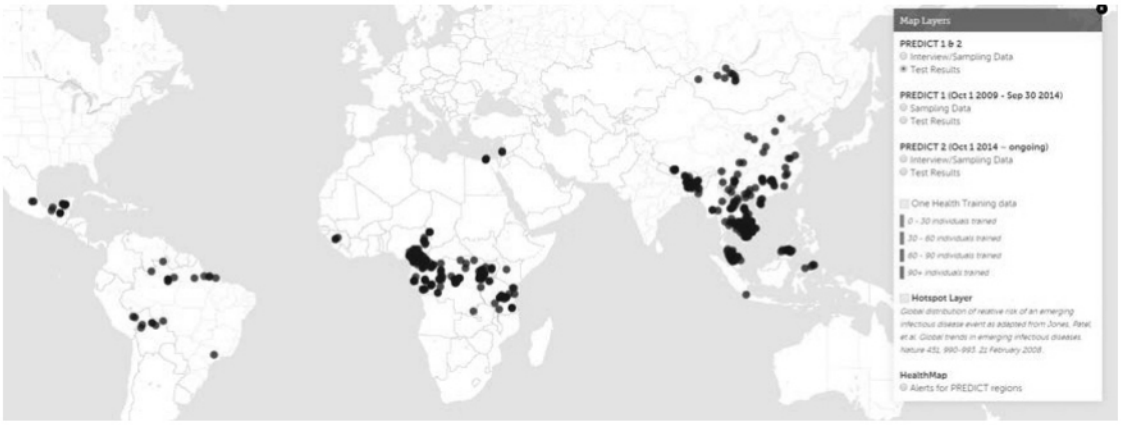


FIGURE 5. Viral map.

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****.*

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). It 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).

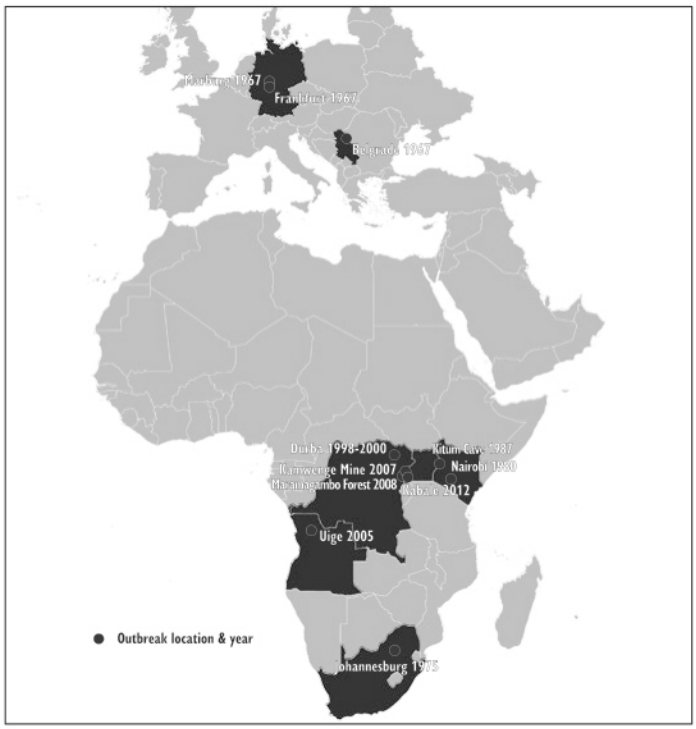


FIGURE 6. Marburg virus was detected in Egyptian rousette bats (Rousettus aegyptiacus) in Sierra Leone. This is the first time the virus has been found in West Africa and is more than 2,700 km from the closest previously reported detection.

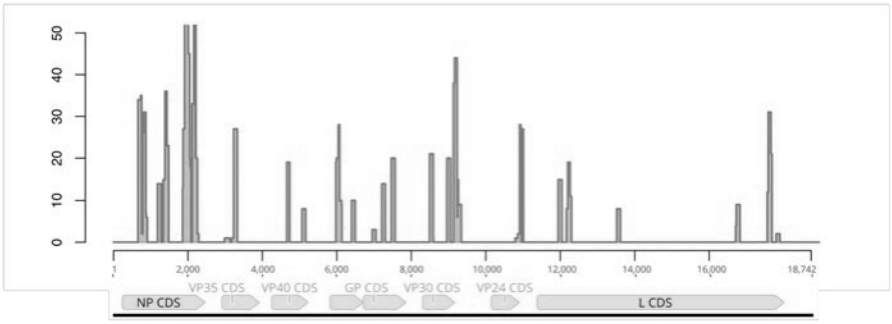


FIGURE 7. Ebola virus (species Zaire ebolavirus) was detected in a greater long-fingered bat (Miniopterus inflatus) in Liberia. Plot shows that approximately 20% of the genome has been sequenced.

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 medicate 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.

TABLE 1. Viral findings approved for release by country, taxa, year and season indicating the number of positive individuals for each virus detected

COUNTRY	VIRUS	TAXA	2015 Dry	2015 Wet	2016 Dry	2016 Wet	2017 Dry	2017 Wet	2018 Dry	2018 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			2	1			
	PREDICT_PMV-131	Rodents/shrews			1		1		
	PREDICT_PMV-133	Bats			1		1		
	PREDICT_PMV-79	Bats			1				
	PREDICT_PMV-80	Bats			1	1			
	PREDICT_PMV-82	Bats Rodents/shrews							
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 Alphacorona-virus/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					
	PREDICT_PMV-83	Rodents/shrews	1					
Republic of Congo	Strain of Kenya bat coronavirus/BtKY56/BtKY55	Bats		11				
					2			
	PREDICT_CoV-30	Bats						
Rwanda	Strain of Chaerephon bat coronavirus/Kenya/KY22/2006	Bats		1				
	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			
Sierra Leone	Bombali Ebolavirus (BOMV)	Bats				3		
	Marburg virus (MARV)	Bats						2
Tanzania	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			
Thailand	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 seroprevelance 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 (see Figure 1).

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.

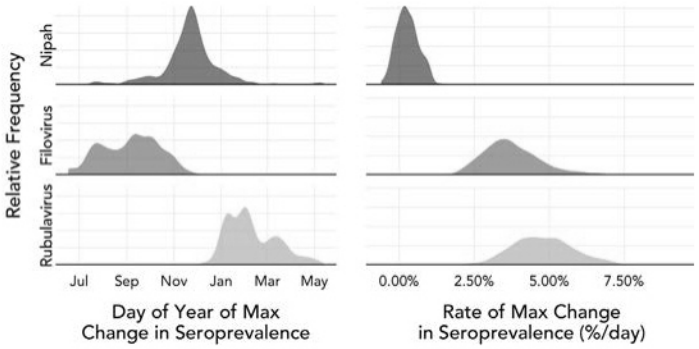


FIGURE 1. Analysis of serological data for three viruses to determine the timing and strength of viral circulation in juvenile bats from a longitudinal dataset from Bangladesh. Plots show periods of the year when the increase in seroprevalence is greatest (left), and the rate of change for each virus (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 (see Figure 2), 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 (Intervention Modeling Projects ACross Teams) to assess the specific risk that these markets play in disease spillover and spread.

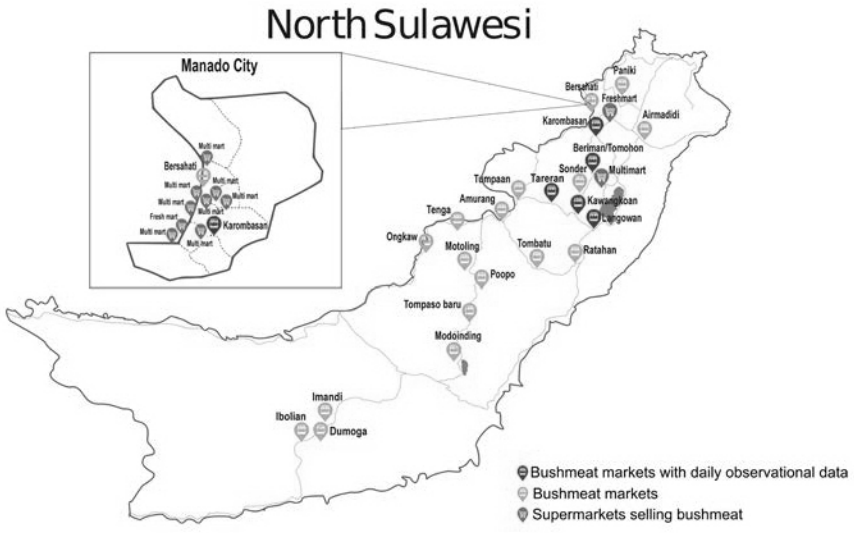


FIGURE 2. Map of the wildlife trade/value chain in North Sulawesi, Indonesia. Green markers indicate bushmeat markets surveyed by PREDICT, and red denotes markets where daily observational data were recently collected. Supermarkets where bushmeat is also available are marked in orange.

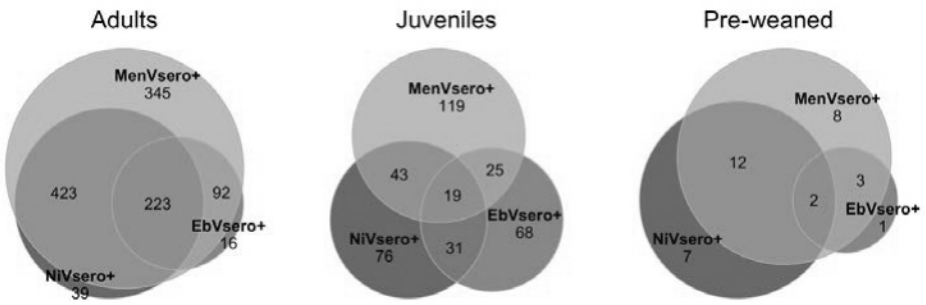


FIGURE 3. Patterns of seropositivity to multiple viruses in fruit bats from Bangladesh. Venn diagrams for adult, juvenile, and pre-weaned (dependent) Pteropus medius bats testing positive for antibodies against Nipah virus, filovirus, and rubulavirus. Numbers under labels are counts of bats with only seroreactivity to those viruses. Numbers in overlapping areas represent number of bats detected with multiple viruses or evidence of co-immunity.

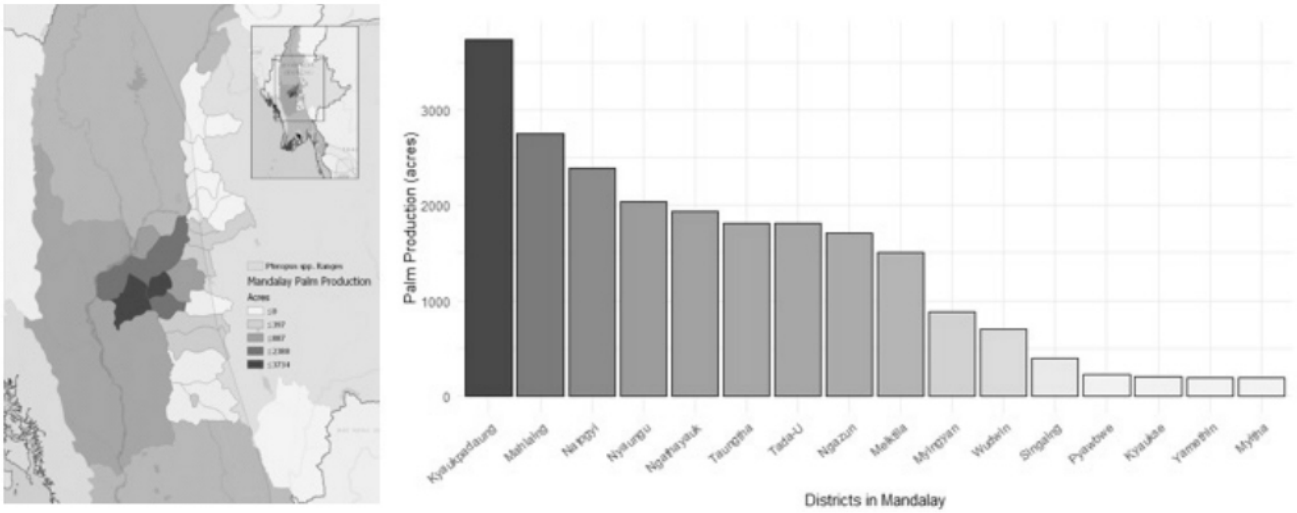


FIGURE 4. Date palm sap harvesting data from Myanmar by district in Mandalay being used to map the risk of bat-borne virus spillover risk.

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 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 (see Figure 5). 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.

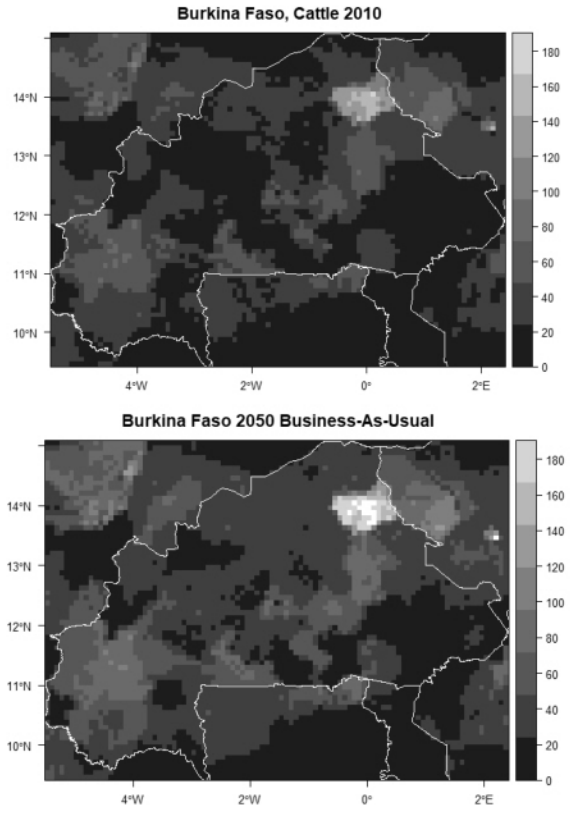
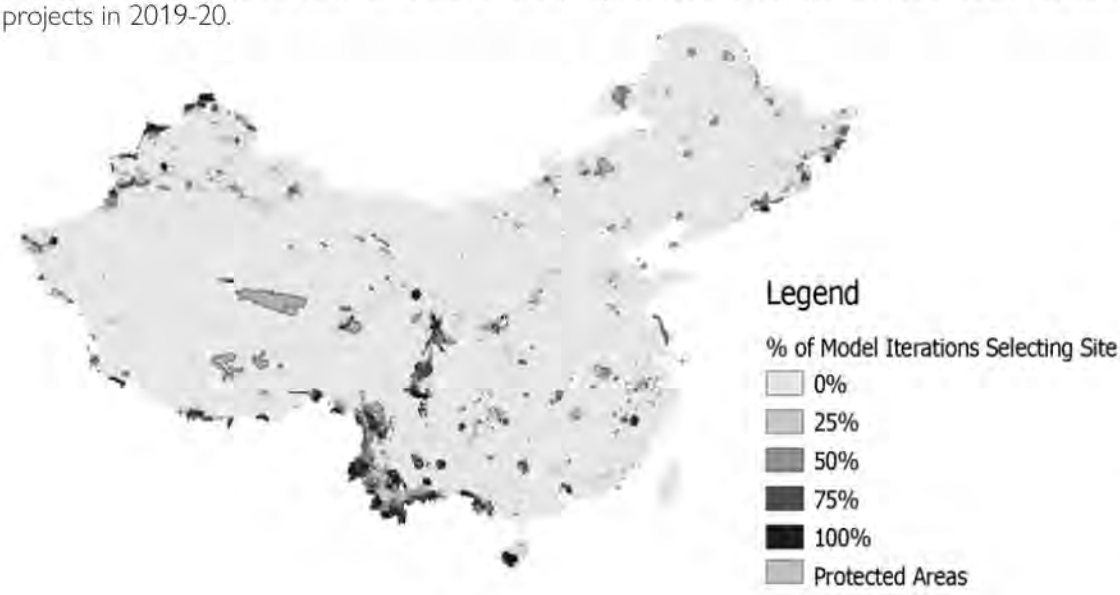


FIGURE 5. Forecasted changes in cattle density for Burkina Faso from 2010 to 2050 under a business-as-usual scenario. Maps produced by PREDICT as part of the Africa Sustainable Livestock 2050 (ASL2050) project in collaboration with FAO.

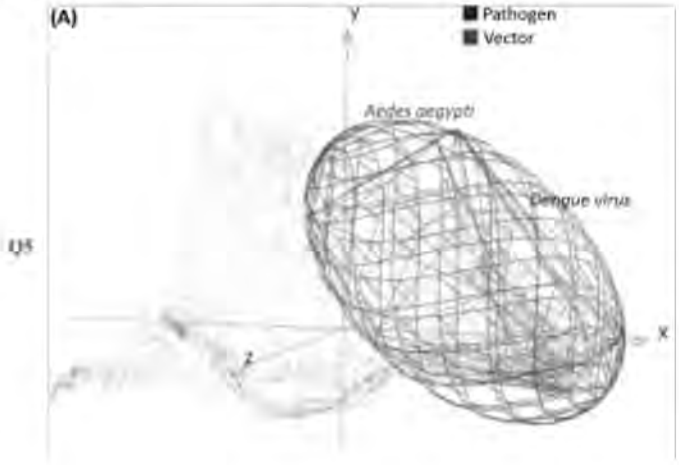
PREDICT's M&A team supported the development and strategic design of the Global Virome Project (GVP). We designed a spatial modeling approach to identify priority sites for targeted wildlife sampling at a 10 x 10 km resolution in countries of relevance to the GVP. PREDICT developed specific maps for 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.



