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Strategies to Prevent (STOP) Spillover

Year 2 Annual Report

1 October 2021 – 30 September 2022

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Strategies to Prevent (STOP) Spillover

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Cover photograph: Live bird market in Dhaka, Bangladesh. Photo credit: icddr,b

Bats roosting in the roof of a building in Kampong Cham Province, Cambodia.
Photo credit: CAMBOHUN

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Acronyms and Abbreviations

AFROHUN	Africa One Health University Network
AMELP	Activity Monitoring, Evaluation and Learning Plan
BFD	Bangladesh Forest Department
CAMBOHUN	Cambodia One Health University Network
CDC	Center for Disease Control (see also US CDC)
CDCD	Communicable Disease Control Department
CMR	Capture-Mark-Release
CoV	Coronavirus
COVID-19	Coronavirus Disease 2019
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
CSO	Community service organization
CytB	Cytochrome B
DARD	Department of Agriculture and Rural Development
DLS	Department of Livestock Services
DNCC	Dhaka North City Corporation
DOH	Department of Health
DOIT	Department of Industry and Trade
DONRE	Department of Natural Resources and Environment
DSCC	Dhaka South City Corporation
DTRA	Defense Threat Reduction Agency
ELISA	Enzyme-linked immunosorbent assay
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
GDAPH	General Directorate of Animal Health and Production
HPAI	Highly Pathogenic Avian Influenza
IEDCR	Institute of Epidemiology Disease Control and Research
IRB	Institutional Review Board
IRC	International Rescue Committee
ISSP	Intervention/Study Selection Process
JSI	JSI Research & Training Institute, Inc.
KAP	Knowledge, Attitudes and Practices
KII	Key Informant Interview
KPIs	Key Performance Indicators
LBM	Live Bird Market
LWSC	Liberia Water and Sewer Corporation
MAFF	Ministry of Agriculture, Forestry and Fisheries
MARD	Ministry of Agriculture and Rural Development
MERS	Middle East Respiratory Syndrome
MIS	Management Information System
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOH	Ministry of Health
NEPRC	National Emergency Preparedness and Response Committee
NGO	Non-Governmental Organization
NIPH	National Institute of Public Health
NPHIL	National Public Health Institute of Liberia
OH-DReaM	One Health-Design Research and Mentorship

OHIAT	One Health Information Assessment Tool
OHS	One Health Secretariat
OM	Outcome Mapping
PCR	Polymerase Chain Reaction
POC	Point-of-Care
PDA	Provincial Department of Agriculture
PHD	Provincial Health Department
PPC	Provincial People's Committee
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SBC	Social and behavior change
SEAOHUN	South East Asia One Health University Network
SHINE	Streamlined Highlighting of Infections to Navigate Epidemics
SOP	Standardized Operating Procedure
STOP Spillover	Strategies to Prevent Spillover USAID Program
TIPs	Trials of Improved Practices
USAID	United States Agency for International Development
US CDC	United States Centers for Disease Control and Prevention
VOHUN	Viet Nam One Health University Network
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WOAH	World Organization for Animal Health
Z-TWG	Zoonosis Technical Working Group

Executive Summary

Strategies to Prevent Spillover (STOP Spillover) is a five-year, U.S. Agency for International Development (USAID)-funded cooperative agreement supporting seven priority countries in Asia and Africa to strengthen their capacities to identify, assess, and monitor risk associated with emerging zoonotic viruses and to develop and introduce risk-reduction measures. Focusing on prioritized zoonotic viruses – Ebola, Marburg, Lassa, Nipah, animal-origin coronaviruses (including SARS-CoV, SARS-CoV-2, and MERS-CoV), and animal-origin zoonotic influenza viruses – STOP Spillover promotes a multisectoral, One Health approach to addressing emerging zoonotic viruses before they pose an epidemic or pandemic threat.

Sustainability is a critical aspect of STOP Spillover, with the project specifically designed to ensure local sustainability and inclusion, capacity strengthening, and stakeholder engagement through a deep understanding of the context-specific spillover ecosystem in each country. By implementing locally designed interventions in each country over the life of the project, and evaluating the social, gender, economic, and environmental acceptability and effectiveness of each intervention, participating countries and stakeholders will strengthen their capacity to develop, validate, and implement interventions to reduce spillover.

This document is the second annual report from STOP Spillover, describing work conducted during Project Year 2 (October 1, 2021 - September 30, 2022).

Project Year 1 (October 1, 2020 through September 30, 2021) focused on the initiation of STOP Spillover activities in four countries (Uganda, Liberia, Bangladesh and Viet Nam). Project Year 2 saw STOP Spillover expanding into three new countries – Cambodia, Sierra Leone and Cote d'Ivoire – bringing the total number of target countries to seven.

Project Year 2 focused primarily on selecting and designing interventions and aligned studies to fill knowledge gaps to support intervention design. The selection of interventions and studies was informed by Outcome Mapping (OM). OM is a participatory process that engages a broad range of traditional and non-traditional stakeholders to collaboratively identify and map desired outcomes.

What does it mean to communities at high-risk spillover interfaces to be asked to map desired outcomes? STOP Spillover country team members and consortium colleagues take the time to listen, engage and to translate community stories into learning opportunities about spillover risks and potential risk reductions. These conversations lay the groundwork for shared problem solving between the community and STOP Spillover that will extend over the life of the project and, with local leadership, well beyond.

During Project Year 2, STOP Spillover conducted OM in five countries (Bangladesh, Viet Nam, Cambodia, Liberia, and Sierra Leone), engaging close to 600 stakeholders, to determine the viral pathogens of focus, potential interventions for mitigating the risk of viral spillover, and gaps in knowledge that need to be addressed in order to design appropriate and effective interventions.

If OM is the beginning of the journey to sustainably reduce risk of spillover in high-risk communities, One Health-Design Research and Mentorship (OH-DReaM) working groups are the engines that drive the process. These working groups are not given instructions for how to accomplish risk-reducing change, they are themselves the architects of change. Working groups are inclusive, diverse and engage government, civil society and other influencers from the community whose endorsement can make or break intervention outcomes. STOP Spillover is committed to the time-consuming,

one-on-one work required to organize, motivate and empower OH-DReaM working groups. It is their best thinking that will yield innovative interventions that are owned, refined and sustained by the community after STOP Spillover is gone.

During Project Year 2, Uganda, Bangladesh, and Viet Nam each established five OH-DReaM working groups, with Liberia establishing four, and Sierra Leone establishing three. Two hundred in-country stakeholders are participating in these working groups, with more to follow in Project Year 3 as additional OH-DReaM working groups are formed in Cambodia and Côte d'Ivoire.

During Project Year 2, only Viet Nam moved beyond the design stage of risk-reduction activities and related studies. Viet Nam initiated studies – including a behavioral risk assessment and an assessment of prior biosafety training programs – to inform the design of activities to reduce the risk of spillover at wildlife farms in Dong Nai province. Results of these studies will be available early in Project Year 3. Viet Nam achieved success by securing the approval from Dong Nai's Department of Health (DOH) and Department of Agriculture and Rural Development (DARD) for a new set of guidelines to improve the coordination and collaboration of stakeholders in the One Health sector in Dong Nai province. In Project Year 3, the team in Viet Nam will work with a range of stakeholders to encourage compliance with these guidelines.

Designing, implementing and validating effective interventions to reduce the risk of spillover, amplification and spread requires supporting surveillance activities. STOP Spillover seeks to prevent duplicative or conflicting surveillance activities within each of our supported countries and to leverage existing in-country capacities. Conducting surveillance assessments is a critical step to help understand existing in-country surveillance resources and capacities. During Project Year 2, surveillance assessments were initiated in Liberia, Bangladesh, Viet Nam, Sierra Leone, and Cambodia. The surveillance assessments for Uganda and Sierra Leone have been completed; those for Liberia, Bangladesh, Viet Nam, Cambodia and Côte d'Ivoire will be completed early in Project Year 3.

STOP Spillover partner the Broad Institute leads the project's work on the development of diagnostic tools to support viral surveillance. The Broad Institute has focused on the development of best-in-class polymerase chain reaction (PCR) assays for all pathogens prioritized by STOP Spillover. Work done during Project Year 2 focused on optimizing these assays to detect viruses from a variety of sample types, with priority given to fecal and wastewater samples. Point-of-care (POC) assays for Ebola, Marburg, and Lassa using clustered regularly interspaced short palindromic repeats (CRISPR) technology are also being developed by the Broad Institute. As Project Year 2 ended, a Lassa POC assay and a combined Ebola/Marburg POC assay were in development and will be ready to be tested in the field in Project Year 3.

STOP Spillover operates in seven countries in Africa and Asia

African countries

STOP Spillover partner Africa One Health University Network (AFROHUN) leads the project's implementation in **Uganda**, **Liberia**, and **Côte d'Ivoire**. STOP Spillover partner Tetra Tech leads project implementation in **Sierra Leone**.

Asian countries

STOP Spillover partner icddr,b leads project implementation in **Bangladesh**. The Viet Nam One Health University Network (VOHUN), under the auspices of STOP Spillover partner South East Asia One Health University Network (SEAOHUN), leads project implementation in **Viet Nam**. The Cambodia One Health University Network (CAMBOHUN), under the auspices of SEAOHUN, led project implementation in **Cambodia** in Project Year 2.

INTRODUCTION

Wild meat stall, District des Montagnes, Côte d'Ivoire.
Photo credit: AFROHUN

Strategies to Prevent Spillover (STOP Spillover) is a five-year, U.S. Agency for International Development (USAID)-funded cooperative agreement to support priority countries in Asia and Africa to strengthen their capacities to identify, assess, and monitor risk associated with emerging zoonotic viruses and to develop and introduce proven and novel risk-reduction measures. STOP Spillover builds on more than 15 years of USAID investments in promoting a multisectoral, One Health approach to addressing emerging zoonotic viruses before they pose an epidemic or pandemic threat. Led by Tufts University, STOP Spillover is a global consortium of 14 partner organizations with expertise in human, animal, and environmental health who will take the next step in understanding and addressing the risks posed by known zoonotic viruses that have the potential to spill over and cause pandemic crises.

STOP Spillover focuses on prioritized zoonotic viruses – Ebola, Marburg, Lassa, Nipah, animal-origin coronaviruses (including SARS-CoV, SARS-CoV-2, and MERS-CoV), and animal-origin zoonotic influenza viruses. In each STOP Spillover host country, the specific viruses to be addressed, and the prioritized high-risk interfaces are determined with in-country stakeholders. By implementing locally designed interventions in each country over the life of the project, and evaluating the social, gender, economic, and environmental acceptability and effectiveness of each intervention, participating countries will strengthen their capacity to develop, validate, and implement interventions to reduce spillover of prioritized zoonotic viruses. The goal of STOP Spillover is **an enhanced understanding and reduced risk of zoonotic viral spillover, amplification, and spread**. In support of this goal, STOP Spillover has three objectives (Figure 1). Objective 1 focuses on understanding the risk of spillover of zoonotic viruses at specific high-risk animal-human interfaces, while Objective 2 focuses on utilizing that improved understanding to develop and test interventions that reduce the risk of spillover. Recognizing that it will not be possible to prevent all spillover events from wildlife, Objective 3 focuses on assisting countries to limit the impact of spillover events should they occur.

STOP Spillover began in October 2020. STOP Spillover currently supports seven USAID priority countries. Project Year 1 (October 1, 2020 through September 30, 2021) focused on initiation of project activities in four countries (Uganda, Liberia, Bangladesh and Viet Nam), with three additional countries (Cambodia, Sierra Leone, and Côte d'Ivoire) added during Project Year 2.