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

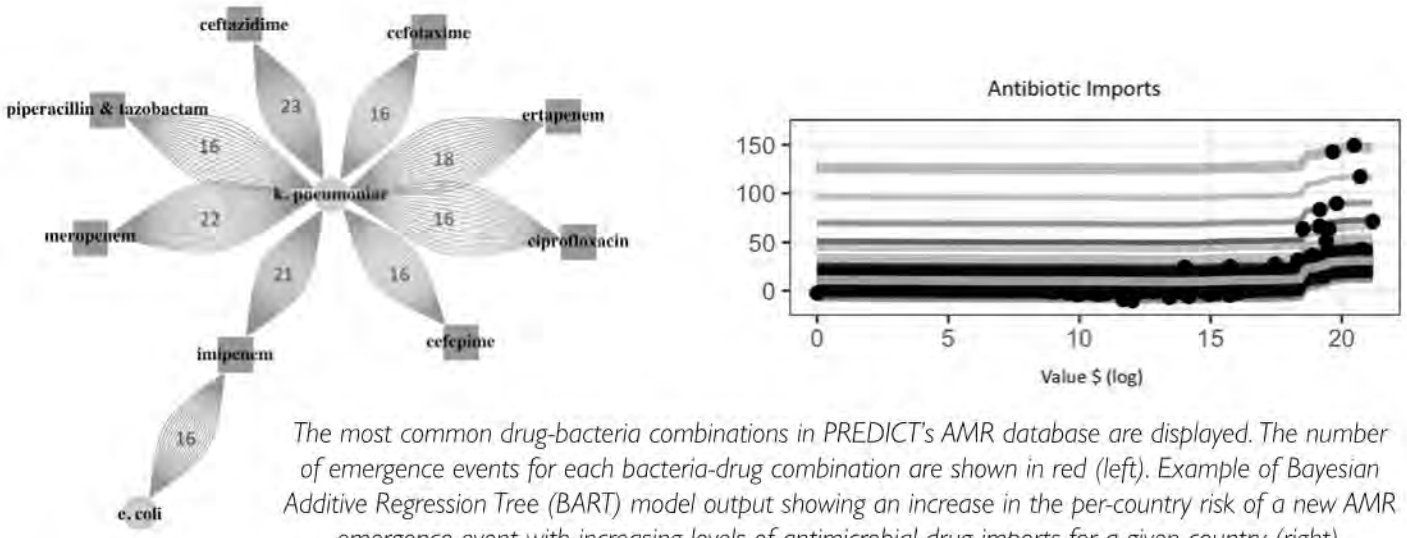
We continued developing new tools within the EIDITH R package to facilitate the cleaning and analysis of project data. These open-source tools allow country and global teams to download their country-level PREDICT-2 data, clean datasets by automatically identifying outliers and fields with missing or 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. Example bottom-left shows how dengue virus (blue polyhedron) distribution coincides with that of its vector, the mosquito Aedes aegypti (red ellipsoid).

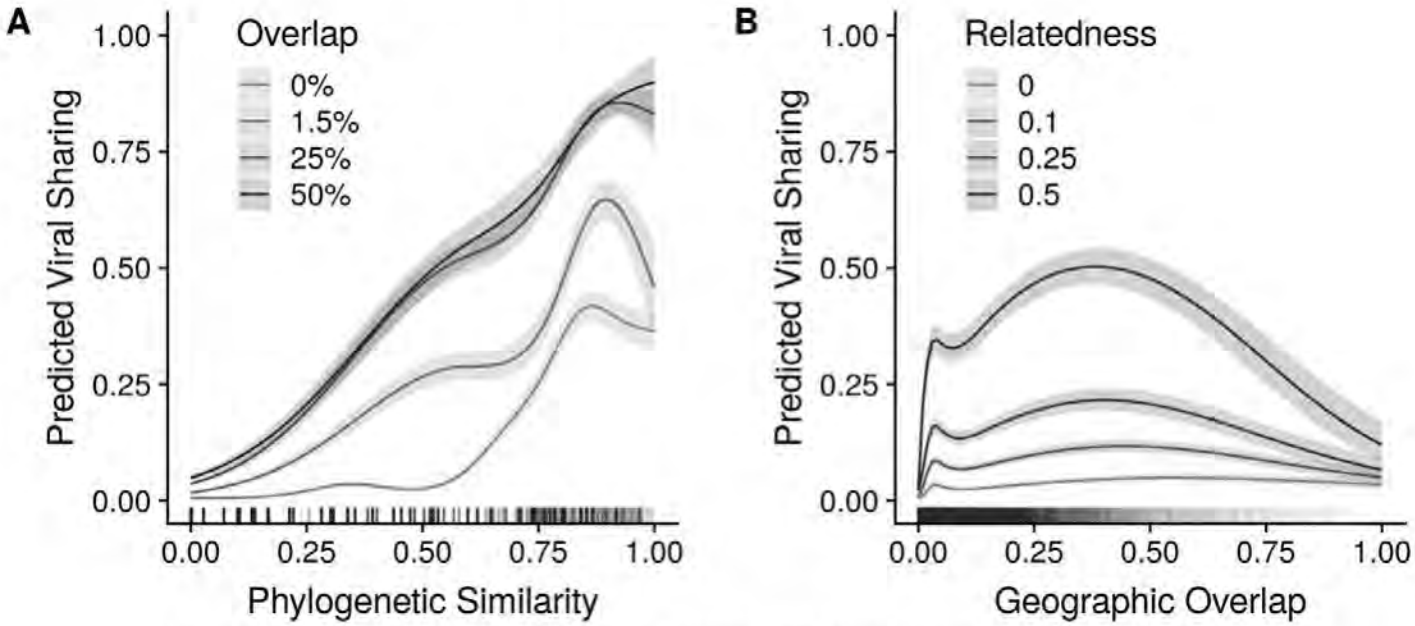
PREDICT developed a new theoretical framework for modeling the geography of disease transmission using biological properties of both hosts and parasites to produce reliable outputs of disease distributions. These analyses can be used to better map and help guide the surveillance and discovery of pathogens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

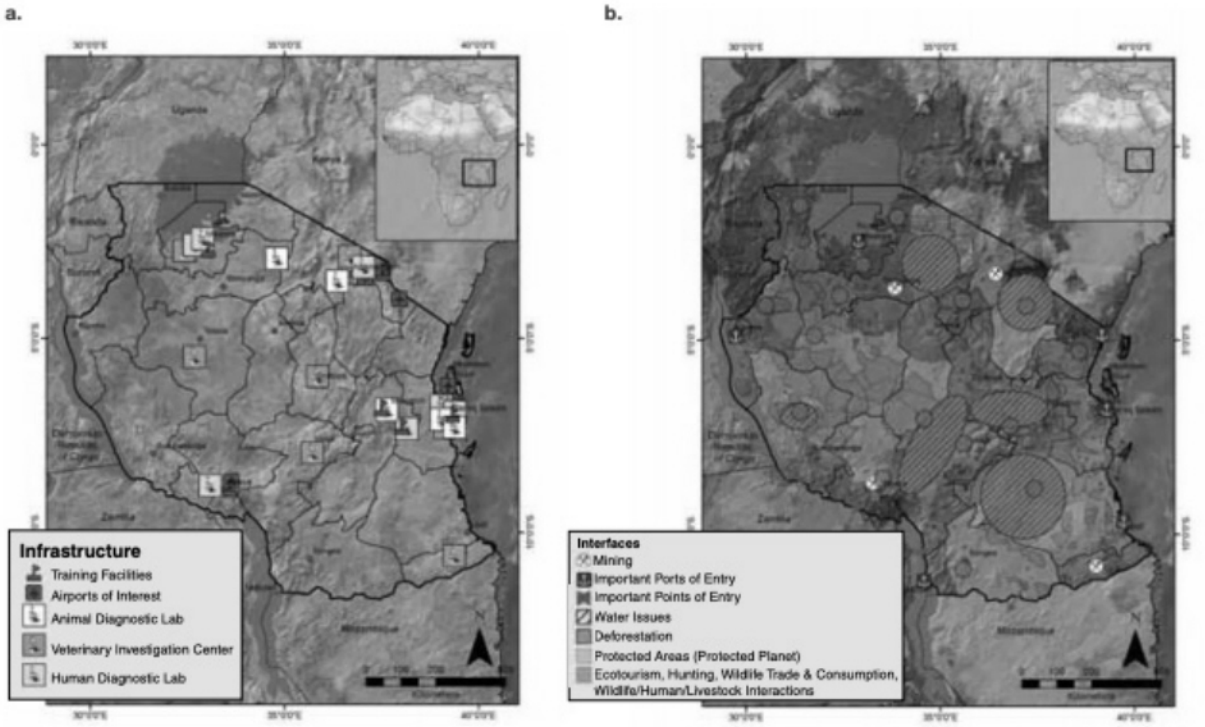
Emerging Disease Insights are available online: **livescience.ecohealthalliance.org**

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. PREDICT 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.

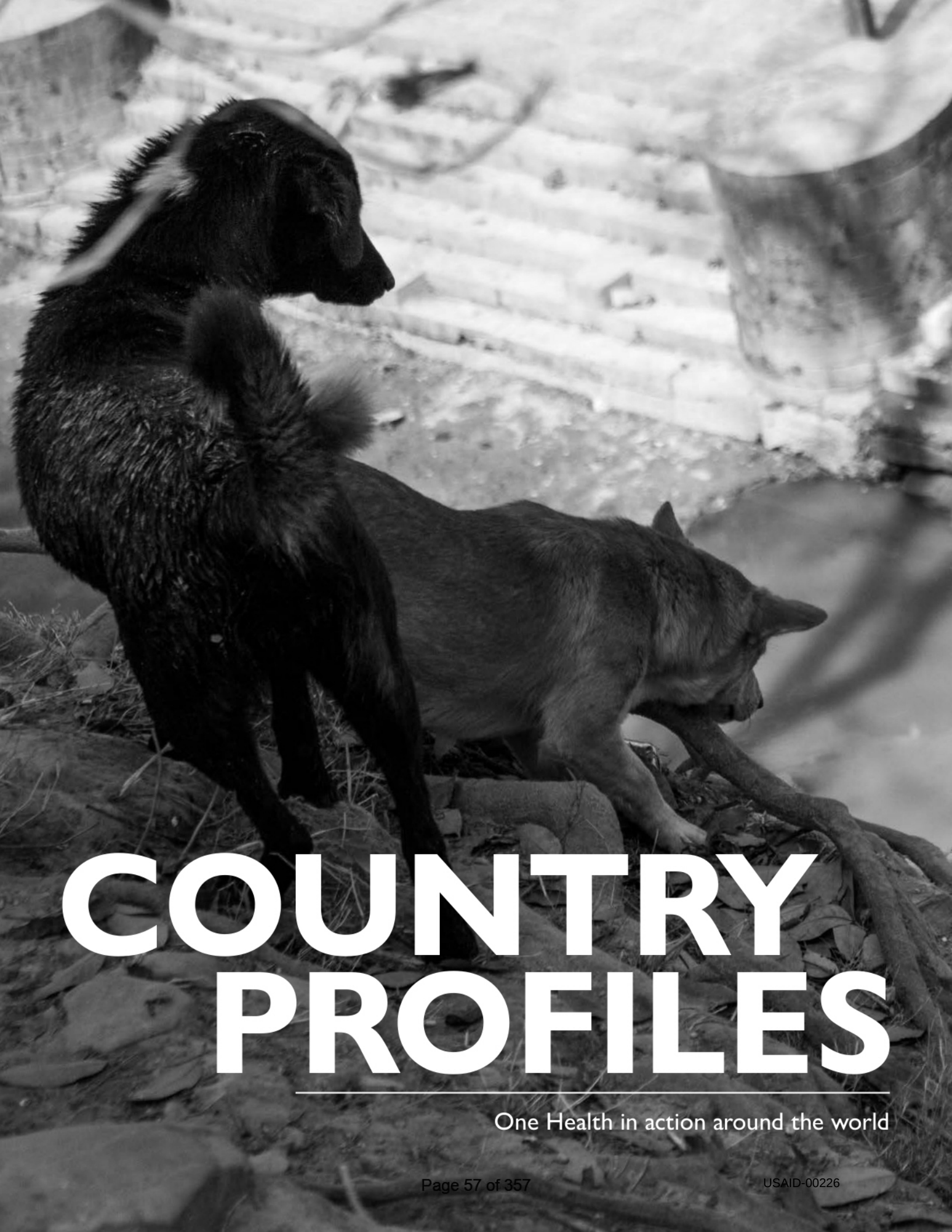
New publications, products and policy briefs

Key outputs highlighted practical pathways and benefits of multisectoral 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 multisectoral 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

One Health in action around the world

Photo: Interface in Nepal (credit: Pranav Pandit)

IMPACT

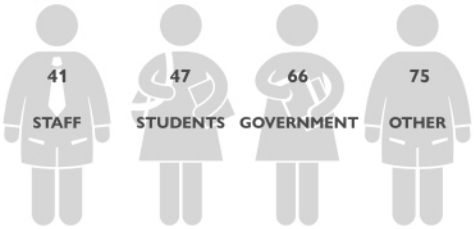
224 trained in One Health skills

4,856 individuals sampled (animals & humans)

941 individuals interviewed

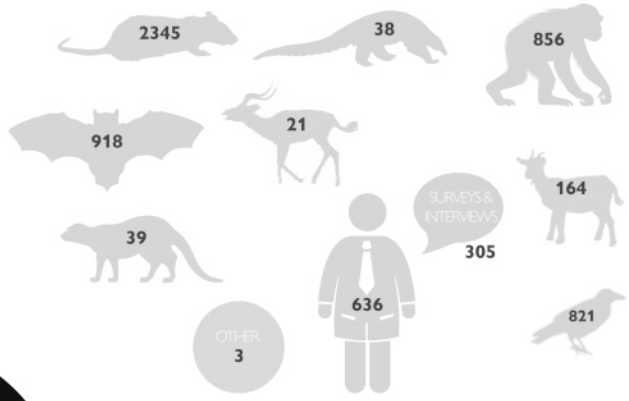
35 unique viruses detected

WORKFORCE DEVELOPMENT



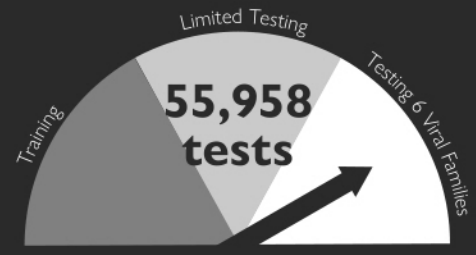
139 MALE | 85 FEMALE

ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

· Military Health Research Center



VIRAL FINDINGS

P1	P2
217 new viruses	**11** new viruses
20 known viruses	**8** PREDICT-1 viruses
	18 known viruses

Global Health Security Agenda

CAMEROON

MOHAMED MOCTAR MOUICHE MOULIOM, DVM, MPH

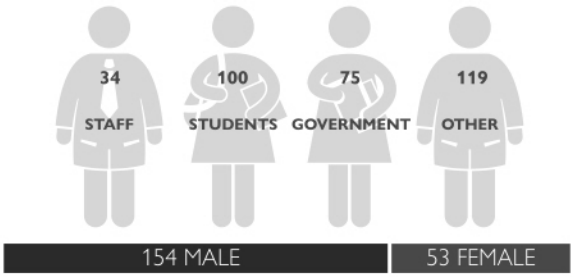
Country Coordinator, PREDICT/Cameroon

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

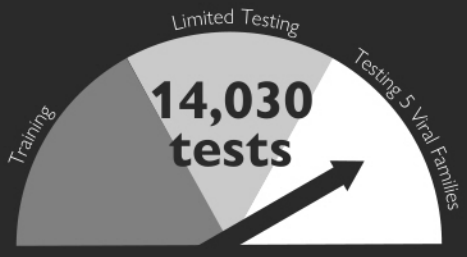
207 trained in One Health skills

1,190 individuals sampled (animals & humans)

635 individuals interviewed

LAB STRENGTHENING

- Institut Pasteur du Côte 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

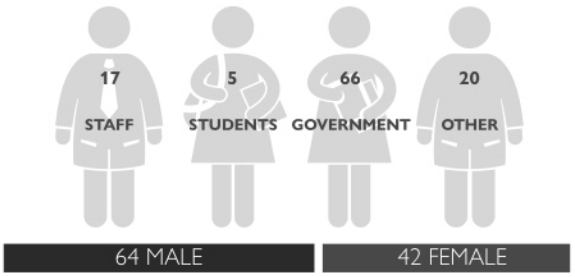
Institut Pasteur Côte d'Ivoire

PARTNERS

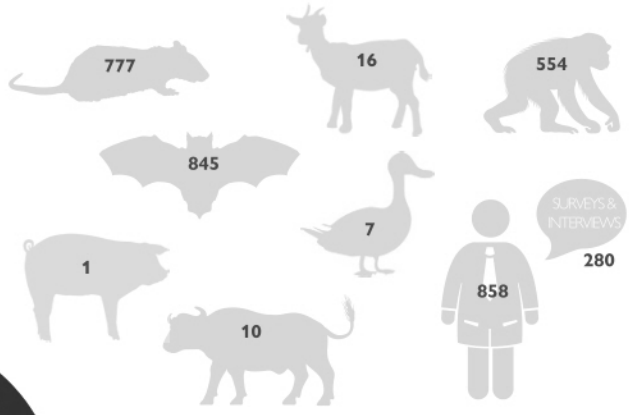
- EcoHealth Alliance
- Institut Pasteur de Côte d'Ivoire
- Laboratoire National d'Appui au Développement Agricole

"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

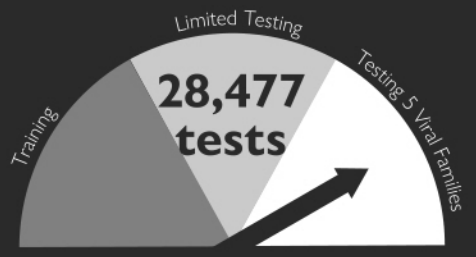
3,068 individuals sampled (animals & humans)

1,138 individuals interviewed

8 unique viruses detected

LAB STRENGTHENING

· Institut National de Recherche Biomédicale



VIRAL FINDINGS

P1	P2
49 new viruses	**1** PREDICT-1 viruses
22 known viruses	**7** known viruses

DEMOCRATIC REPUBLIC OF THE CONGO

Global Health Security Agenda

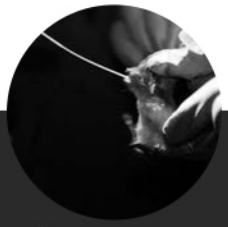
PLACIDE MBALA, MPH, PhD

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.