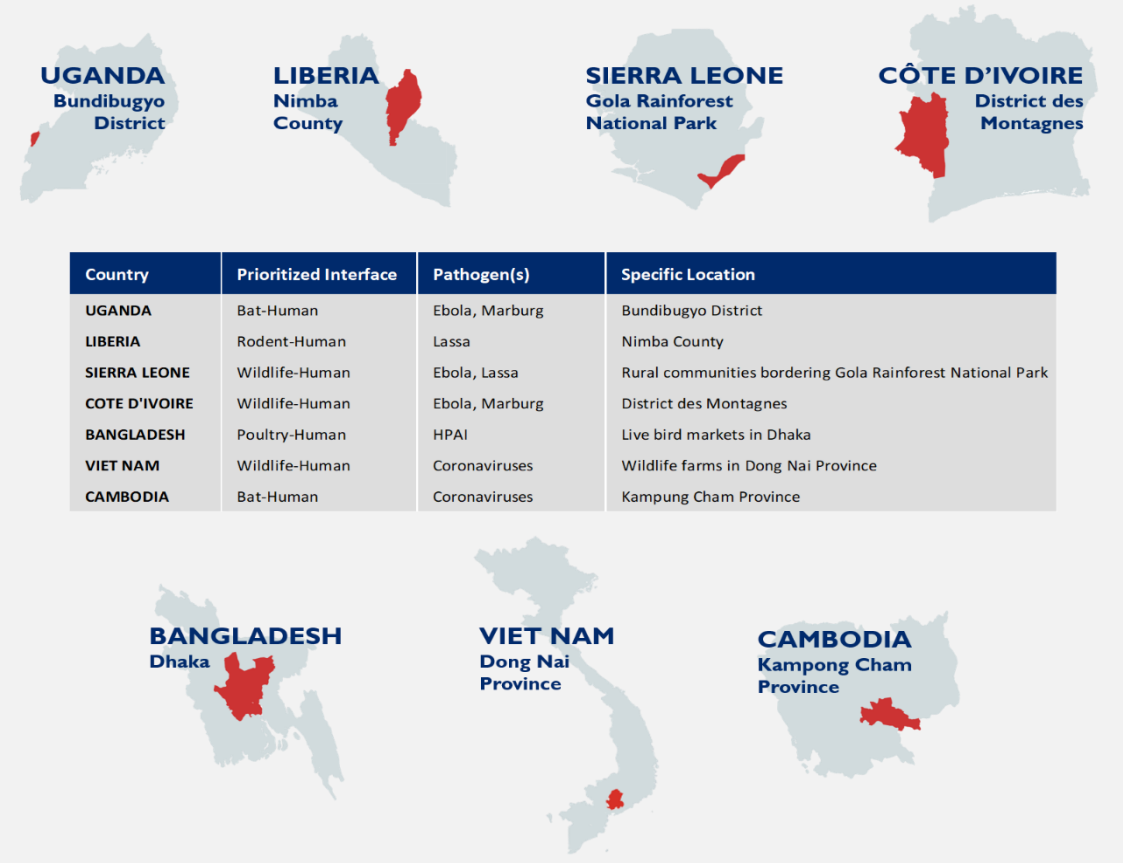
A core component of STOP Spillover is Outcome Mapping (OM). OM is a participatory process that uses a collaborative stakeholder-driven approach to engage a broad range of traditional and non-traditional stakeholders to identify and map desired outcomes. Through the OM process, STOP Spillover works with multisector stakeholders at the national, sub-national, and community levels to identify strengths and limitations within their zoonotic spillover ecosystems and interfaces, and their desired changes and barriers to change, and determine how these changes can be achieved. Through OM, STOP Spillover enhances the capacity of local, regional, and national institutions to understand their spillover ecosystems and to develop, deploy and validate tools and interventions to reduce risk of spillover. This approach recognizes stakeholders' motivating factors and strengths, and guides the integration of interventions into planned and ongoing local and national systems to enhance impact, institutionalize change and promote sustainability. In each STOP Spillover country, OM is used to determine the viral pathogens of focus, the high-risk interfaces at which to focus efforts, the key stakeholders to engage,

OBJECTIVE 1	OBJECTIVE 2	OBJECTIVE 3
Strengthen country capacity to monitor, analyze and characterize the risk of priority emerging zoonotic viruses spilling over from animals to people	Strengthen country capacity to develop, validate, and implement interventions to reduce risk of priority emerging zoonotic viruses spilling over from animals to people	Strengthen country capacity to mitigate amplification and spread of priority zoonotic diseases in human populations
EXPECTED RESULTS		
Up to 10 countries are able to update risk assessments and identify key knowledge gaps related to risk of spillover, amplification, and spread of priority emerging zoonotic viruses in animal and human populations. Up to 10 countries have strengthened capacity to address these key knowledge gaps. Up to 10 countries are able to monitor, analyze, and characterize the gender and sex-specific risks associated with high-risk, animal-human interfaces through their gender-sensitive applied research and testing/ validating intervention strategies.	Up to 10 countries are able to use available information to test and validate the effectiveness of interventions to reduce spillover of priority emerging zoonotic viruses from animals to humans. Up to 10 countries are able to implement interventions, policies, and regulations to reduce spillover of priority emerging zoonotic viruses from animals to humans. Up to 10 countries can develop, analyze, validate, and implement gender-responsive and culturally appropriate interventions relevant to women, girls, men, and boys to limit direct contact with animals and animal products. Up to 10 countries are able to implement interventions and are working towards implementing policies and regulations to reduce spillover of priority emerging zoonotic viruses from animals to humans.	Up to 10 countries have the capacity to understand risk and plan an appropriate response to contain amplification and spread of zoonotic disease events originating from wildlife. High-risk communities, workers, and health facilities in up to 10 countries can rapidly recognize and respond to suspect zoonotic disease events originating from wildlife. Up to 10 countries have the ability to integrate research findings and best practices into risk mitigation efforts to directly impact gender and sex-specific risks.

Figure 1. STOP Spillover objectives and expected results.

potential interventions for mitigating the risk of viral spillover, and gaps in knowledge that need to be addressed in order to design appropriate and effective interventions. Figure 2 shows the specific viral pathogens and high-risk interfaces prioritized by in-country stakeholders through the OM process in each country.

We believe that knowing what to do to reduce the risks of spillover from animals to humans is not enough. To truly prevent the next pandemic, we must institutionalize knowledge in local communities and governments and work together as teams to develop, test, and implement smart interventions. A locally-led approach is fundamental to STOP Spillover. In each target country, STOP Spillover is led by a



Country	Prioritized Interface	Pathogen(s)	Specific Location
UGANDA	Bat-Human	Ebola, Marburg	Bundibugyo District
LIBERIA	Rodent-Human	Lassa	Nimba County
SIERRA LEONE	Wildlife-Human	Ebola, Lassa	Rural communities bordering Gola Rainforest National Park
COTE D'IVOIRE	Wildlife-Human	Ebola, Marburg	District des Montagnes
BANGLADESH	Poultry-Human	HPAI	Live bird markets in Dhaka
VIET NAM	Wildlife-Human	Coronaviruses	Wildlife farms in Dong Nai Province
CAMBODIA	Bat-Human	Coronaviruses	Kampung Cham Province

Figure 2. Prioritized interfaces and pathogens in STOP Spillover countries.

country team composed of in-country personnel. Once high-risk interfaces and interventions have been identified by local stakeholders through the OM process, One Health-Design, Research and Mentorship (OH-DReaM) working groups are established to design, implement and evaluate the interventions. Each OH-DReaM working group includes in-country representatives chosen specifically for the intervention, interface and activity of interest. Each OH-DReaM working group is overseen by a country team member and supported by targeted subject matter experts and mentors from global-level STOP Spillover technical resource hubs.

STOP Spillover's first year was defined by its deep engagement with countries, key stakeholders, and communities. This engagement with in-country stakeholders has continued into the project's second year. The COVID-19 pandemic presented numerous challenges during Project Year 1: the entire project was set-up virtually; most project activities – including stakeholder engagement and participatory OM workshops – were conducted virtually; and international consortium members were unable to travel to support country teams. In the beginning of Project Year 2, challenges due to COVID-19 persisted in some countries, but country teams and supporting global personnel adapted to enable STOP Spillover to continue its work in all countries. The easing of COVID-19 restrictions across STOP Spillover-supported countries during Project Year 2 allowed the project to begin conducting activities in-person.

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Locally-led Approach

"Sustainable development depends on local actors leading efforts to improve their communities and working inclusively and collectively to see those efforts through. For this reason, local capacity strengthening is and has been a foundational component of USAID programming." - USAID's Local Capacity-Strengthening Policy, 2022

Sustainability is a critical aspect of STOP Spillover. The project is specifically designed to ensure local sustainability and inclusion, capacity strengthening, and stakeholder engagement through a deep understanding of the context-specific spillover ecosystem in each country. STOP Spillover's locally-led approach is strengthening capacity in seven priority countries to reduce the risk of zoonotic spillovers and stop pandemics before they start. STOP Spillover's approach to local capacity strengthening builds on the existing strengths of local actors and systems, and responds to local – national, sub-national, and community – contexts. STOP Spillover engages a range of government and non-government stakeholders at all levels – national, regional and local – to build a network within the pandemic prevention community and aims to add value, avoid duplication and promote efficiency and complementarity. By actively engaging change makers who are best positioned to advance progress at the local level, STOP Spillover strives to ensure that risk-reduction interventions are designed and implemented to meet the needs of local communities. This locally-led and local-first approach is at the core of our work:

- STOP Spillover, using a process called **Outcome Mapping**, brought national and local stakeholders together in each of its countries to prioritize pathogens and potential spillover locations, and to prioritize STOP Spillover activities – research or applied interventions – that responded to specific needs of local stakeholders.

- STOP Spillover launched **One Health-Design Research and Mentorship (OH-DReaM) Working Groups,** local groups of stakeholders and experts who are beginning to conduct research, and design, implement, and validate risk-reduction interventions.

- STOP Spillover's country teams are **working hand-in-hand with local, regional, and national government partners** to develop and strengthen interventions to limit the drivers of viral spillover from animals to humans and to address human behaviors that may increase spillover risk.

ACTIVITIES & ACCOMPLISHMENTS

OBJECTIVE ONE

Porcupine farm, Dong Nai Province, Viet Nam.
Photo credit: VOHUN

Objective 1 focuses on assisting countries to improve their understanding of how priority zoonotic viruses spill over from animals to people. The participatory OM process helps STOP Spillover – and the in-country stakeholders – understand the knowledge gaps needed to be filled in order to characterize the risk of viruses spilling over from animals to humans. OM informs applied research to address strategic research questions for reducing risk by generating the specific evidence needed to develop risk-reduction interventions. Additionally, OM – together with broader stakeholder engagement – informs if support is needed to strengthen existing surveillance capacity to detect and mitigate the risk of spillover of prioritized pathogens. Improved understanding of risk directly feeds into and supports Objectives 2 and 3, including the development of risk-reduction interventions. This section outlines STOP Spillover's achievements and accomplishments for Objective 1 during Project Year 2.