IMPACT

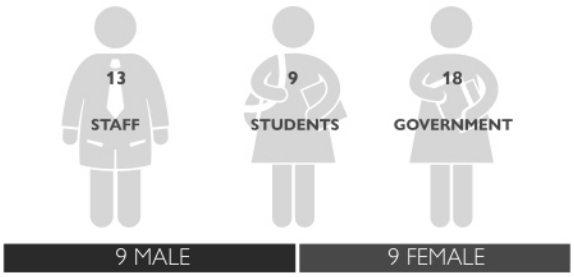
18 trained in One Health skills

2,100 individuals sampled (animals & humans)

1,097 individuals interviewed

9 unique viruses detected

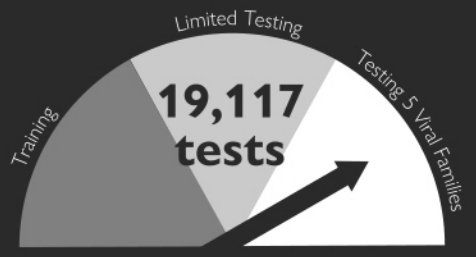
WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE

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

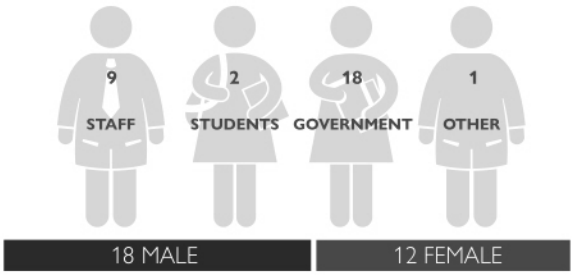
Egypt National Research Centre's Center of Scientific Excellence for Influenza Viruses

PARTNERS

- EcoHealth Alliance
- Egypt National Research Centre

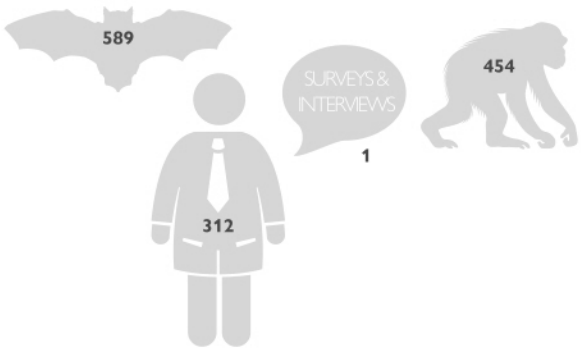
The Egypt team demonstrated how interdisciplinary backgrounds can work together toward a common goal: promoting One Health activities to better understand and respond to viral zoonotic threats in Egypt.

WORKFORCE DEVELOPMENT



18 MALE | 12 FEMALE

ONE HEALTH SURVEILLANCE



IMPACT

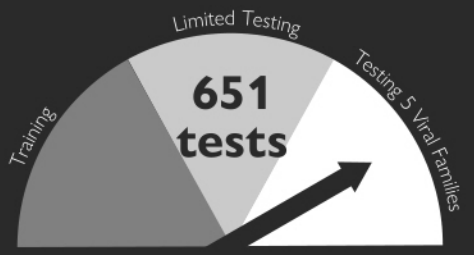
30 trained in One Health skills

1,355 individuals sampled (animals & humans)

313 individuals interviewed

LAB STRENGTHENING

- Addis Ababa University Aklilu Lemma Institute of Pathobiology



Global Health Security Agenda

ETHIOPIA

DESALEGN BELAY TAKELE

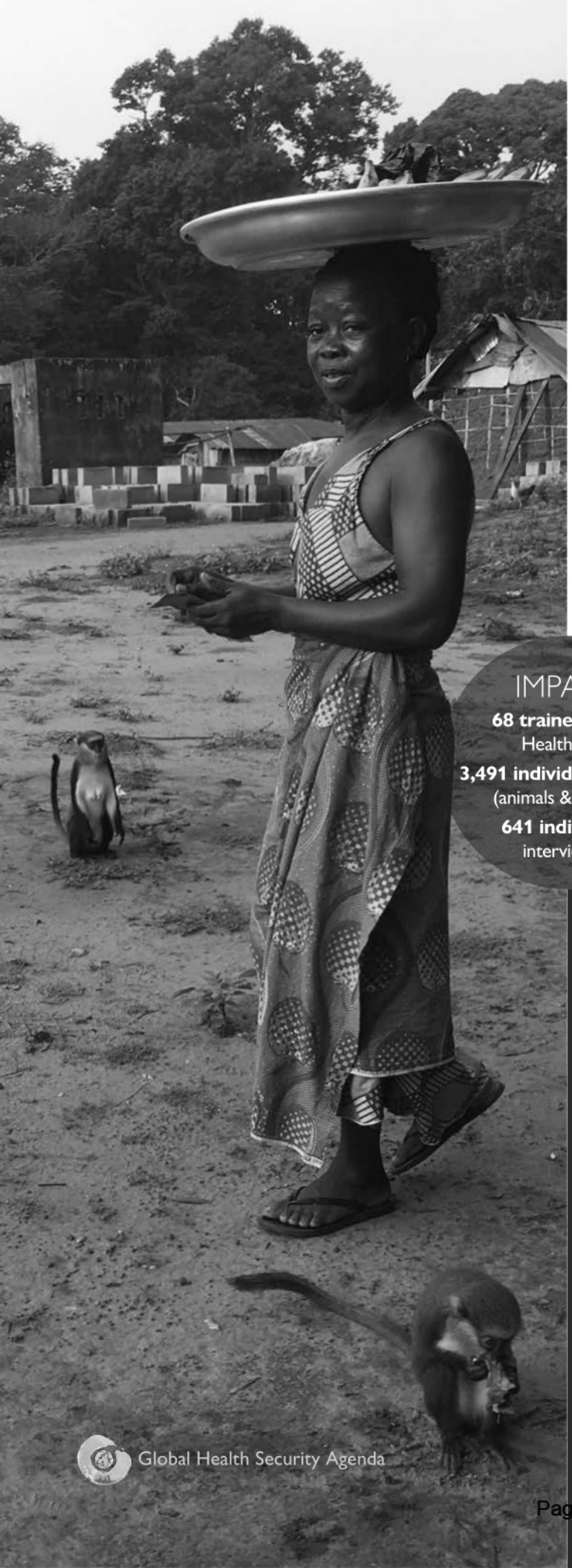
PREDICT/Ethiopia, Associate Researcher

National Influenza Laboratory, Ethiopian Public Health Institute

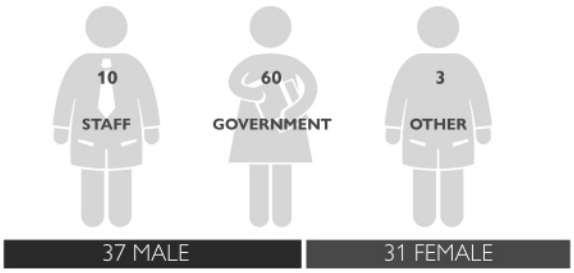
PARTNERS

- 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 international collaboration—UC Davis is a practical powerhouse of One Health."



WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE

IMPACT

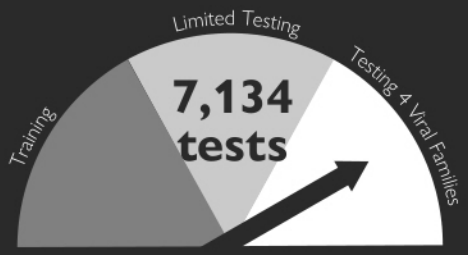
68 trained in One Health skills

3,491 individuals sampled (animals & humans)

641 individuals interviewed

LAB STRENGTHENING

- Accra Veterinary Laboratory
- Noguchi Memorial Institute for Medical Research



Global Health Security Agenda

GHANA

RICHARD SUU-IRE, DVM, PhD

PREDICT/Ghana, Wildlife Disease Surveillance Lead

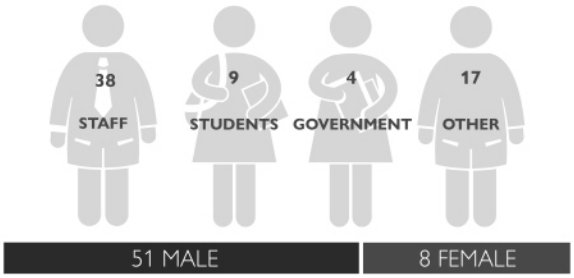
Wildlife Division of the Forestry Commission, Ministry of Land and Natural Resources

PARTNERS

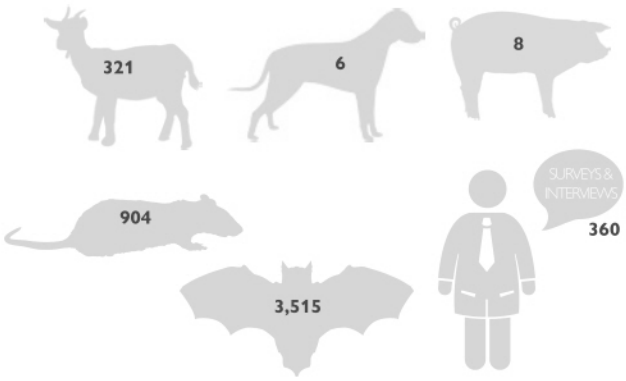
- University of California, Davis
- Wildlife Division of the Forestry Commission, Ministry of Land & Natural Resources
- Veterinary Services Directorate, Ministry of Food & Agriculture
- Noguchi Memorial Institute for Medical Research, University of Ghana
- Ghana Health Services
- Military Hospital of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

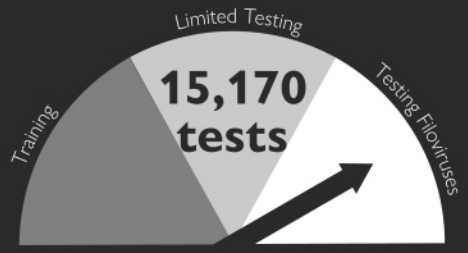
59 trained in One Health skills

4,754 individuals sampled (animals & humans)

360 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
- Laboratoire de Fievres Hemorrhagiques

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."

Global Health Security Agenda

WORKFORCE DEVELOPMENT

12 STAFF
10 STUDENTS
2 GOVERNMENT
11 OTHER

18 MALE | 7 FEMALE

ONE HEALTH SURVEILLANCE

1,080

1,084

SURVEYS & INTERVIEWS
1

IMPACT

25 trained in One Health skills

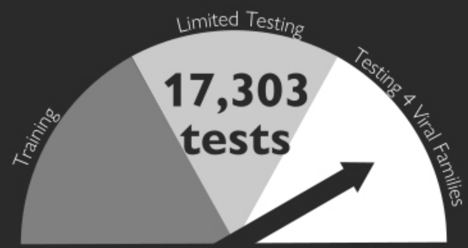
2,164 individuals sampled (animals & humans)

1,085 individuals interviewed

7 unique viruses detected

LAB STRENGTHENING

· Jordan University of Science and Technology



VIRAL FINDINGS

P2

1 new virus
1 PREDICT-1 viruses
5 known viruses

JORDAN

MUSTAFA ABABNEH

PREDICT/Jordan, Technical Laboratory Lead

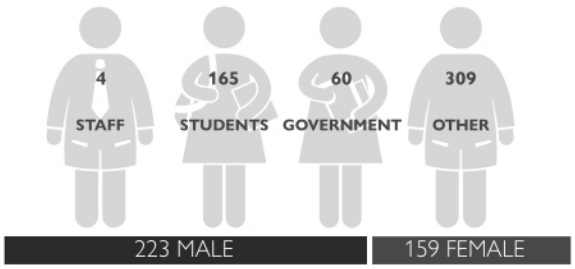
Jordan University of Science and Technology

PARTNERS

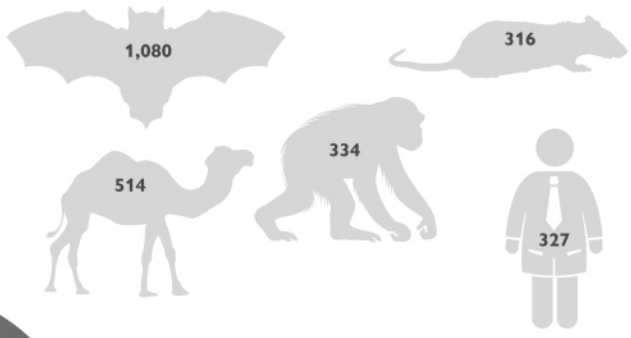
- EcoHealth Alliance
- Jordan University of Science and Technology

"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

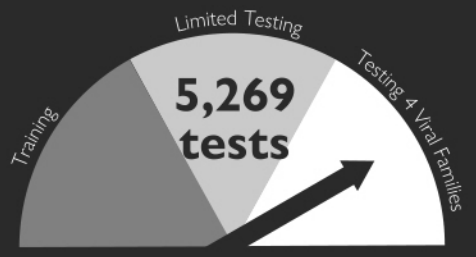
1,861 individuals sampled (animals & humans)

327 individuals interviewed

2 unique viruses detected

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

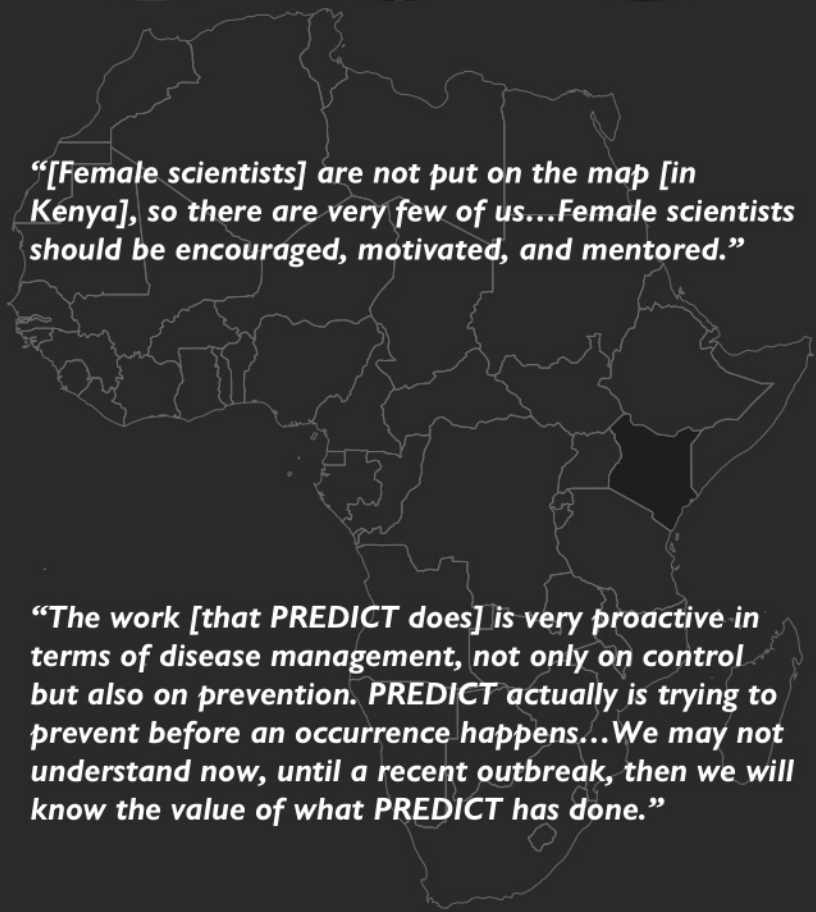
- Smithsonian Institution
- Institute of Primate Research
- Kenya Medical Research Institute

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."

IMPACT

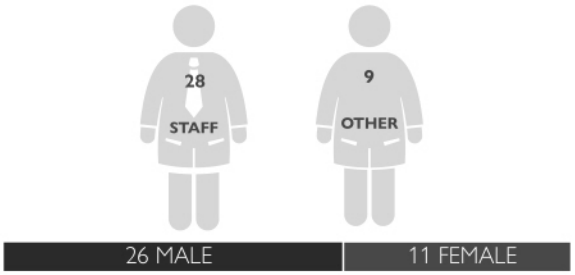
37 trained in One Health skills

5,386 individuals sampled (animals & humans)

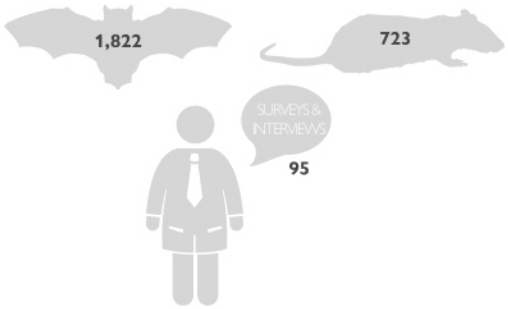
95 individuals interviewed

1 unique virus detected

WORKFORCE DEVELOPMENT

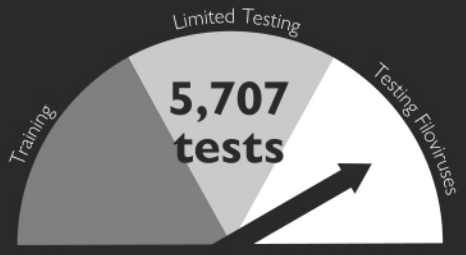


ONE HEALTH SURVEILLANCE



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.

Global Health Security Agenda

LIBERIA

JACKSON PULTOLNOR

PREDICT/Liberia, Team Lead

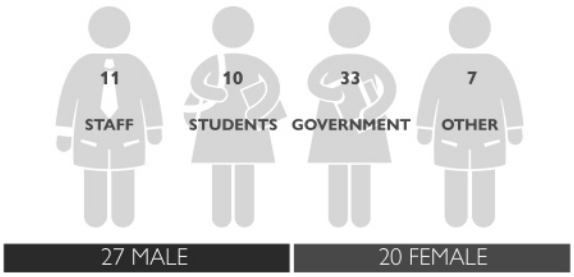
Society for the Conservation of Nature, Liberia

PARTNERS

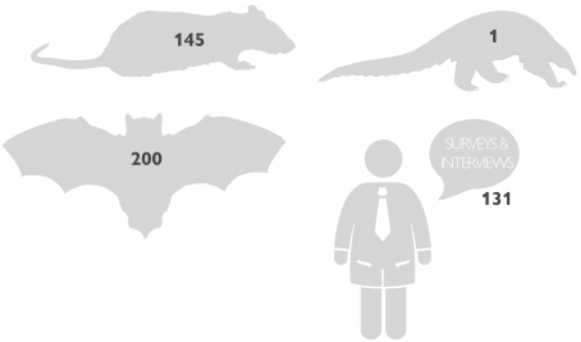
- EcoHealth Alliance
- National Public Health Institute of Liberia
- Columbia University Center for Infection & Immunity

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	P2
55 new viruses	**1** PREDICT-1 viruses
13 known 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 I saw the movie "Outbreak" about the spread of Ebola."