Outcome Mapping

Through OM, STOP Spillover works with a diverse range of stakeholders to ensure that we include relevant actors to enhance national and local capabilities to locate potentially new and emerging high-risk interfaces. STOP Spillover's OM process is built around participatory workshops (Figure 3). The nature and number of participatory workshops are adapted for each country context, but the overall goals and outputs of the process are the same. We work with relevant actors to identify specific risks at prioritized interfaces, understand knowledge gaps and barriers to intervention design, brainstorm potential interventions contextualized to the needs for specific interfaces to reduce the risk of spillover, and identify actions that critical stakeholders need to take for the interventions to achieve the desired outcomes.

During this reporting period, OM was conducted in Bangladesh, Viet Nam, Cambodia, Liberia, and Sierra Leone. Côte d'Ivoire held a one-day national stakeholder meeting, which helped inform the selection of priority pathogens and interfaces. An OM workshop with stakeholders from the selected interface in Côte d'Ivoire is scheduled for the opening weeks of Project Year 3.

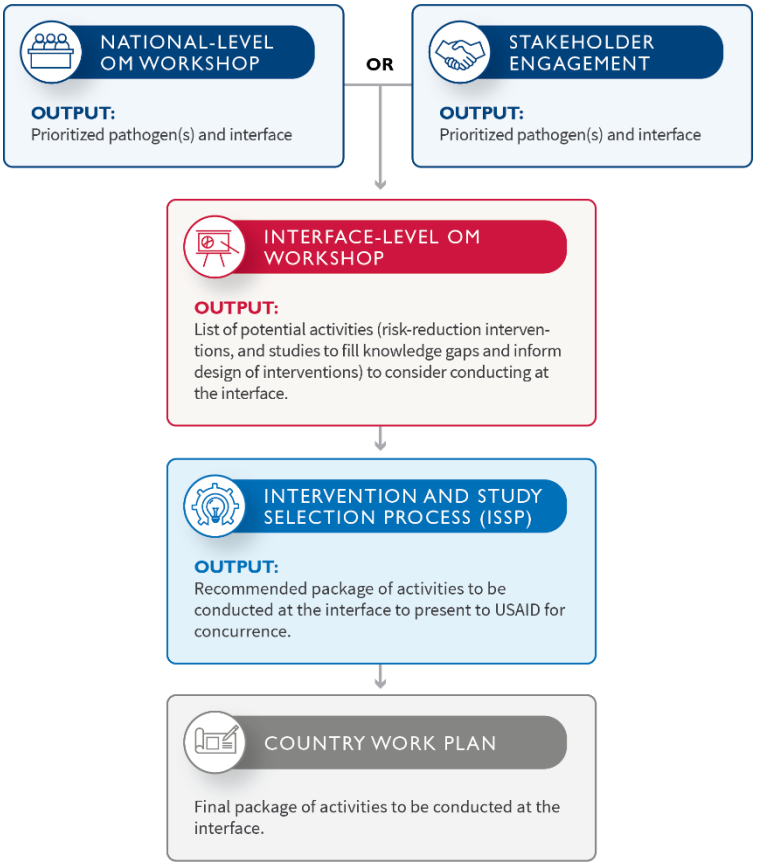


Figure 3. STOP Spillover's OM process. The OM process applied by STOP Spillover in some countries includes two phases: a national-level participatory workshop followed by an interface-level participatory workshop. In other countries STOP Spillover forgoes the national-level workshop, leveraging targeted stakeholder engagement to make key decisions which feed into the interface-level workshop. Following the participatory planning phases, STOP Spillover synthesizes the information obtained and, through an "intervention/study selection process", selects the activities for which STOP Spillover is best positioned to support.

Number of stakeholders engaged through Outcome Mapping: 594

Bangladesh: 117
Viet Nam: 110
Cambodia: 93
Liberia: 64
Sierra Leone: 164
Côte d'Ivoire: 46

Number of Outcome Mapping engagements conducted: 14

Bangladesh: 3
Viet Nam: 3
Cambodia: 2
Liberia: 1
Sierra Leone: 4
Côte d'Ivoire: 1

Outcome Mapping in Bangladesh

The poultry–human interface – specifically, live bird markets (LBMs) in Dhaka – was identified as the prioritized interface during a national-level OM workshop during Project Year 1, and during this reporting period three separate OM engagements were conducted to focus on Dhaka's LBMs.

The first interface OM workshop, held on November 21, 2021, targeted stakeholders from a retail LBM operated under private ownership. The second interface OM workshop, held over three days – December 9-11, 2021 – targeted stakeholders from a wholesale LBM (including some retail poultry shops) operated under Dhaka City Corporation. The 76 participants of these two workshops included representatives from market committees, poultry shop owners, poultry shop workers/slaughterers, mobile poultry vendors, mobile poultry slaughterers, cleaners, live poultry transporters (long haul and rickshaw van), restaurant owners, fishery owners and workers, and staff of poultry dealers. The third interface OM workshop, conducted on December 28, 2021, targeted national-level stakeholders involved in various capacities with the poultry value chain interface. The 41 participants at this one-day workshop included representatives from government departments, regulatory bodies, research organizations, and non-government organizations (NGOs). While this workshop targeted national-level stakeholders, the LBMs were also represented.

Across these three interface OM workshops, a total of 117 participants identified knowledge gaps and barriers, as well as opportunities, to be addressed to reduce spillover risk at Dhaka's LBMs. Potential interventions to reduce spillover risk were discussed by participants, as were desired outcomes for critical partners involved in the poultry value chain. The information gathered at Bangladesh's OM workshops was subsequently synthesized by the Bangladesh country team, supported by global STOP Spillover colleagues, and used to make informed selections of risk-reduction activities for Dhaka's LBMs (see ***Studies at Prioritized Interfaces*** and ***Risk-Reduction Activities at Prioritized Interfaces***).