WORKFORCE DEVELOPMENT

ONE HEALTH SURVEILLANCE

IMPACT

20 trained in One Health skills

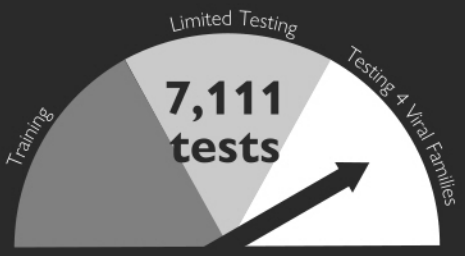
1,544 individuals sampled (animals & humans)

400 individuals interviewed

11 unique viruses detected

LAB STRENGTHENING

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



VIRAL FINDINGS

P1	P2
16 new viruses	**2** new viruses
11 known viruses	**2** PREDICT-1 viruses
	7 known viruses

Global Health Security Agenda

RWANDA

ADRIEN EMILE NTWALI

PREDICT/Rwanda, Field Veterinarian

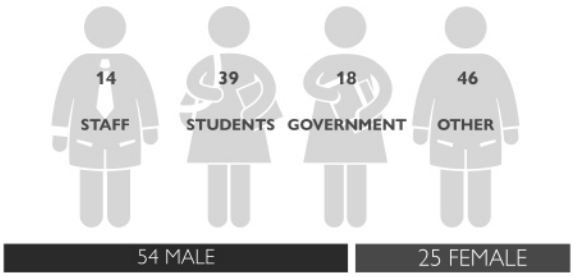
Gorilla Doctors

PARTNERS

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

"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

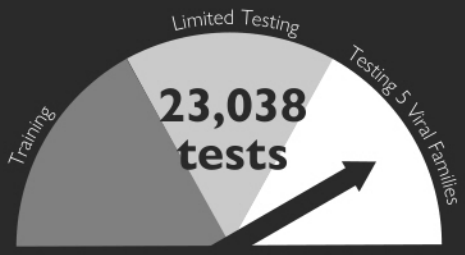
79 trained in One Health skills

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

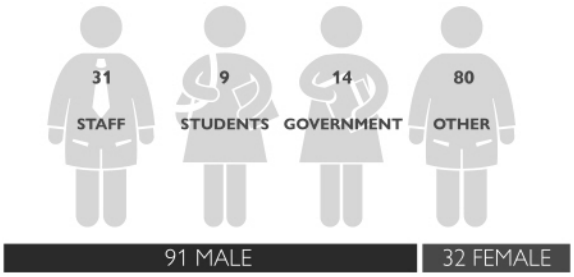
National Veterinary Laboratory

PARTNERS

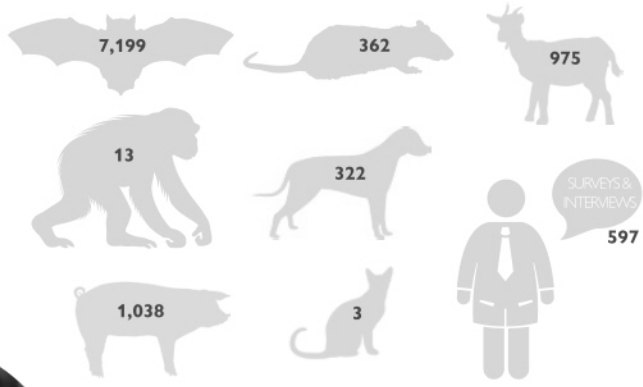
- University of California, Davis
- Inter State School of Veterinary Science & Medicine of Dakar
- Cheikh Anta Diop University/ Dantec University Hospital
- L'Institut Senegalais de Recherches Agricoles

"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

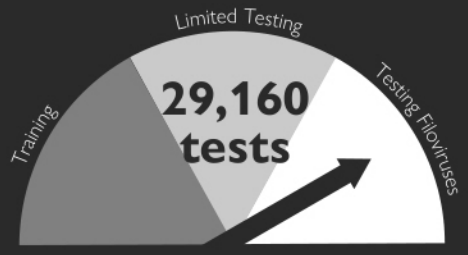
9,912 individuals sampled

597 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.

Global Health Security Agenda

SIERRA LEONE

EDWIN LAVALIE

PREDICT/Sierra Leone, Field Ecologist

University of Makeni

PARTNERS

- University of California, Davis
- University of Makeni

ABDULAI BANGURA

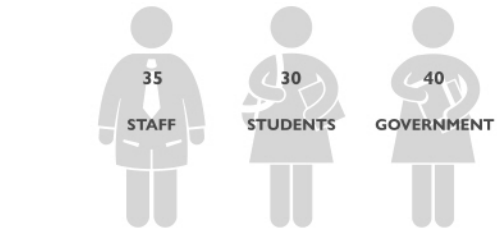
PREDICT/Sierra Leone, Field Ecologist

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."

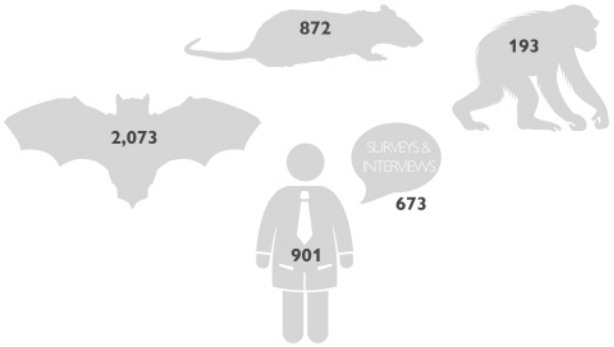
WORKFORCE DEVELOPMENT



52 MALE | 71 FEMALE

*One individual gender unknown

ONE HEALTH SURVEILLANCE



IMPACT

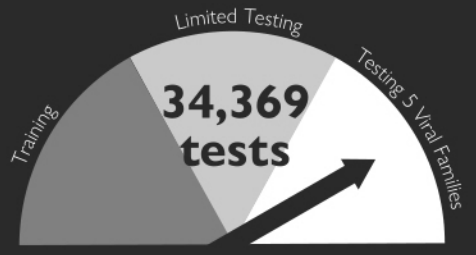
124 trained in One Health skills*

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

Global Health Security Agenda

TANZANIA

HAPPY RAPHAEL MKALI

PREDICT/Tanzania, Laboratory Lead

Ifakara Health Institute

WALTER SIMON MAGESA

PREDICT/Tanzania, Laboratory Scientist

Sokoine University of Agriculture

PARTNERS

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

"The capacity building of local experts on surveillance and detection of known and unknown pathogens of pandemic potential and the One Heath 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."

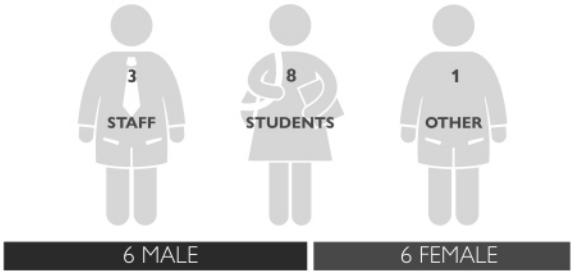
IMPACT

12 trained in One Health skills

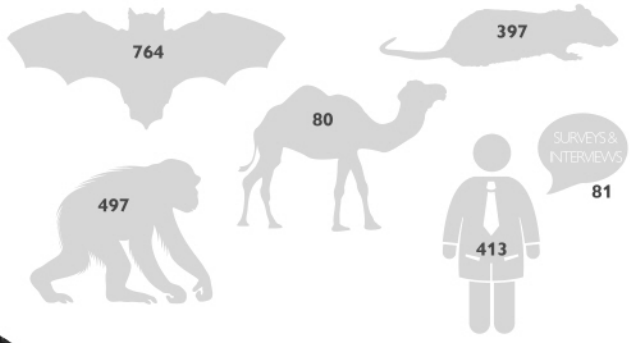
2,151 individuals sampled (animals & humans)

494 individuals interviewed

WORKFORCE DEVELOPMENT

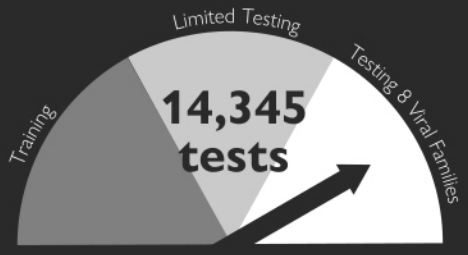


ONE HEALTH SURVEILLANCE



LAB STRENGTHENING

- Uganda Viral Research Institute
- Makerere University Walter Reed Project



VIRAL FINDINGS

P1	P2
39 new viruses	
17 known viruses	

Global Health Security Agenda

UGANDA

RICKY OKELLO OKWIR

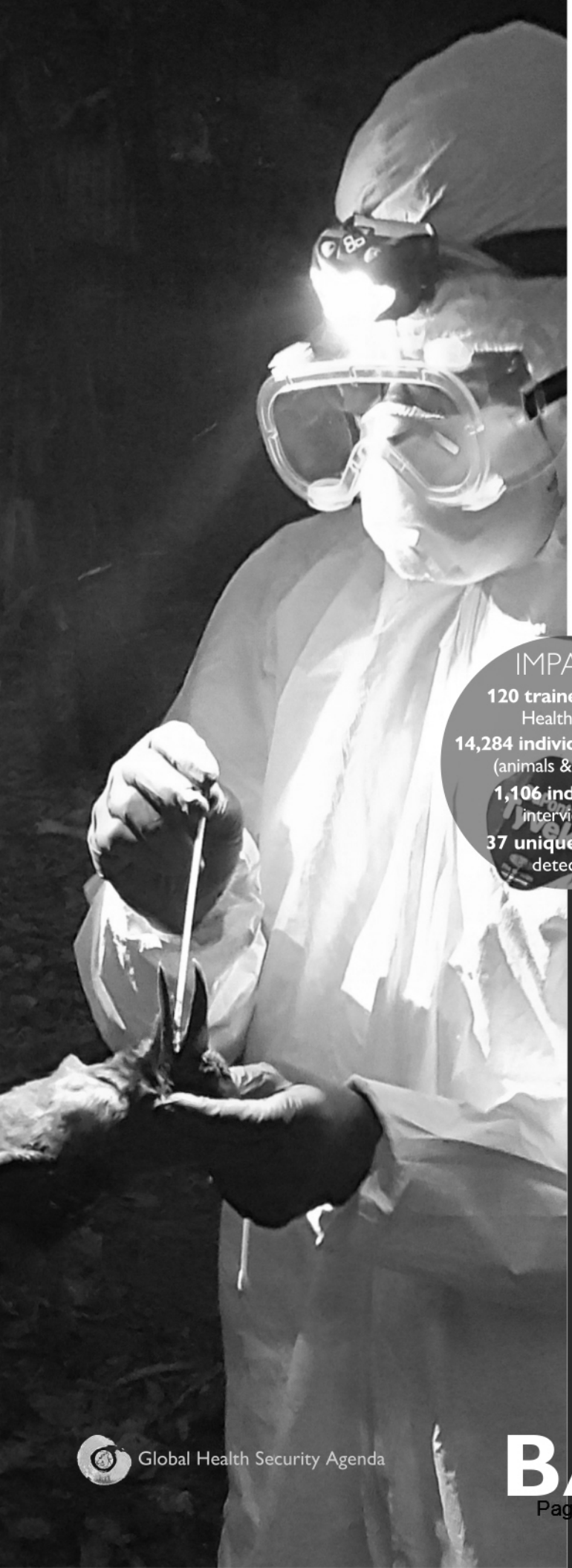
PREDICT/Uganda, Field Veterinarian

Gorilla Doctors

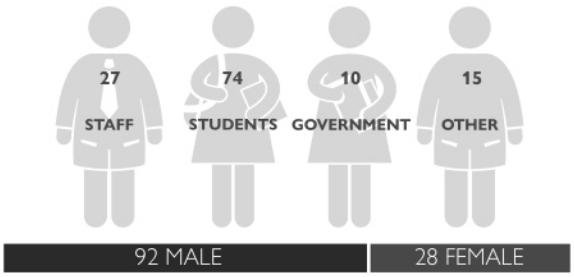
PARTNERS

- Mountain Gorilla Veterinary Project/Gorilla Doctors
- University of California, Davis
- Uganda Viral Research Institute
- Makerere University Walter Reed Project

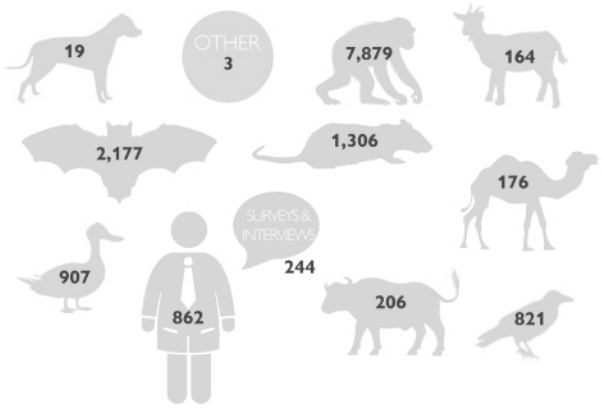
"I was compelled to enter the veterinary profession at an early age of just 10 years after suffering a traumatic incident in our remote village. I watched a mother squirrel and her baby speared by a group of hunters. I rescued the squirrels, and as a young school-going child, took care of the two squirrels 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

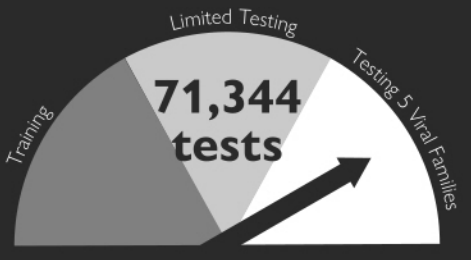
14,284 individuals sampled (animals & humans)

1,106 individuals interviewed

37 unique viruses detected

LAB STRENGTHENING

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



VIRAL FINDINGS

P1	P2
217 new viruses	**11** new viruses
20 known viruses	**8** PREDICT-1 viruses
	18 known viruses

Global Health Security Agenda

BANGLADESH

SHARIFUL ISLAM

PREDICT/Bangladesh, Field Coordinator-Epidemiology

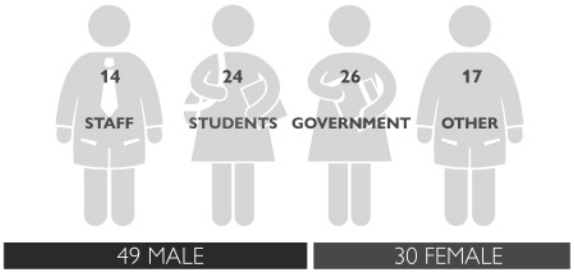
Institute of Epidemiology Disease Control & Research

PARTNERS

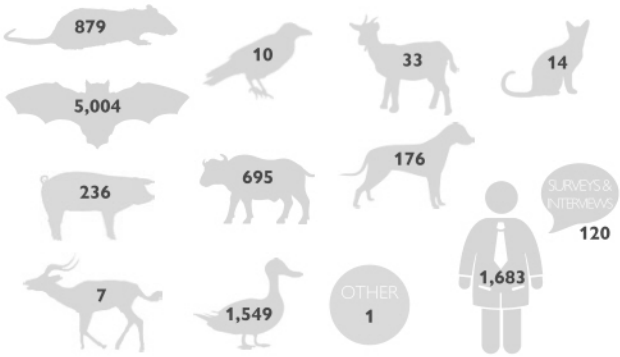
- EcoHealth Alliance
- icddr,b
- Institute of Epidemiology, Disease Control & Research
- Bangladesh Forest Department

Dr. Islam has been leading field teams with multisectoral 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

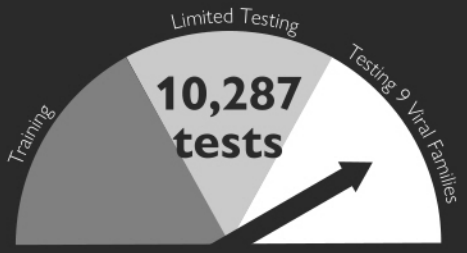
10,177 individuals sampled (animals & humans)

1,803 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

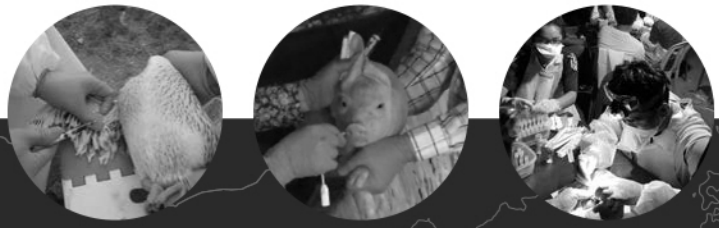
VEASNA DUONG

PREDICT/Cambodia, Country Coordinator

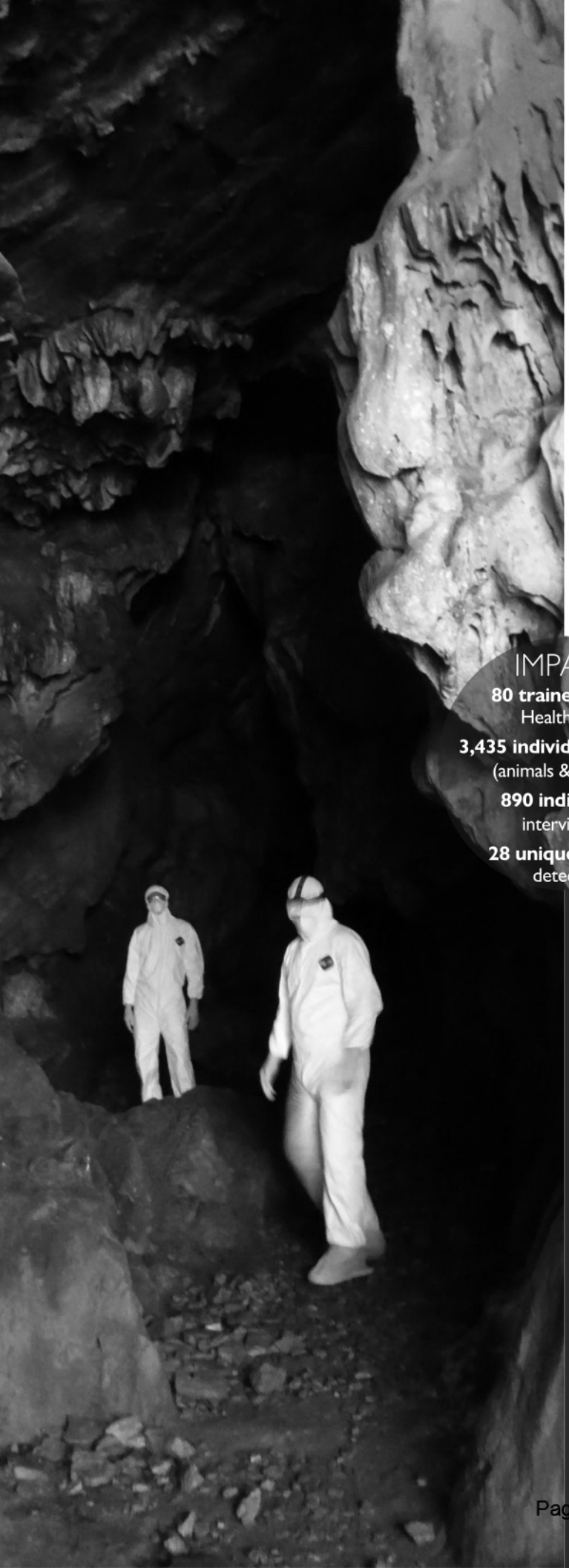
Institut Pasteur du Cambodge

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."