OM workshop in Dhaka, Bangladesh. Photo credit: icddr,b

Outcome Mapping in Viet Nam

Rather than conducting an OM workshop at the national level to select the prioritized interface and pathogen, followed by a workshop at the interface level to select the prioritized interventions and studies and understand knowledge gaps that need to be addressed (the model applied in countries that conducted OM prior to Viet Nam), OM was only conducted only at the interface. In-place of a national-level OM workshop, key decisions about the prioritized pathogen and interface were made in consultation with key national-level stakeholders, leading to the prioritization of coronaviruses and the selection of the wildlife–human interface at wildlife farms in Dong Nai as the interface and geographical location to focus STOP Spillover's activities.

In November 2021, the Viet Nam country team conducted consultative meetings with key stakeholders in Dong Nai province – including Dong Nai Department of Health (DOH), DOH sub-department of Food Safety, Dong Nai Center for Disease Control (CDC), Dong Nai Department of Agriculture and Rural Development (DARD sub-department of Animal Husbandry, and DARD sub-department of Forest Protection – to identify critical partners to invite to the OM workshop. An OM workshop was conducted in Dong Nai province over four days – December 7-10, 2021 – with 110 participants representing stakeholders from national, provincial, and community levels. The first three days of the workshop targeted stakeholders from the national, provincial, and district levels. Eighty participants at this first phase of the workshop included representatives from: General Department of Preventive Medicine, Ministry of Health (MOH); Ministry of Agriculture and Rural Development (MARD); Dong Nai DOH; Dong Nai DARD; Dong Nai Department of Natural Resources and Environment (DONRE); Dong Nai Department of Industry and Trade (DOIT); Division of Environmental Police, Ministry of Public Security; Dong Nai Department of Information and Communication; Dong Nai CDC; Women's Union; Dong Nai Provincial People's Committee (PPC); and officials from four of Dong Nai's districts. The final day of the four-day workshop targeted community-level stakeholders involved in the wildlife trade in Dong Nai. Thirty participants at this event included representatives from various sectors, including: wildlife and domestic animal farm owners; wildlife farm workers; restaurant owners; consumers of farmed wildlife; community leaders; Women's Union; Youth Union; community veterinarians; and community health workers. Participants identified knowledge gaps and barriers that need to be addressed to reduce spillover risk at captive wildlife farms, as well as opportunities for intervention design. Potential interventions to reduce spillover risk at captive wildlife farms were discussed by participants, as were desired outcomes for critical partners involved in the wildlife value chain. This four-day workshop was convened in-person, but broadcast through Zoom to facilitate virtual representation for stakeholders who could not attend in-person, including global representatives from STOP Spillover's technical resource hubs. Viet Nam served as the model for this direct-to-interface approach, providing lessons for how to be flexible with OM strategy in other countries. The information gathered at Viet Nam's OM workshop was subsequently synthesized by the Viet Nam country team, supported by global STOP Spillover colleagues, and used to make informed selections of risk-reduction activities in Dong Nai (see ***Studies at Prioritized Interfaces*** and ***Risk-Reduction Activities at Prioritized interfaces***).

OM workshop in Dong Nai, Viet Nam. Photo credit: VOHUN

Outcome Mapping in Liberia

Similar to the strategy applied in Viet Nam, STOP Spillover's OM strategy forwent a national-level workshop (as conducted in Bangladesh and Uganda during Project Year 1) and went directly to the interface. In place of a national-level OM workshop, key decisions about the prioritized pathogen and interface were made in consultation with key national-level stakeholders. Lassa fever's status as a priority public health problem for the Government of Liberia led to the Lassa virus being selected as the priority pathogen for STOP Spillover's initial work in Liberia. Nimba County was selected as a starting point for STOP Spillover's work based on the high reported number of infections and deaths from Lassa, coupled with a shared international border with the Republic of Guinea and Côte d'Ivoire. Lassa fever is also a public health threat in these countries and border crossings are considered a potential spillover location. Prior to conducting the OM workshop, the Liberia country team met key government stakeholders at the central and county levels to introduce STOP Spillover and to discuss and seek concurrence on focusing the project's initial activities on Lassa fever in Nimba County. Stakeholders engaged included: the Senior USAID Mission Global Health Security Agenda Advisor; the Minister of Health; the Coordinator of the One Health Platform; the Vice President of the University of Liberia, College of Health Sciences; the Executive Director of the Environmental Protection Agency (EPA); the Director-General of National Public Health Institute of Liberia (NPHIL) and her key collaborators; the Chief Veterinary Officer of the Ministry of Agriculture (MOA); the Nimba County Health Team; and the Nimba County Superintendent Office. The Liberia country team also participated in a meeting of the National Emergency Preparedness and Response Committee (NEPRC). NEPRC meetings are organized by NPHIL and attended by representatives from various institutions, including World Health organization (WHO), USAID, United States Center for Disease Control and Prevention (US CDC), One Health Platform, partners and other government agencies, to share disease updates and activities. All stakeholders agreed that STOP Spillover's starting point should be Lassa fever in Nimba County, noting that in subsequent years other key interfaces, locations, and pathogens of interest could be considered.

One week in advance of the OM workshop, STOP Spillover organized a Lassa Summit on February 18, 2022. Thirty-six participants comprising the Liberia country team, global STOP Spillover resource hub members and a small number of external experts convened virtually and in-person for this one-day meeting. The Lassa Summit provided an opportunity in advance of OM for STOP Spillover global experts to learn about the drivers, ongoing disease control efforts, and context of Lassa fever in Liberia, particularly Nimba Country, and for the Liberia country team to learn from expert consortium members and external partners on experience related to Lassa fever.