IMPACT

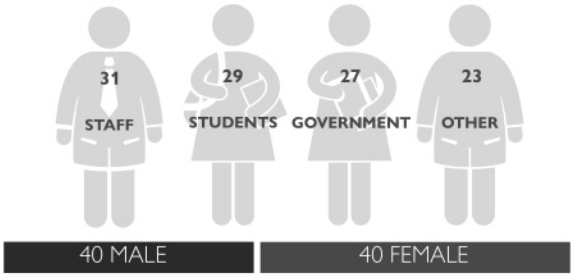
80 trained in One Health skills

3,435 individuals sampled (animals & humans)

890 individuals interviewed

28 unique viruses detected

WORKFORCE DEVELOPMENT

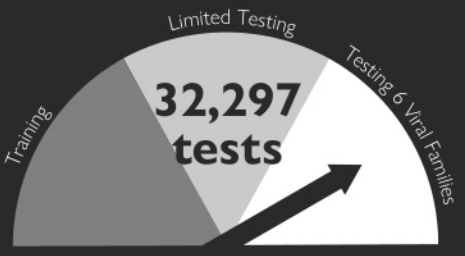


40 MALE | 40 FEMALE

ONE HEALTH SURVEILLANCE

LAB STRENGTHENING

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



VIRAL FINDINGS

P1	P2
46 new viruses	**11** new viruses
22 known viruses	**5** PREDICT-1 viruses
	12 known viruses

CHINA

GUANGJIAN ZHU, PhD

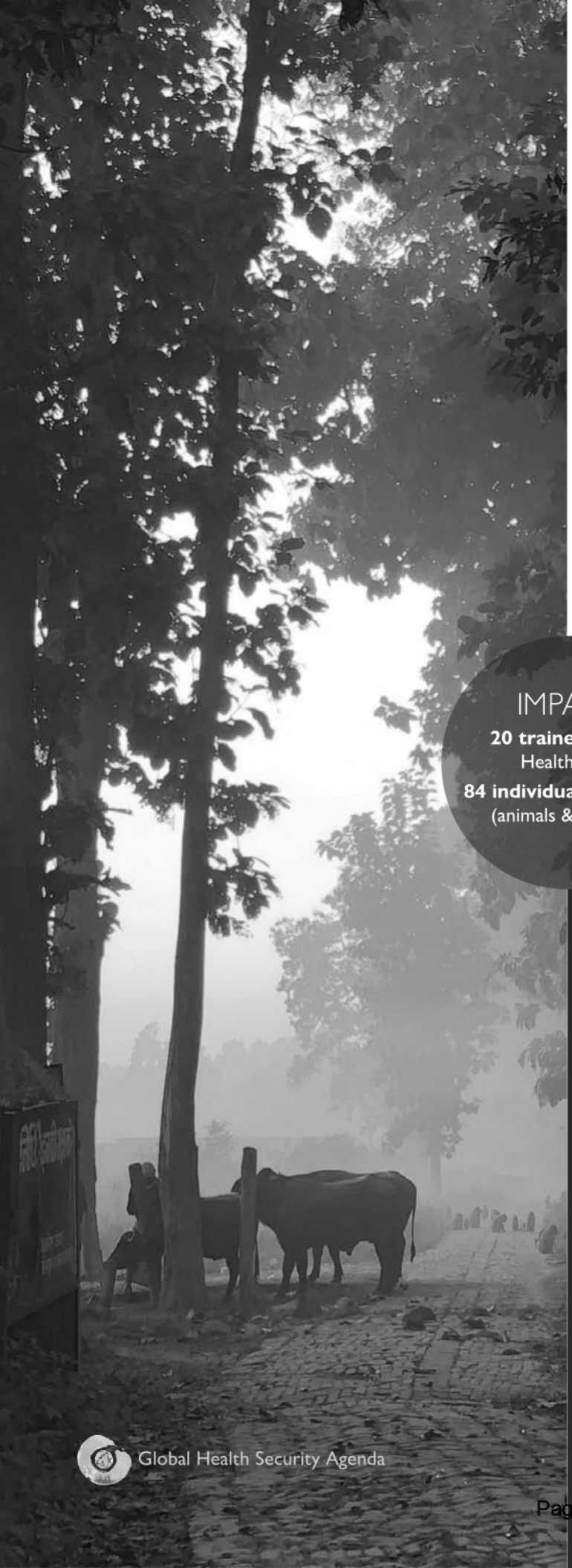
PREDICT/China, Field Coordinator

EcoHealth Alliance

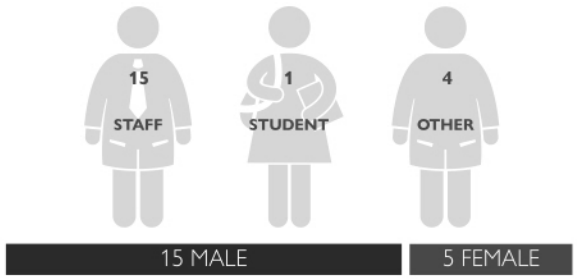
PARTNERS

- 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

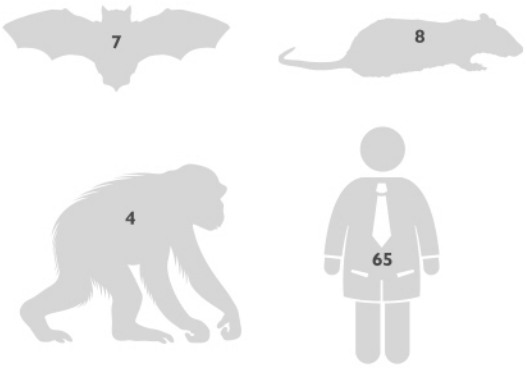
"I believe every individual who works with PREDICT is the key of its success. The greater success of PREDICT in China lies in the sharing and collaborating with the world."



WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



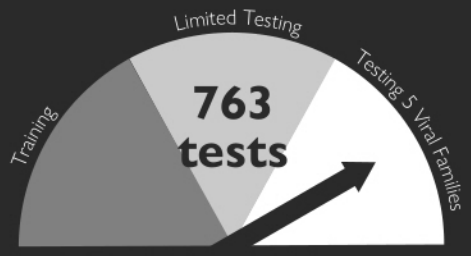
IMPACT

20 trained in One Health skills

84 individuals sampled (animals & humans)

LAB STRENGTHENING

- Sanjay Ghandi Postgraduate Institute of Medical Sciences



Global Health Security Agenda

INDIA

HARJEET SINGH MAAN

PREDICT/India, Laboratory Lead

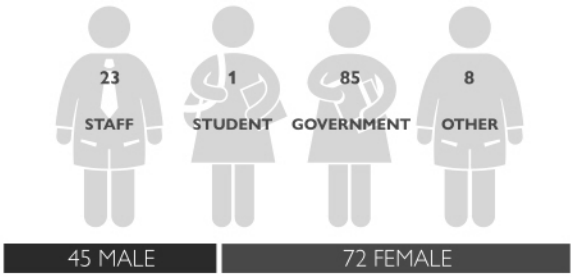
Sanjay Gandhi Postgraduate Institute of Medical Sciences

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



45 MALE | 72 FEMALE

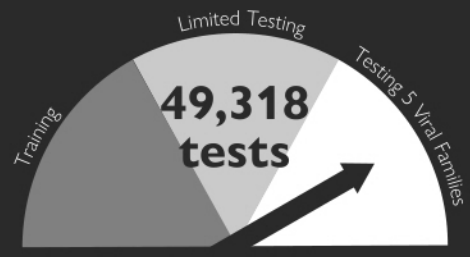
ONE HEALTH SURVEILLANCE

IMPACT

- **117 trained** in One Health skills
- **3,218 individuals** sampled (animals & humans)
- **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	P2
14 new viruses	**14** new viruses
6 known 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

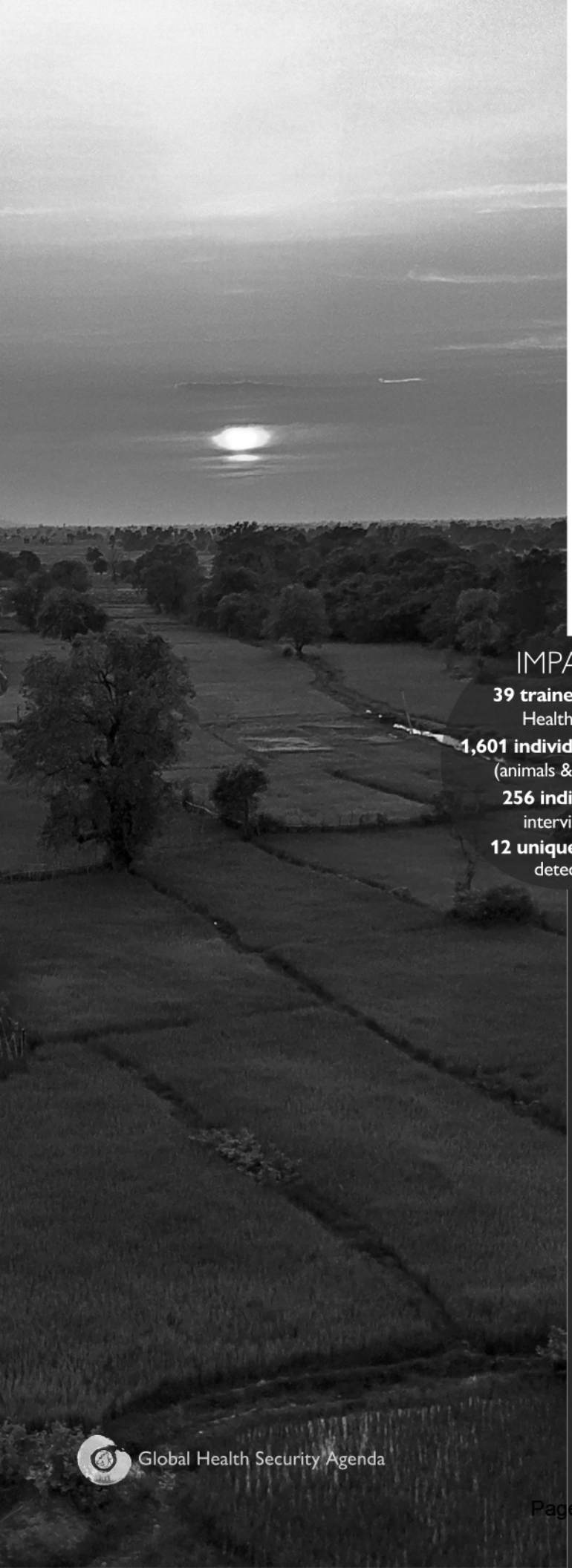
PREDICT/Indonesia, Field Coordinator

PARTNERS

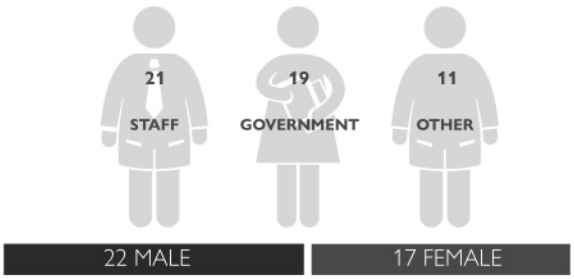
- EcoHealth Alliance
- Primate Research Center of the Institut Pertanian Bogor (Bogor Agricultural University)
- Eijkman Institute for Molecular Biology

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

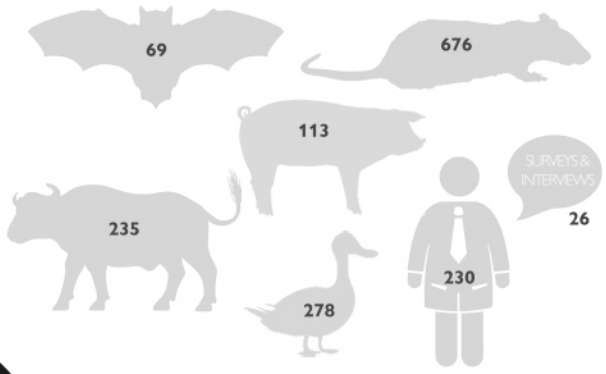
"Since I joined PREDICT/Indonesia, I've had many opportunities to improve my knowledge and skills in molecular biology and virology, especially in best practices for viral detection, surveillance, and biosecurity. I hope this knowledge and my ability to share it will increase and strengthen the capacity 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

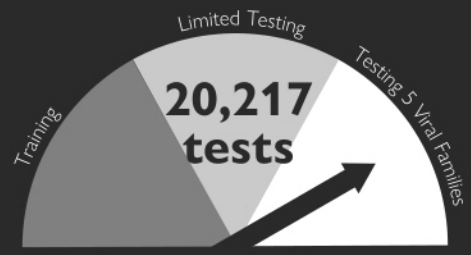
1,601 individuals sampled (animals & humans)

256 individuals interviewed

12 unique viruses detected

LAB STRENGTHENING

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



VIRAL FINDINGS

P1	P2
16 new viruses	**5** known viruses
5 known viruses	**2** new viruses

Global Health Security Agenda

LAO PDR

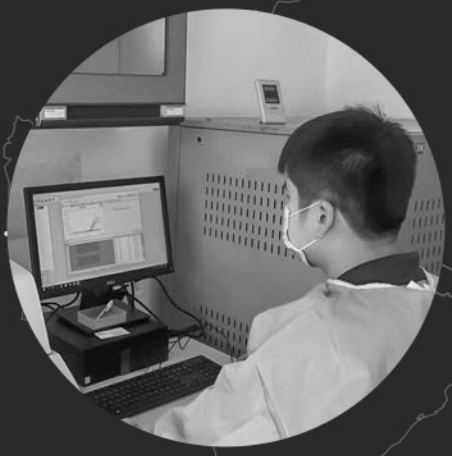
SINAKHONE XAYADETH

PREDICT/Lao PDR, Laboratory Technician

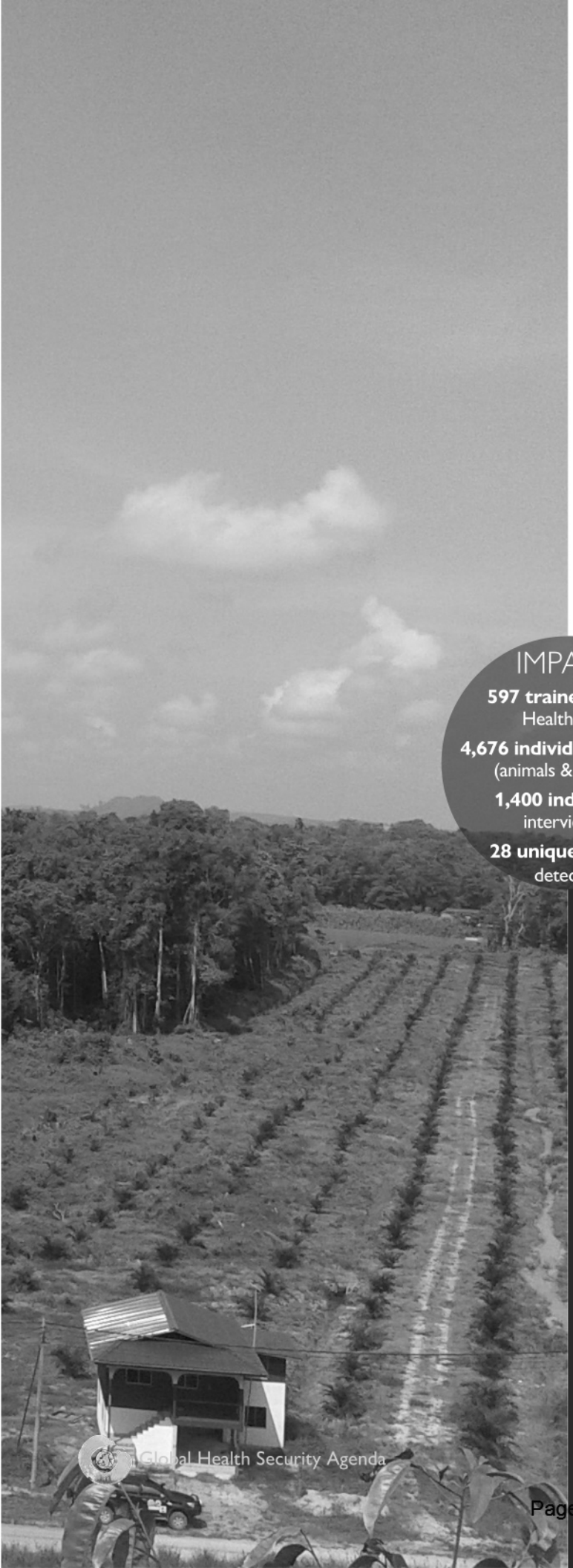
National Center for Laboratory & Epidemiology

PARTNERS

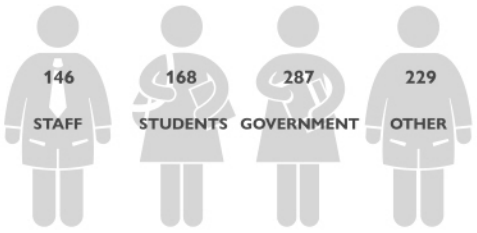
- Metabiota, Inc.
- National Animal Health Laboratory
- National Center for Laboratory & Epidemiology



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.

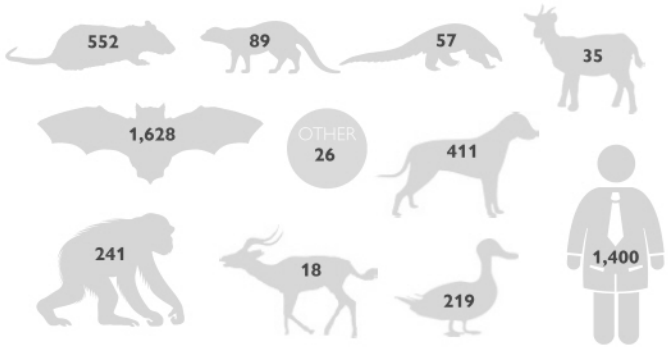


WORKFORCE DEVELOPMENT



343 MALE | 280 FEMALE

ONE HEALTH SURVEILLANCE



IMPACT

597 trained in One Health skills

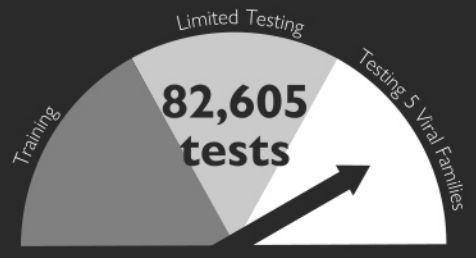
4,676 individuals sampled (animals & humans)

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	P2
57 new viruses	**17** new viruses
19 known viruses	**3** PREDICT-1 viruses
	8 known viruses

Global Health Security Agenda

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, Genetic & Forensic Laboratory
- Danau Girang Field Centre
- University Malaysia Sabah
- Sabah State Health Department
- Queen Elizabeth Hospital

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.

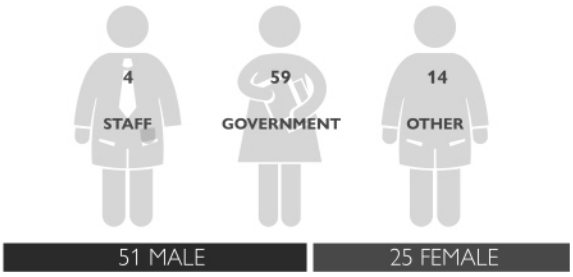
IMPACT

76 trained in One Health skills

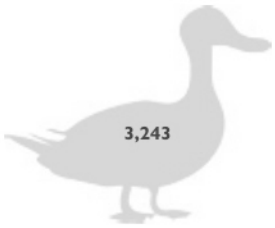
3,243 animals sampled

1 unique virus detected

WORKFORCE DEVELOPMENT

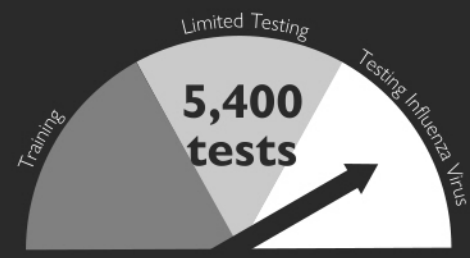


ONE HEALTH SURVEILLANCE



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

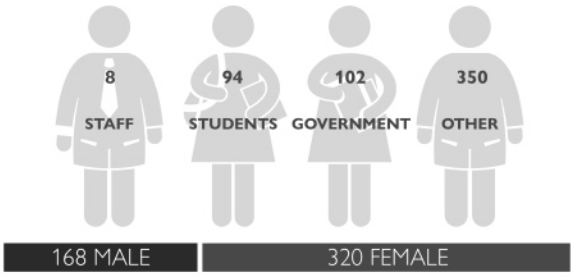
PREDICT/Mongolia, Avian Specialist

Wildlife Conservation Society

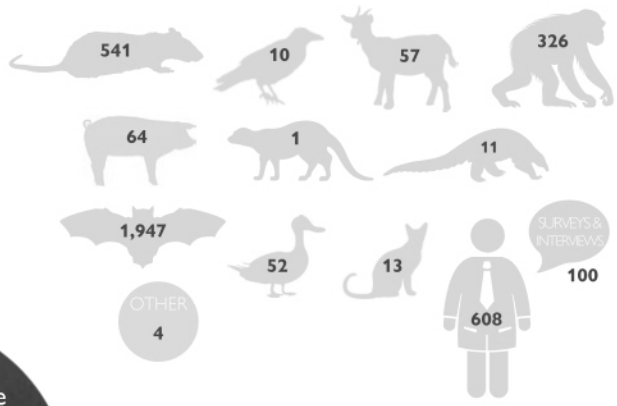
"Through the PREDICT project, I have got a lot of field experience and wildlife disease knowledge, including bird survey organizations, sample collection, bird necropsy and teamwork. I hope to expand my knowledge by continuing to learn new skills that will enhance my capabilities to use the One Health approach. "

"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

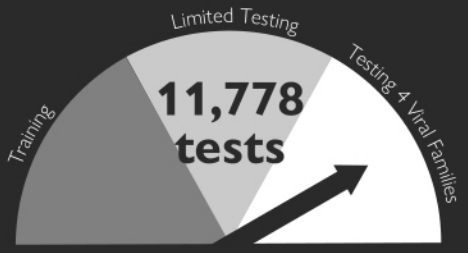
3,611 individuals sampled (animals & humans)

708 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

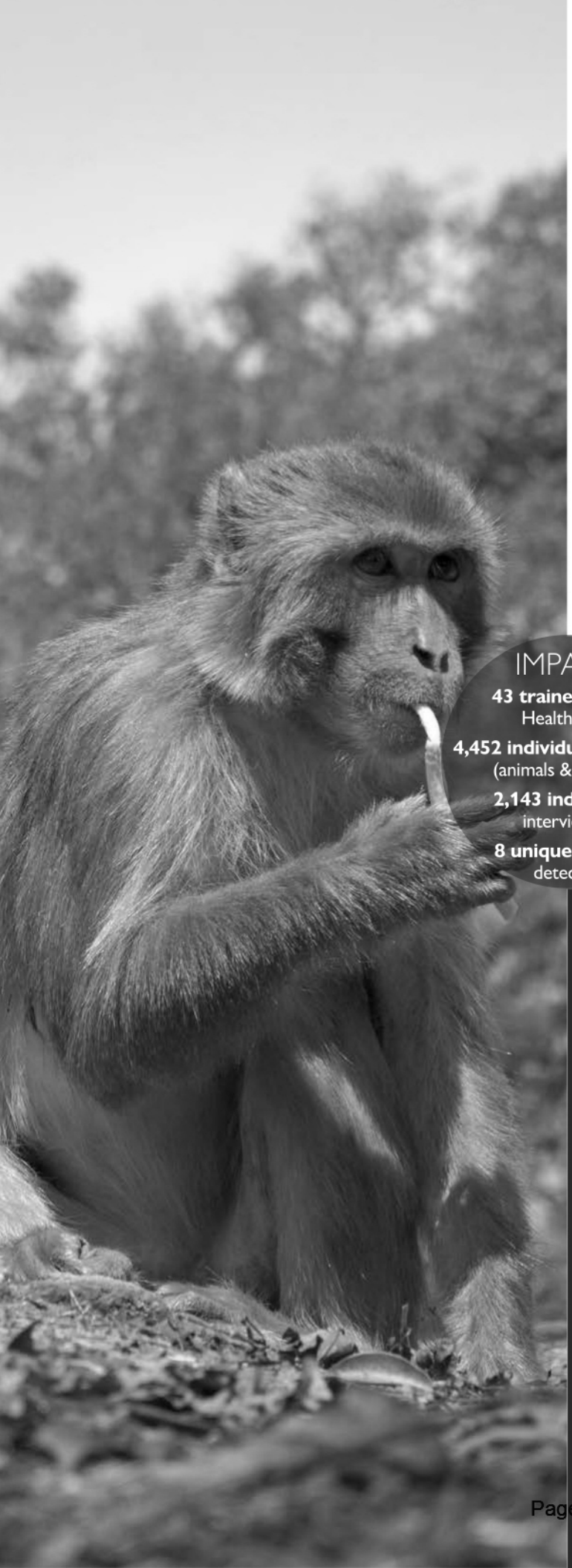
PREDICT/Myanmar, Country Coordinator

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.



IMPACT

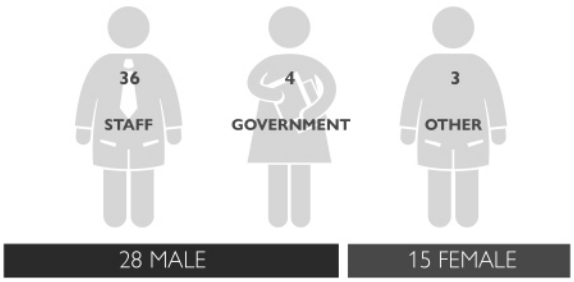
43 trained in One Health skills

4,452 individuals sampled (animals & humans)

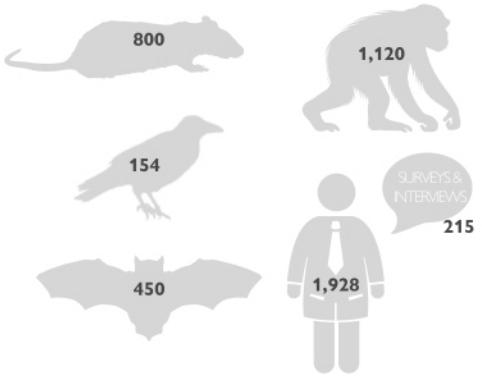
2,143 individuals interviewed

8 unique viruses detected

WORKFORCE DEVELOPMENT

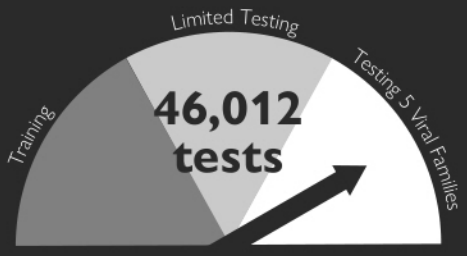


ONE HEALTH SURVEILLANCE



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

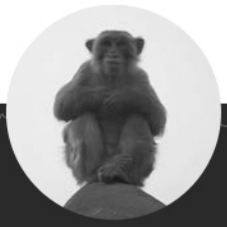
DIBESH KARMACHARYA, PhD

PREDICT/Nepal, Country Coordinator

Center for Molecular Dynamics Nepal

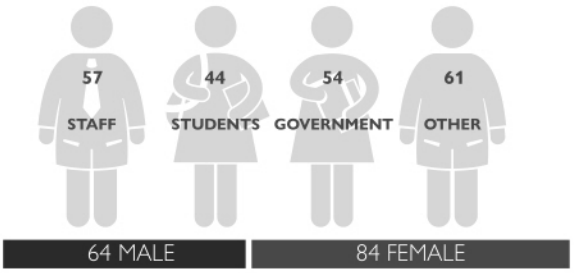
PARTNERS

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

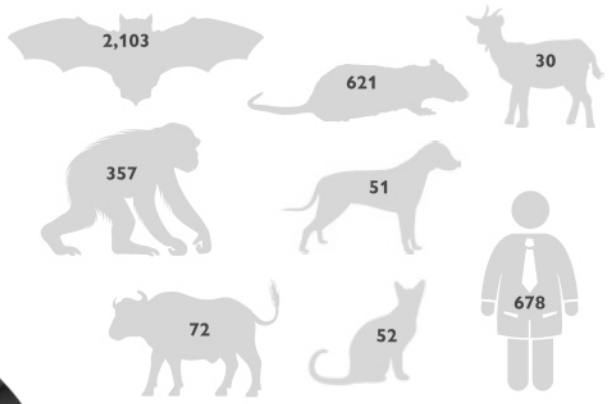


"PREDICT has helped in building capacity for emerging disease detection and characterization in Nepal, greatly enhancing country's surveillance capabilities."

WORKFORCE DEVELOPMENT



ONE HEALTH SURVEILLANCE



IMPACT

148 trained in One Health skills

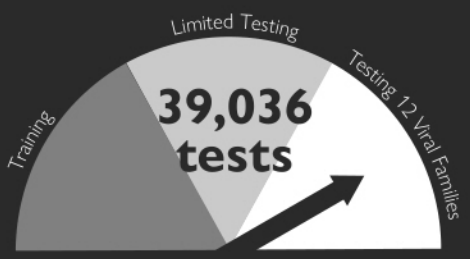
3,964 individuals sampled (animals & humans)

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

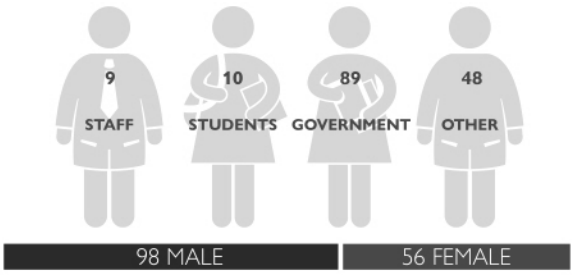
PARTNERS

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

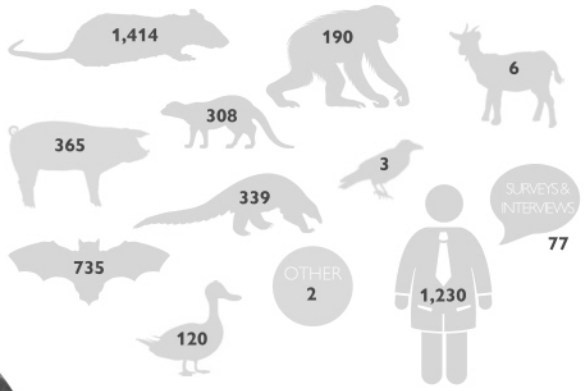
"I was awarded a PREDICT Modeling & Analytics Fellowship to work with the team at EcoHealth Alliance in New York City. The fellowship helped me to expand my work to evaluate habitat suitability and Nipah Virus Risk of Lyle's Flying Fox in Thailand. The methods and techniques I learned as part of PREDICT 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

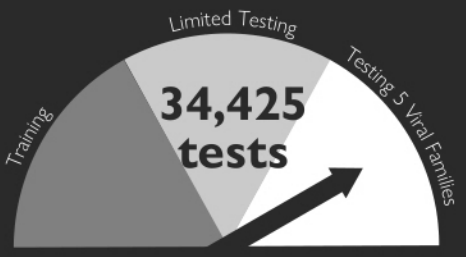
4,712 individuals sampled (animals & humans)

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	P2
23 new viruses	**2** new viruses
7 known viruses	**1** PREDICT-1 virus
	6 known viruses

Global Health Security Agenda

VIET NAM

NGUYEN THI THANH NGA

PREDICT/Viet Nam, Country Coordinator

Wildlife Conservation Society

NGUYEN DUC THINH

PREDICT/Viet Nam, Laboratory Technician

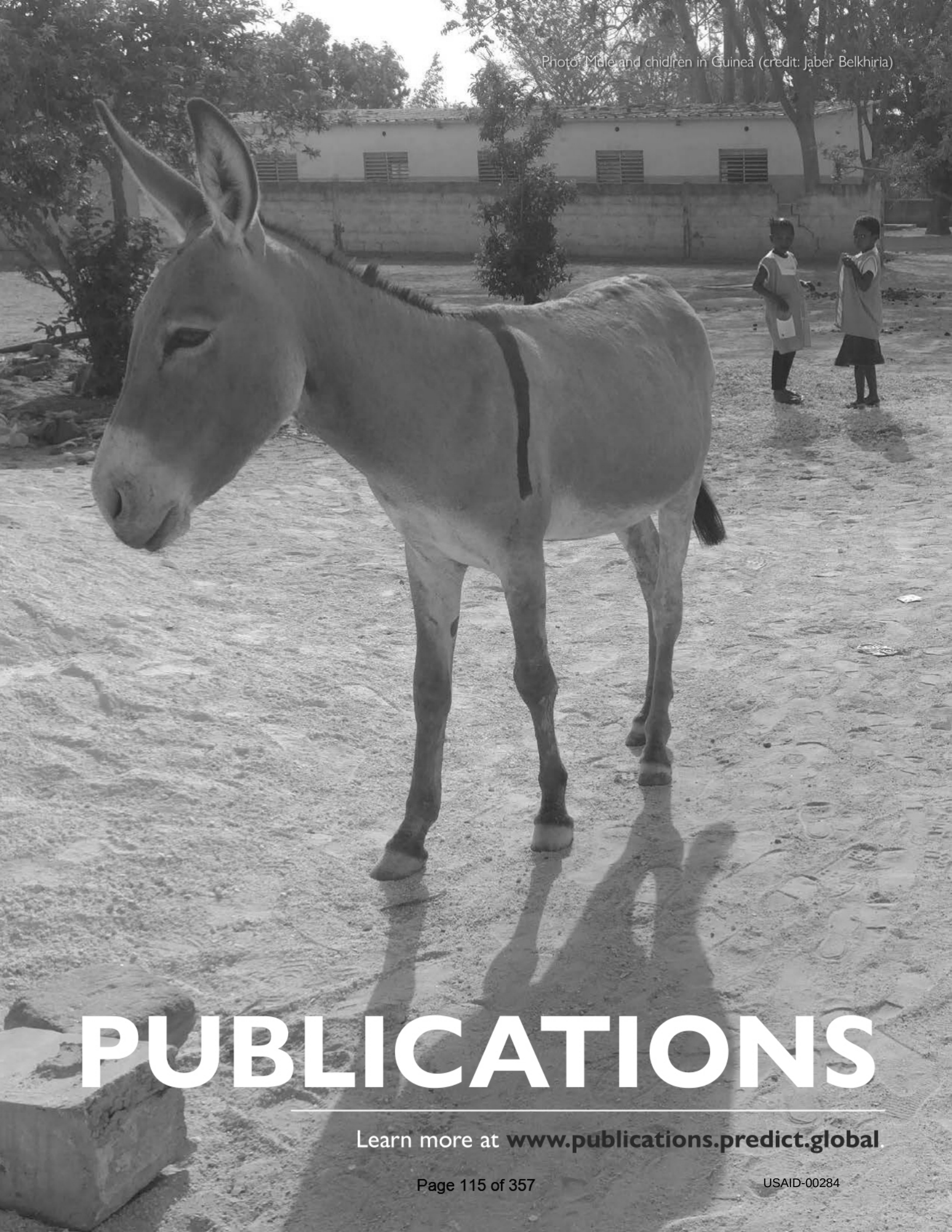
Viet Nam National University of Agriculture

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."