Liberia's OM workshop was conducted in Ganta, Nimba County, over three days (February 23-25, 2022). This workshop was convened in-person, but broadcast through Zoom to facilitate virtual representation for stakeholders and consortium members who could not attend in-person. Fifty-six participants attended in person at the venue

STOP Spillover meeting with members of Boe Community, Nimba County, Liberia. Photo credit: AFROHUN

in Ganta, with eight participants dialing in through Zoom. Stakeholders from national, county and local levels were represented, including representatives from the MOH, Ministry of Internal Affairs, MOA, NPHIL, EPA, University of Liberia College of Health Sciences, Water, Sanitation and Hygiene (WASH) Commission, Forestry Development Authority, Food and Agriculture Organization (FAO), Breakthrough Action, International Rescue Committee (IRC), Nimba County Health Team, and traditional and religious leaders. The workshop served as a forum for participants to discuss the context of Lassa fever in Nimba County, and identify opportunities, gaps, and barriers to minimizing the transmission, spread and amplification of Lassa virus. Potential interventions to reduce spillover risk of Lassa virus – from rodents to humans, from human to human, and from human to rodents – were discussed by participants, as were desired outcomes for identified critical partners. Immediately after the workshop, the country team, supported by STOP Spillover colleagues from Tufts and STOP Spillover partner Right Track Africa, visited Boe Community in Nimba County to meet with community members regarding Lassa fever, including practices, type of housing, and access to health care. The information gathered at Liberia's OM workshop was synthesized by the Liberia country team, supported by global STOP Spillover colleagues, and used to make informed selections of risk-reduction activities in Nimba County (see ***Studies at Prioritized Interfaces*** and ***Risk-Reduction Activities at Prioritized Interfaces***).

Outcome Mapping in Sierra Leone

Similar to Bangladesh, Sierra Leone's model of OM involved national-level OM to select the prioritized pathogen(s) and interface, followed by interface-level OM to select the prioritized interventions, stakeholders, and desired outcomes, as well knowledge gaps that need to be addressed.

A one-day national-level OM workshop was held in Freetown on May 19, 2022. A total of 40 individuals participated in the consultation: 20 in-person and five virtual non-STOP Spillover participants, and 15 STOP Spillover personnel. Participants were drawn from the key One Health sectors and institutions, including relevant government ministries, departments

and agencies, international and local NGOs, research institutions, and universities. National stakeholders identified Ebola virus and Lassa virus as the priority pathogens, and prioritized the wildlife–human interface in rural forested areas. Specifically, communities around the Gola Rainforest National Park were identified as a high-risk area for Ebola and Lassa spillover, which includes Kenema, Kailahun, and Pujehun Districts that are known hotspots for these diseases.

Sierra Leone's interface OM was conducted in two phases - at the district and then at the community levels. A district-level workshop was held on May 26, 2022, targeting district and chiefdom-level actors in Kenema and around the Gola Rainforest National Park. A total of 24 participants attended this level of the interface OM, with representation from government, local NGOs, informal community groups, wild meat traders, traditional healers, the media, and the Gola Rainforest Program. Two community-level workshops were held on May 28, 2022, targeting two purposely selected communities identified through district-level stakeholder meetings held before the OM. Largo (a Lassa hotspot in the Kenema Lassa belt) and Perrie (an Ebola hotspot in the Gola Rainforest) were selected as the two case study communities to engage. Dialogue sessions with 100 community members, conducted by two separate STOP Spillover teams and supported by staff from the District Health Medical Team, focused on investigating incidences of Lassa fever and Ebola, general awareness of zoonotic risk, current traditional practices to identifying and managing risks, identifying previous and ongoing interventions, and exploring the vision communities have for addressing zoonotic risk or risk of spillover. The information gathered through Sierra Leone's OM workshops was subsequently synthesized by the Sierra Leone country team, supported by global STOP Spillover colleagues, and used to make informed selections of risk-reduction activities at the wildlife–human interface in rural forested areas (see ***Studies at Prioritized Interfaces*** and ***Risk-Reduction Activities at Prioritized Interfaces***).

STOP Spillover meeting with members of Largo Community, Kenema District, Sierra Leone. Photo credit: Bruno Ghersi

Outcome Mapping in Cambodia

The OM process applied by STOP Spillover in some countries (e.g., Uganda and Bangladesh) includes two phases: a national-level OM to concur with national stakeholders on the prioritized interface and pathogen, followed by an interface-level OM to select the prioritized interventions and studies, and understand the knowledge gaps that need to be filled. In other countries (e.g., Viet Nam and Liberia), STOP Spillover forgoes the national-level OM, and instead seeks national level input and concurrence on pathogens and interfaces through broader stakeholder engagement, and then conducts interface-level OM. The model of OM applied in Cambodia was a mix of these two models. A one-day national stakeholder engagement meeting and project launch brought together key national-level government stakeholders and was leveraged as a form of national-level OM where decisions were made regarding the STOP Spillover priority pathogen(s) and interface. The national level meeting was followed by an OM workshop at the selected interface.

The combined STOP Spillover launch event and one-day national stakeholder engagement meeting was organized on June 1, 2022 in Phnom Penh. The primary objective of the event was to formally launch STOP Spillover in Cambodia, introducing the project to key national stakeholders including line ministries, NGOs and academic institutions. The objective of the one-day national stakeholder engagement meeting that followed was to determine the priority pathogen(s), interface and potential stakeholders to engage for STOP Spillover activities. The combined meeting was attended by 38 participants (not including STOP Spillover personnel), 34 of whom were present in person, while another four people joined virtually. Participation included representatives from governmental ministries (Ministry of Agriculture, Forestry and Fisheries [MAFF], MOH, and Ministry of the Environment [MOE]), academic and research institutions (University of Health Science, Royal University of Agriculture, Prek Leap National Institute of Agriculture, Kampong Cham National Institute of Agriculture, and Pasteur Institute of Cambodia), and NGOs (FAO, Agronomes et Vétérinaires Sans Frontières, GIZ Cambodia, Heifer International, Wildlife Alliance, Conservation International, Wildlife Conservation Society, World Wildlife Fund, US CDC, US Defense Threat Reduction Agency (DTRA), PREZODE and WaterAid). The USAID Mission, Tufts University, and SEAOHUN and CAMBOHUN also participated. The participants concurred and prioritized the bat–human interface, with coronaviruses as the priority pathogens. Kampong Cham province was prioritized as the specific region to focus STOP Spillover's initial efforts due to the potentially high risk associated with the bat guano farming industry.