PUBLICATIONS

Learn more at **www.publications.predict.global**.

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USAID
FROM THE AMERICAN PEOPLE

UCDAVIS
VETERINARY MEDICINE

WCS

EcoHealth
Alliance

METABIOTA™

Smithsonian
Institution

From: (b)(6)
Sent: Thu, 22 Dec 2016 18:29:13 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Requests

Yikes... Ok keep me posted and let me know if you need anything

Sent from my iPhone

On Dec 22, 2016, at 1:28 PM, (b)(6) @usaid.gov> wrote:

Okay, I'm at the (b)(6). I'll keep you posted.

I responded to (b)(6) message and sent the concurrence email out.

Best,

On Thu, Dec 22, 2016 at 1:25 PM (b)(6) @usaid.gov> wrote:
Disregard my previous email ...

Sent from my iPhone

On Dec 22, 2016, at 1:24 PM, (b)(6) @usaid.gov> wrote:

Hello teams Uganda, DRC,

the following travel approval requests has come in from PREDICT. We appreciate your concurrence and welcome any questions you may have.

Team Rwanda, this is just a notification. There is no action requested.

> 4. UC Davis would like to request travel approval for (b)(6) to travel from Baltimore, MD, USA to Kigali, Rwanda and Uganda and DRC from December 29, 2016-March 2, 2017 to meet with PREDICT staff and partners.

Trip purpose: *This trip will enable* (b)(6) *to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat.* (b)(6) *will again be visiting each country to oversee the coordination with FAO and the human surveillance and wildlife sampling as we ramp up for a year of intense sample collection.* (b)(6) *will be aiding* (b)(6) *to capture and sample bats in the Bukima Caves, as well as sample and transfer baboons from Rumangabo.* (b)(6) *will be traveling to Lwiro sanctuary to help collect samples from the chimps and other primates at the facility, as well as personnel. In Uganda,* (b)(6) *will aid* (b)(6) *with project sampling and working with staff to start making virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the*

internet bases histopathology program. In Rwanda, (b)(6) will be following up on a bat die off that still remains a mystery after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.

---------- Forwarded message ---------
From: (b)(6) @ucdavis.edu>
Date: Fri, Dec 16, 2016 at 1:33 PM
Subject: RE: PREDICT International Travel Requests
To: (b)(6) @usaid.gov>
Cc: (b)(6) @usaid.gov>, (b)(6) (GH/HIDN) <(b)(6) @usaid.gov>, (b)(6) @usaid.gov>, (b)(6) <(b)(6) @ucdavis.edu>, (b)(6) @ucdavis.edu>, (b)(6) <(b)(6) @ucdavis.edu>

Thanks, (b)(6) I'll let Metabiota know. The ITA for (b)(6) will be revised to include only RoC and resubmitted.

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(b)(6) (cell)

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

Sent: Friday, December 16, 2016 10:06 AM

To: (b)(6)

Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)

Subject: Re: PREDICT International Travel Requests

Just to be safe, don't plan on DRC for this trip. If however, we get an indication sometime soon that things are back to normal travel-wise AND there is still time to add back DRC as part of the ROC visit, we can try for an expedited

approval.

(b)(6)

(b)(6)

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

Mobile phone: (b)(6)

Email: (b)(6) *@usaid.gov*

On Dec 15, 2016, at 11:24 PM, (b)(6) @ucdavis.edu> wrote:

Thanks, (b)(6) Metabiota is carefully monitoring the political situation in DRC and will not send (b)(6) there if there are safety concerns. Ideally they want

(b)(6) to scope out the sites, but if DRC travel is not allowed then, yes, key people can meet with (b)(6) in Brazzaville. The intelligence from the Metabiota team in-country is that they expect the political

upheaval to be short lived, but if you think it is prudent

for MB to remove DRC travel from (b)(6) itinerary completely, they will revise the ITA and submit ITA's for key people to meet with (b)(6) in Brazzaville instead. Please advise.

Thanks!

(b)(6)

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(b)(6) (cell)

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

Sent: Thursday, December 15, 2016 1:58 PM

To: (b)(6)

Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)

Subject: Re: PREDICT International Travel Requests

Thanks, (b)(6)

All travel to Pacifica meeting approved.

All other travel (except DRC/(b)(6)) approved subject to mission concurrence.

DRC/(b)(6) travel to be reevaluated after further consultation.

(b)(6)

(b)(6)

(b)(6)

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

Mobile phone: (b)(6)

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

On Dec 15, 2016, at 10:26 PM, (b)(6) @ucdavis.edu> wrote:

Hi (b)(6) You are correct. (b)(6) is a recent addition to the External Advisory Panel, so we would be attending the meeting in an advisory capacity.

I'll touch base with Metabiota regarding the DRC portion of (b)(6) trip and follow up with you when I know more.

Thanks!

(b)(6)

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(b)(6) (cell)

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

Sent: Thursday, December 15, 2016 3:59 AM

To: (b)(6)

Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)

Subject: Re: PREDICT International Travel Requests

Hi (b)(6)

Can you provide more information on the proposed role of (b)(6) in the Predict semi-annual meeting? Is (b)(6) like (b)(6) part of the advisory group?

For the proposed (b)(6) travel to DRC in January, it may not be possible. As you know there was a travel warning issued last week and those usually get updated every month. So we may not know for a while if the travel situation stays the

same (i.e. no travel) or goes back to normal. Is it possible to postpone the DRC part or would it be possible to have key people from Kinshasa come over to Brazzaville to meet with (b)(6)? That would allow for at least discussing the surveillance strategy,

but visiting surveillance sites would obviously not be possible.

Thanks!

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Please find below international travel requests for your review and approval. Please note that #4 for (b)(6) *is a late submission necessitated by staffing changes in*

Rwanda. Please let me know if you have any questions. Thanks!!

1.

Multiple – PREDICT Semi-Annual Meeting (USA): airfare varies (see below)/$268 (Pacifica) max daily per diem

2.

(b)(6) (Sierra Leone, Guinea): $2,473 airfare/ $282 (Freetown), $327 (Conakry) max daily per diems

3.

(b)(6) (Cambodia): $3,000 airfare/$236 (Phnom Penh) max daily per diem

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(b)(6) (RoC, DRC): $1,202 airfare/$302 (Brazzaville), $394 (Kinshasa) max daily per diems

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(b)(6) (Cote d'Ivoire): $857 airfare/$327 (Abidjan) max daily per diem

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(b)(6) (Cote d'Ivoire): $1,117 airfare/$327 (Abidjan) max daily per diem

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(b)(6) (Cote d'Ivoire, Sierra Leone, Guinea): $1,695 airfare/$327 (Abidjan), $282 (Freetown), $327 (Conakry) max daily per diems

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(b)(6) (China): $1,522 airfare/$407 (Guangzhou), $377 (Beijing), $268 (Guilin), $241 (Kunming) max daily per diems

Travel Requests:

1.

UC Davis would like to request travel approval for

the individuals listed below to travel from **their respective departure locations (listed below)** to

Pacifica, California, USA from January 9-12, 2017 to attend the PREDICT-2 Semi-Annual Consortium meeting from January 10-11, 2017.

Trip purpose: All travelers will be attending the Semi-Annual

Consortium Meeting in Pacifica, California. In support of Global Health Security Agenda, this meeting will provide participants an opportunity to discuss work plans, budgets, and strategies for implementation of Year 3 activities with project partners. Max

daily per diem for Pacifica is $268.

Traveler Name	Departure Location	Airfare Cost
(b)(6)	Manchester, England	$1,700
(b)(6)	Nanaimo, British Colombia, Canada	$888

(b)(6)	Nanaimo, British Columbia, Canada	$888
(b)(6)	Rome, Italy	$2,400
(b)(6)	Perth, Australia	$4,000

(b)(6) *will initiate* (b)(6) *travel for this trip in Manchester, England, due to pre-existing person travel plans. After the meeting,* (b)(6) *will return from San Francisco, California,*

USA to (b)(6) *home base in Hanoi, Vietnam.*

2.

Metabiota would like to request travel approval for (b)(6) for Metabiota, to travel from

Nuremberg, Germany to Freetown, Sierra Leone from January 10-20, 2017, then from

Freetown, Sierra Leone, to Conakry, Guinea from January 20-28, 2017 to

train field staff in bat capture and identification for implementation of project activities.

Trip purpose:

Sierra Leone and Guinea - (b)(6) will provide training for field staff on bat capture and identification. Training will include field and classroom activities, and discussion of challenges and best practices. Field training activities will coincide

with regular sampling trips for year 3.

3.

UC Davis would like to request approval for

(b)(6) to travel from Davis, California, USA to Phnom Penh, Cambodia from January 12-21, 2017 to join the PREDICT/Cambodia team in field and lab activities and document our

work for communications and reports.

Trip Purpose: [redacted] will travel to

Cambodia to meet [redacted] and the PREDICT-2 team in Cambodia and to document the team's One Health approach to zoonotic disease surveillance, including a planned concurrent sampling event targeting human, livestock, and wildlife at the rodent trade

hub in Kandal, on the Vietnam border (the project's first official concurrent surveillance event). A professional [redacted] is donating [redacted] services to the project, though PREDICT will cover all [redacted] travel expenses.

4.

UC Davis would like to request travel approval for [redacted] to travel from

Baltimore, MD, USA to Kigali, Rwanda and Uganda and DRC from December 29, 2016-March 2, 2017 to

meet with PREDICT staff and partners.

Trip purpose:

This trip will enable [redacted] to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat. [redacted] will again be visiting

each country to oversee the coordination with FAO and the human surveillance and wildlife sampling as we ramp up for a year of intense sample collection. [redacted] will be aiding [redacted] to capture and sample bats in the Bukima Caves, as well as sample and transfer

baboons from Rumangabo. [redacted] will be traveling to Lwiro sanctuary to help collect samples from

the chimps and other primates at the facility, as well as personnel. In Uganda, (b)(6) *will aid* (b)(6) *with project sampling and working with staff to start making*

virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the internet bases histopathology program. In Rwanda, (b)(6) *will be following up on a bat die off that still remains a mystery*

after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.

5.

Metabiota would like to request travel approval for (b)(6), to travel from

Cape Town, South Africa to Brazzaville, Republic of Congo from January 8-11, 2017 to

review human surveillance strategy with the in-country team and implement a plan for animal surveillance. From

Brazzaville, Republic of Congo, (b)(6) will travel to Kinshasa, Democratic Republic of Congo

from January 11-13, 2017 to

review human surveillance strategy with the in-country team and visit field surveillance sites.

Trip purpose:

Republic of Congo - On December 12, 2016, the in-country team in Brazzaville, Republic of Congo, submitted

the human surveillance protocol to the in-country

ethics committee for final review. In order to begin human behavioral surveillance, and evaluate capacity for human syndromic surveillance, (b)(6) will work with the behavioral team on beginning human surveillance in bush meat markets and implement a

plan for concurrent animal surveillance. The team will also visit a proposed human syndromic surveillance site in Brazzaville, to assess capacity and identify collaborating staff.

DRC - (b)(6) will work closely with the in-country team to evaluate and revise the human and animal surveillance strategy, and visit human syndromic surveillance sites.

6.

Metabiota would like to request travel approval for (b)(6), to travel from

Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to

conduct human surveillance training and laboratory training.

Trip purpose:

On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and

laboratory testing, (b)(6), and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT

laboratory procedures with identified staff.

7.

Metabiota would like to request travel approval for (b)(6) to travel from

Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to

conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol.

They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6), and (b)(6) will work with the hospital team on implementing

human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

8.

Metabiota would like to request travel approval for (b)(6) to travel from

Nanaimo, British Columbia, Canada to Abidjan, Cote d'Ivoire from

February 12-24, 2017 to conduct human surveillance training and laboratory training. (b)(6) will

then travel from

Abidjan, Cote d'Ivoire to Freetown, Sierra Leone from February 25-28, 2017, and from

Freetown, Sierra Leone to Conakry, Guinea from March 1-4, 2017, to

accompany a team from UC Davis to assess laboratory plans.

Trip purpose:

Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory

testing, (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory

procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

9.

EcoHealth Alliance would like to request travel approval for (b)(6) to travel from

New York, NY, USA to Guangzhou, Beijing, Kunming, and Guilin, China from

January 15 to February 28, 2017 for meetings with in-country partners in China, and the Global Virome Project meeting in Beijing.

Trip purpose:

(b)(6) will meet with local (b)(6), to assist with fieldwork in Yunnan, Guangxi, and Guangdong provinces. (b)(6) will also be coordinating and organizing the Global Virome

Project Working Group Meeting, and the China National Virome Project event in Beijing.

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(b)(6) (cell)

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(b)(6)

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

Mobile phone: (b)(6)

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

For more information on USAID's Emerging Pandemic Threats program, see: http://www.usaid.gov/ept2

From: (b)(6)
Sent: Thu, 22 Dec 2016 18:27:40 +0000
To: (b)(6)
Subject: Re: Time Sensitive: PREDICT International Travel Requests

Thank you!!

Sent from my iPhone

On Dec 22, 2016, at 1:27 PM, (b)(6) @usaid.gov> wrote:

Hello (b)(6)

Thank you for bringing this to my attention. The Rwanda team no longer provides concurrence. They only need notification. Thus, (b)(6) can start his travel. We should hear back from the Uganda team shortly as they provide concurrence fairly quickly.

Best,

On Thu, Dec 22, 2016 at 12:39 PM (b)(6) @ucdavis.edu> wrote:

Hi (b)(6) I just wanted to follow up regarding Mission concurrence for (b)(6) travel, as I did not see that email go out to the Missions. That

trip is requested to begin 12/29, so I'm hoping I just wasn't copied on the email. (b)(6) plan is to stay in Rwanda through January 30, then travel to Uganda on February 1. If the DRC travel ban is lifted in time, (b)(6) would like to travel to DRC from

February 15-28, but we recognize that this might now be possible given the current situation. If the ban is not lifted, (b)(6) will return to Rwanda for the remainder of (b)(6) trip. Please let me know if you need

anything else to proceed with requesting Mission

concurrence from Uganda and Rwanda.

UC Davis would like to request travel approval for

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One Health Institute

University of California, Davis

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Cc: (b)(6) (GH/HIDN); (b)(6)
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Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

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Mobile phone: (b)(6)

Email: (b)(6) *@usaid.gov*

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same (i.e. no travel) or goes back to normal. Is it possible to postpone the DRC part or would it be possible to have key people from Kinshasa come over to Brazzaville to meet with (b)(6)? That would allow for at least discussing the surveillance strategy,

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This trip will enable (b)(6) to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat. (b)(6) will again be visiting

each country to oversee the coordination with FAO and the human surveillance and wildlife sampling as we ramp up for a year of intense sample collection. (b)(6) will be aiding (b)(6) to capture and sample bats in the Bukima Caves, as well as sample and transfer

baboons from Rumangabo. (b)(6) will be traveling to Lwiro sanctuary to help collect samples from the chimps and other primates at the facility, as well as personnel. In Uganda, (b)(6) will aid (b)(6) with project sampling and working with staff to start making

virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the internet bases histopathology program. In Rwanda, (b)(6) will be following up on a bat die off that still remains a mystery

after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.

5.

Metabiota would like to request travel approval for (b)(6), to travel from

Cape Town, South Africa to Brazzaville, Republic of Congo from January 8-11, 2017 to

review human surveillance strategy with the in-country team and implement a plan for animal surveillance. From

Brazzaville, Republic of Congo, (b)(6) will travel to Kinshasa, Democratic Republic of Congo

from January 11-13, 2017 to

review human surveillance strategy with the in-country team and visit field surveillance sites.

Trip purpose:

Republic of Congo - On December 12, 2016, the in-country team in Brazzaville, Republic of Congo, submitted the human surveillance protocol to the in-country

ethics committee for final review. In order to begin human behavioral surveillance, and evaluate capacity for human syndromic surveillance, (b)(6) will work with the behavioral team on beginning human surveillance in bush meat markets and implement a

plan for concurrent animal surveillance. The team will also visit a proposed human syndromic surveillance site in Brazzaville, to assess capacity and identify collaborating staff.

DRC - (b)(6) will work closely with the in-country team to evaluate and revise the human and animal surveillance strategy, and visit human syndromic surveillance sites.

6.

Metabiota would like to request travel approval for (b)(6), to travel from

Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to

conduct human surveillance training and laboratory training.

Trip purpose:

On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and

laboratory testing, (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT

laboratory procedures with identified staff.

7.

Metabiota would like to request travel approval for (b)(6) to travel from

Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to

conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol.

They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6), and (b)(6) will work with the hospital team on implementing

human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

8.

Metabiota would like to request travel approval for (b)(6) to travel from

Nanaimo, British Columbia, Canada to Abidjan, Cote d'Ivoire from

February 12-24, 2017 to conduct human surveillance training and laboratory training. (b)(6) will then travel from

Abidjan, Cote d'Ivoire to Freetown, Sierra Leone from February 25-28, 2017, and from

Freetown, Sierra Leone to Conakry, Guinea from March 1-4, 2017, to

accompany a team from UC Davis to assess laboratory plans.

Trip purpose:

Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the

national laboratory. In order to begin human surveillance and laboratory

testing, (b)(6), and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory

procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

9.

EcoHealth Alliance would like to request travel approval for (b)(6) to travel from

New York, NY, USA to Guangzhou, Beijing, Kunming, and Guilin, China from

January 15 to February 28, 2017 for meetings with in-country partners in China, and the Global Virome Project meeting in Beijing.

Trip purpose:

(b)(6) will meet with local (b)(6), to assist with fieldwork in Yunnan, Guangxi, and Guangdong provinces. (b)(6) will also be coordinating and organizing the Global Virome

Project Working Group Meeting, and the China National Virome Project event in Beijing.

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(b)(6) (cell)

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Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

Mobile phone: (b)(6)

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

For more information on USAID's Emerging Pandemic Threats program, see: http://www.usaid.gov/ept2

From: (b)(6)
Sent: Wed, 4 Jan 2017 16:32:38 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Request (Group ITA request for GVP Beijing meeting)

(b)(6)

Thanks...I will follow up with [redacted] again. [redacted] is on vacation until next week.

(b)(6)
Emerging Threats Division
Global Health Bureau, USAID/Washington
Telephone: (b)(6)
Cell: (b)(6)
e-mail: (b)(6)@usaid.gov

On Tue, Jan 3, 2017 at 6:15 PM, (b)(6)@ucdavis.edu> wrote:

Hi (b)(6). A list of the actions currently with (b)(6) or OAA are below.

1. **Patan Academy of Health Sciences (PAHS) subaward for Nepal**. Requested start date was 12/15/16, so this one is a bit late already. Submitted 11/10.

2. **Noguchi Memorial Institute for Medical Research (NMIMR) subaward for Ghana**. Requested start date was 1/1/17, so this one is a bit late, too. Submitted 11/23.

3. **Rwanda Biomedical Center (RBC) National Reference Laboratory subcontract for sample testing in Rwanda**. This was submitted 11/28. There isn't really a start date for this one, though it is urgent since it is holding up in-country testing in Rwanda at the moment. This is the one that requires a D&F also, so it may take a while.

Actions that are with me and will be coming your way in the next several weeks are below for planning purposes:

1. **National Institute of Hygiene and Epidemiology (NIHE) subaward for Viet Nam**. This one was reviewed and returned by OAA while (b)(6) was out on medical leave. I have a revised version from WCS and just need to review it before resubmitting.

2. New subaward request for India is pending EHA revision.

3. New subcontract for Rwanda (in addition to RBC subcontract above) is pending my review.

4. New subaward request for Lao PDR is pending my review.

5. New vehicle request to purchase multiple vehicles is pending my review.

6. New equipment request to purchase multiple items is pending my review.

(b)(6) is working on the agenda now, so I expect it will go out soon.

Thanks,

(b)(6)

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Tuesday, January 03, 2017 10:02 AM
To: (b)(6)
Subject: Re: PREDICT International Travel Request (Group ITA request for GVP Beijing meeting)

(b)(6)

(b)(6) is going to send an e-mail about to Beijing seeking concurrence. We know that the contacts are aware of the meeting and initiative because (b)(6) met with them in September, but we still need written concurrence to proceed with travel. I just asked (b)(6) to send the msg ASAP so I am hoping for a quick turn around on this request.

I pinged (b)(6) today on the outstanding subawards. (b)(6) has to do them as the AOR. (b)(6) is currently on annual leave so we are still in a holding pattern on those. Please let me know the drop dead dates on these subawards.

Also -- is there a final (or near final) agenda for next week that you can send me? Thanks!

thanks

(b)(6)

(b)(6)

Emerging Threats Division

Global Health Bureau, USAID/Washington

Telephone: (b)(6)

Cell: (b)(6)

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

On Tue, Jan 3, 2017 at 12:37 PM, (b)(6)@ucdavis.edu> wrote:

Hi all. Just following up regarding (b)(6) email below. Thanks!

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(cell)

From: (b)(6) [mailto:(b)(6)@usaid.gov]
Sent: Wednesday, December 21, 2016 10:11 AM
To: (b)(6) (RDMA/OPH)
Cc: (b)(6)
Subject: Fwd: PREDICT International Travel Request (Group ITA request for GVP Beijing meeting)

Hello team RDMA,

the following travel approval requests has come in from PREDICT. We appreciate your concurrence and welcome any questions you may have.

1. UC Davis would like to request approval for the **individuals listed below** to travel from **their respective departure locations (listed below)** to **Beijing, China** from February 4-8, 2017 for a Global Virome Project Working Group meeting to take place February 5-7, 2017.

Trip purpose: All travelers are invited participants of the Global Virome Project. The meeting will provide an opportunity for working groups to meet and collaborate on project strategies development. There will also be a press event to announce the China National Virome Project.

Traveler Name	Departure Location	
(b)(6)	Sacramento, California	
	Sacramento, California	
	San Francisco, California	
	San Francisco, California	
	San Francisco, California	
	San Francisco, California	
*Peter Daszak**	Newark, New Jersey	
(b)(6)	New York, New York	
	New York, New York	

(b)(6)	New York, New York	
	New York, New York	
	New York, New York	
	Washington, DC	
	Washington, DC	
	Washington, DC	
	Boston, Massachusetts	
	Dar es Salaam, Tanzania	
	Lagos, Nigeria	
	New Delhi, India	
	Rome, Italy	
	Seattle, Washington	
	New York, New York	
	New York, New York	
	Newark, New Jersey	
(b)(6) (if requested and appropriate)	Washington, DC	
(b)(6)	Jacksonville, Florida	
	Bangkok, Thailand	
	Bangkok, Thailand	
	Bangkok, Thailand	
	Geneva, Switzerland	
	Hong Kong	
	Paris, France	
	Paris, France	
	Rio de Janeiro, Brazil	
	Rio de Janeiro, Brazil	
	Rome, Italy	

(b)(6)

(b)(6)

(b)(6)

Emerging Threats Division

U.S. Agency for International Development (USAID)

Telephone: (b)(6) ***Cell:*** (b)(6) **@usaid.gov**

---------- Forwarded message ----------
From: (b)(6) @usaid.gov>
Date: Wed, Dec 21, 2016 at 1:01 PM
Subject: Re: PREDICT International Travel Request (Group ITA request for GVP Beijing meeting)
To: (b)(6) @ucdavis.edu>
Cc: (b)(6) @usaid.gov>, (b)(6) @usaid.gov>, (b)(6) @ucdavis.edu>, (b)(6) @ucdavis.edu>, (b)(6) @ucdavis.edu>, (b)(6) @usaid.gov>

All approved except (b)(6) (who is a USG employee) subject to mission concurrence.

(b)(6)

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

Mobile phone: (b)(6)

Email: (b)(6) *@usaid.gov*

On Dec 21, 2016, at 5:56 PM, (b)(6) @ucdavis.edu> wrote:

Please find below a group international travel request for your review and approval. Please let me know if you have any questions. Thanks!!

1. UC Davis would like to request approval for the **individuals listed below** to travel from **their respective departure locations (listed below)** to **Beijing, China** from February 4-8, 2017 for a Global Virome Project Working Group meeting to take place February 5-7, 2017.

Trip purpose: All travelers are invited participants of the Global Virome Project. The meeting will provide an opportunity for working groups to meet and collaborate on project strategies development. There will also be a press event to announce the China National Virome Project.

Traveler Name	Departure Location	
(b)(6)	Sacramento, California	
	Sacramento, California	
	San Francisco, California	
	San Francisco, California	
	San Francisco, California	
	San Francisco, California	
*Peter Daszak**	Newark, New Jersey	
(b)(6)	New York, New York	
	New York, New York	
	New York, New York	
	New York, New York	
	New York, New York	
	Washington, DC	
	Washington, DC	
	Washington, DC	
	Boston, Massachusetts	
	Dar es Salaam, Tanzania	
	Lagos, Nigeria	
	New Delhi, India	
	Rome, Italy	
	Seattle, Washington	
	New York, New York	
	New York, New York	
	Newark, New Jersey	

(b)(6) (if requested and appropriate)		Washington, DC	
(b)(6)		Jacksonville, Florida	
		Bangkok, Thailand	
		Bangkok, Thailand	
		Bangkok, Thailand	
		Geneva, Switzerland	
		Hong Kong	
		Paris, France	
		Paris, France	
		Rio de Janeiro, Brazil	
		Rio de Janeiro, Brazil	
		Rome, Italy	

(b)(6)

From: (b)(6)
Sent: Mon, 19 Dec 2016 19:22:06 +0000
To: (b)(6)
Subject: Re: PREDICT International Travel Requests

Thanks

Sent from my iPhone

On Dec 19, 2016, at 2:14 PM, (b)(6) @usaid.gov> wrote:

Hello teams CDI, Sierra Leone, and Guinea,

the following travel approval requests has come in from PREDICT. We appreciate your concurrence and welcome any questions you may have.

2. Metabiota would like to request travel approval for (b)(6) (b)(6) for Metabiota, to travel from Nuremberg, Germany to Freetown, Sierra Leone from January 10-20, 2017, then from Freetown, Sierra Leone, to Conakry, Guinea from January 20-28, 2017 to train field staff in bat capture and identification for implementation of project activities.

Trip purpose: Sierra Leone and Guinea - (b)(6) will provide training for field staff on bat capture and identification. Training will include field and classroom activities, and discussion of challenges and best practices. Field training activities will coincide with regular sampling trips for year 3.

6. Metabiota would like to request travel approval for (b)(6) (b)(6), to travel from Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in

the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

7. Metabiota would like to request travel approval for [redacted] to travel from Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, [redacted] and [redacted] will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

[redacted]
Emerging Threats Division
U.S. Agency for International Development (USAID)
Telephone: [redacted] *Cell:* [redacted] **@usaid.gov**

---------- Forwarded message ----------
From: [redacted]@usaid.gov>
Date: Thu, Dec 15, 2016 at 4:57 PM
Subject: Re: PREDICT International Travel Requests
To: [redacted]@ucdavis.edu>
Cc: [redacted]@usaid.gov>, "[redacted] (GH/HIDN)" <[redacted]@usaid.gov>, [redacted]@usaid.gov>, [redacted] <[redacted]@ucdavis.edu>, [redacted]@ucdavis.edu>, [redacted] <[redacted]@ucdavis.edu>

Thanks, [redacted]

All travel to Pacifica meeting approved.

All other travel (except DRC/[redacted]) approved subject to mission concurrence.

DRC/[redacted] travel to be reevaluated after further consultation.

[redacted]

[redacted]

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health
U.S. Agency for International Development
Mobile phone: (b)(6)
Email: (b)(6) *@usaid.gov*

On Dec 15, 2016, at 10:26 PM, (b)(6) @ucdavis.edu> wrote:

Hi (b)(6) You are correct. (b)(6) is a recent addition to the External Advisory Panel, so we would be attending the meeting in an advisory capacity. I'll touch base with Metabiota regarding the DRC portion of (b)(6) trip and follow up with you when I know more.

Thanks!

(b)(6)

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(cell)

From: (b)(6) [mailto:aclements@usaid.gov]
Sent: Thursday, December 15, 2016 3:59 AM
To: (b)(6)
Cc: (b)(6) (GH/HIDN); (b)(6)
(b)(6)
Subject: Re: PREDICT International Travel Requests

Hi (b)(6)

Can you provide more information on the proposed role of (b)(6) in the Predict semi-annual meeting? Is (b)(6) like (b)(6) part of the advisory group?

For the proposed (b)(6) travel to DRC in January, it may not be possible. As you know there was a travel warning issued last week and those usually get updated every month. So we may not know for a while if the travel situation stays the same (i.e. no travel) or goes back to normal. Is it possible to postpone the DRC part or would it be possible to have key people from Kinshasa come over to Brazzaville to meet with (b)(6)? That would allow for at least discussing the surveillance strategy, but visiting surveillance sites would obviously not be possible.

Thanks!

(b)(6)

On Thu, Dec 15, 2016 at 12:52 AM, (b)(6) @ucdavis.edu> wrote:

Please find below international travel requests for your review and approval. Please note that #4 for (b)(6) is a late submission necessitated by staffing changes in Rwanda. Please let me know if you have any questions. Thanks!!

Travel Requests:

1. UC Davis would like to request travel approval for **the individuals listed below** to travel from **their respective departure locations (listed below)** to Pacifica, California, USA from January 9-12, 2017 to attend the PREDICT-2 Semi-Annual Consortium meeting from January 10-11, 2017.

Trip purpose: All travelers will be attending the Semi-Annual Consortium Meeting in Pacifica, California. In support of Global Health Security Agenda, this meeting will provide participants an opportunity to discuss work plans, budgets, and strategies for implementation of Year 3 activities with project partners. Max daily per diem for Pacifica is $268.

Traveler Name	Departure Location	Airfare Cost
(b)(6)	Manchester, England	$1,700
	Nanaimo, British Colombia, Canada	$888

(b)(6)	Nanaimo, British Columbia, Canada	$888
	Rome, Italy	$2,400
	Perth, Australia	$4,000

(b)(6) *will initiate* (b)(6) *travel for this trip in Manchester, England, due to pre-existing person travel plans. After the meeting,* (b)(6) *will return from San Francisco, California, USA to* (b)(6) *home base in Hanoi, Vietnam.*

2. Metabiota would like to request travel approval for (b)(6) for Metabiota, to travel from Nuremberg, Germany to Freetown, Sierra Leone from January 10-20, 2017, then from Freetown, Sierra Leone, to Conakry, Guinea from January 20-28, 2017 to train field staff in bat capture and identification for implementation of project activities.

Trip purpose: Sierra Leone and Guinea - (b)(6) will provide training for field staff on bat capture and identification. Training will include field and classroom activities, and discussion of challenges and best practices. Field training activities will coincide with regular sampling trips for year 3.

3. UC Davis would like to request approval for (b)(6) to travel from Davis, California, USA to Phnom Penh, Cambodia from January 12-21, 2017 to join the PREDICT/Cambodia team in field and lab activities and document our work for communications and reports.

Trip Purpose: (b)(6) will travel to Cambodia to meet (b)(6) and the PREDICT-2 team in Cambodia and to document the team's One Health approach to zoonotic disease surveillance, including a planned concurrent sampling event targeting human, livestock, and wildlife at the rodent trade hub in Kandal, on the Vietnam border (the project's first official concurrent surveillance event). A professional (b)(6) is donating (b)(6) services to the project, though PREDICT will cover all (b)(6) travel expenses.

4. UC Davis would like to request travel approval for (b)(6) to travel from Baltimore, MD, USA to Kigali, Rwanda and Uganda and DRC from December 29, 2016-March 2, 2017 to meet with PREDICT staff and partners.

Trip purpose: *This trip will enable* (b)(6) *to meet with PREDICT Country Coordinators from Rwanda, Uganda and Democratic Republic of the Congo at MGVP headquarters in Musanze, during Gorilla Doctor rounds and all staff retreat.* (b)(6) *will again be visiting each country to oversee the coordination with FAO and the human surveillance and wildlife sampling*

as we ramp up for a year of intense sample collection. (b)(6) *will be aiding* (b)(6) *to capture and sample bats in the Bukima Caves, as well as sample and transfer baboons from Rumangabo.* (b)(6) *will be traveling to Lwiro sanctuary to help collect samples from the chimps and other primates at the facility, as well as personnel. In Uganda,* (b)(6) *will aid* (b)(6) *with project sampling and working with staff to start making virtual slides from the canning scope at NADDIC, as well as holding a meeting with pathologists and histology technicians to further the internet bases histopathology program. In Rwanda,* (b)(6) *will be following up on a bat die off that still remains a mystery after histopathology results. One shipment of samples was lost due to cold chain issues and so a new shipment of duplicate samples needs to be sent.*

5. Metabiota would like to request travel approval for (b)(6), to travel from Cape Town, South Africa to Brazzaville, Republic of Congo from January 8-11, 2017 to review human surveillance strategy with the in-country team and implement a plan for animal surveillance. From Brazzaville, Republic of Congo, (b)(6) will travel to Kinshasa, Democratic Republic of Congo from January 11-13, 2017 to review human surveillance strategy with the in-country team and visit field surveillance sites.

Trip purpose: Republic of Congo - On December 12, 2016, the in-country team in Brazzaville, Republic of Congo, submitted the human surveillance protocol to the in-country ethics committee for final review. In order to begin human behavioral surveillance, and evaluate capacity for human syndromic surveillance, (b)(6) (b)(6) will work with the behavioral team on beginning human surveillance in bush meat markets and implement a plan for concurrent animal surveillance. The team will also visit a proposed human syndromic surveillance site in Brazzaville, to assess capacity and identify collaborating staff. DRC - (b)(6) will work closely with the in-country team to evaluate and revise the human and animal surveillance strategy, and visit human syndromic surveillance sites.

6. Metabiota would like to request travel approval for (b)(6), to travel from Cape Town, South Africa to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

7. Metabiota would like to request travel approval for (b)(6) to travel from Yaoundé, Cameroon to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training.

Trip purpose: On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) (b)(6) and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff.

8. Metabiota would like to request travel approval for (b)(6) to travel from Nanaimo, British Columbia, Canada to Abidjan, Cote d'Ivoire from February 12-24, 2017 to conduct human surveillance training and laboratory training. (b)(6) will then travel from Abidjan, Cote d'Ivoire to Freetown, Sierra Leone from February 25-28, 2017, and from Freetown, Sierra Leone to Conakry, Guinea from March 1-4, 2017, to accompany a team from UC Davis to assess laboratory plans.

Trip purpose: Cote d'Ivoire - On December 12, 2016, the in-country team received approval of the human surveillance protocol. They have also begun animal surveillance efforts in conjunction with the national laboratory. In order to begin human surveillance and laboratory testing, (b)(6) , and (b)(6) will work with the hospital team on implementing human training with selected staff and spend time in the site enrolling the first participants. They will also conduct training on PREDICT laboratory procedures with identified staff. Sierra Leone and Guinea - (b)(6) will accompany a team from UC Davis to assess laboratory plans, and the possibility for laboratory strengthening activities in both countries.

9. EcoHealth Alliance would like to request travel approval for (b)(6) to travel from New York, NY, USA to Guangzhou, Beijing, Kunming, and Guilin, China from January 15 to February 28, 2017 for meetings with in-country partners in China, and the Global Virome Project meeting in Beijing.

Trip purpose: (b)(6) will meet with local (b)(6) , to assist with fieldwork in Yunnan, Guangxi, and Guangdong provinces. (b)(6) will also be coordinating and organizing the Global Virome Project Working Group Meeting, and the China National Virome Project event in Beijing.

(b)(6)

One Health Institute

University of California, Davis

(b)(6) (office)

(cell)

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(b)(6)

Emerging Threats Division/Office of Infectious Diseases/Bureau for Global Health

U.S. Agency for International Development

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

For more information on USAID's Emerging Pandemic Threats program, see: http://www.usaid.gov/ept2