The interface OM workshop was conducted from July 5-8, 2022 in Kampong Cham province. National, provincial, and district level stakeholders were engaged from July 5-6, while

OM workshop in Kampong Cham, Cambodia. Photo credit: CAMBOHUN

community-level stakeholders were invited on July 7-8. In total 55 persons (excluding STOP Spillover personnel) attended the interface OM workshop in person. Participation at the first stage of the workshop targeting national, provincial, and district level stakeholders included representatives from General Directorate of Animal Health and Production (GDAHP), Communicable Disease Control Department (CDCD), National Institute of Public Health (NIPH), Forestry Administration, Provincial Health Department, Provincial Department of Agriculture, Provincial Department of Environment, District Administration, Operational Districts, District Veterinarian, and Kampong Cham National Institute of Agriculture. The second phase targeted local authorities and bat guano harvesters from Kampong Cham. USAID Washington, Tufts University, and SEAOHUN and CAMBOHUN also participated. Participants identified knowledge gaps and barriers that need to be addressed to reduce spillover risk from bats to humans in Kampong Cham province, as well as opportunities for intervention design. The information gathered at Cambodia's OM workshop was subsequently synthesized by the Cambodia country team, supported by global STOP Spillover colleagues, and used to make informed selections of risk-reduction activities in Kampong Cham province (see ***Studies at Prioritized Interfaces*** and ***Risk-Reduction Activities at Prioritized Interfaces***).

Outcome Mapping in Côte d'Ivoire

Similar to Cambodia, Côte d'Ivoire leveraged a one-day national stakeholder engagement meeting, combined with a STOP Spillover launch event, as a form of national-level OM to make key decisions regarding the priority pathogen and interface. Conducted on September 29, 2022 in Abidjan, this meeting was presided over by Mrs. Fadiga Aida (representative of the One Health platform), Mrs. Akua Kwateng-Addo (Director of the USAID Health Office), Dr. Kallo Vessaly (Director of Veterinary Services, representing the Ministry of Animal and Fishery Resources) and Professor Nandjui Béatrice (Dean of Unités de Formation et de Recherches Sciences Médicale of Université Félix Houphouët-Boigny). In addition, 46 participants attended the in-person event, representing government directorates and services, universities, research institutes, FAO, NGOs and village and religious communities. The participants prioritized the wildlife–human interface, with filoviruses (Ebola and Marburg) selected as the priority pathogens. District des Montagnes in the west of the country was prioritized as the specific region to focus STOP Spillover's initial efforts due to human encroachment on wildlife habitats, a high consumption of wild meat, and a shared border with Liberia and Guinea. Both neighboring countries have had recent epidemics of Ebola and/or Marburg – Guinea (Ebola, 2014; Marburg, 2021), and Liberia (Ebola, 2014) – and border crossings are considered a potential spillover location.

Breakout discussion during the national stakeholder engagement in Abidjan, Côte d'Ivoire. Photo credit: AFROHUN

Studies at Prioritized Interfaces

Objective 1 focuses on assisting countries to improve their understanding of risk associated with spillover of priority viruses from animals to people. Applied research addressing a set of strategic research questions is crucial for generating the evidence needed to develop and test interventions that reduce risk to populations at specific high-risk animal-human interfaces. To design effective interventions to reduce the risk of spillover, a deep understanding of the country context and the drivers of behaviors that put communities at risk of infection at a specific interface is needed. Interventions – and/or strategies to reinforce behavioral change – won't work if they are not responsive to local needs.

During Project Year 2, STOP Spillover convened an Intervention/Study Selection Process (ISSP) for six countries (Uganda, Viet Nam, Bangladesh, Liberia, Cambodia, and Sierra Leone) to consider the activities suggested by stakeholders from the respective OM planning workshops, agree on prioritization criteria, and package risk-reduction activities and aligned studies identified by stakeholders into distinctly implementable projects (see box ***How STOP Spillover prioritizes risk-reduction interventions and studies***). In this section we briefly describe the studies and their current status (risk-reduction activities are described in ***Risk-Reduction Activities at Prioritized Interfaces***).

How STOP Spillover prioritizes risk-reduction interventions and studies

Outbreaks can start – and stop – at the country level, and early country-level and country-led interventions are key to preventing and reducing the impact of outbreaks. While brainstorming and prioritizing interventions to reduce the risk of spillover forms a significant component of an OM workshop, it is important to note that decisions regarding the interventions to implement are not made at OM workshops. The output of OM is a list of many activities proposed by local stakeholders, but it's not possible to proceed with all activities that are proposed at OM workshops. The consortium has the responsibility to ensure that the activities we conduct are within the remit and scope of the project, appropriate technical expertise exists to support implementation, and sufficient financial resources are available. To facilitate this decision-making process, STOP Spillover has instigated an **Intervention/Study Selection Process** (ISSP). The ISSP brings in the technical expertise across STOP Spillover to make informed programmatic decisions regarding the interventions – and studies needed to inform interventions – that emerge from OM.

The ISSP is an engagement of country teams and technical experts from across Tufts and STOP Spillover partners to consider the proposed activities that emanated from the OM planning workshop, agree on selection or prioritization criteria, and use these to package stakeholder input into distinctly implementable projects. The country teams are intensely engaged in the ISSP process, bringing in their country knowledge and keen understanding of what the OM participants proposed as STOP Spillover intervention points. The final output of STOP Spillover's ISSP is a recommended package of activities -- interventions and aligned studies -- to pursue in a given country. Upon concurrence from USAID, these are incorporated into work plans.

Studies in Uganda

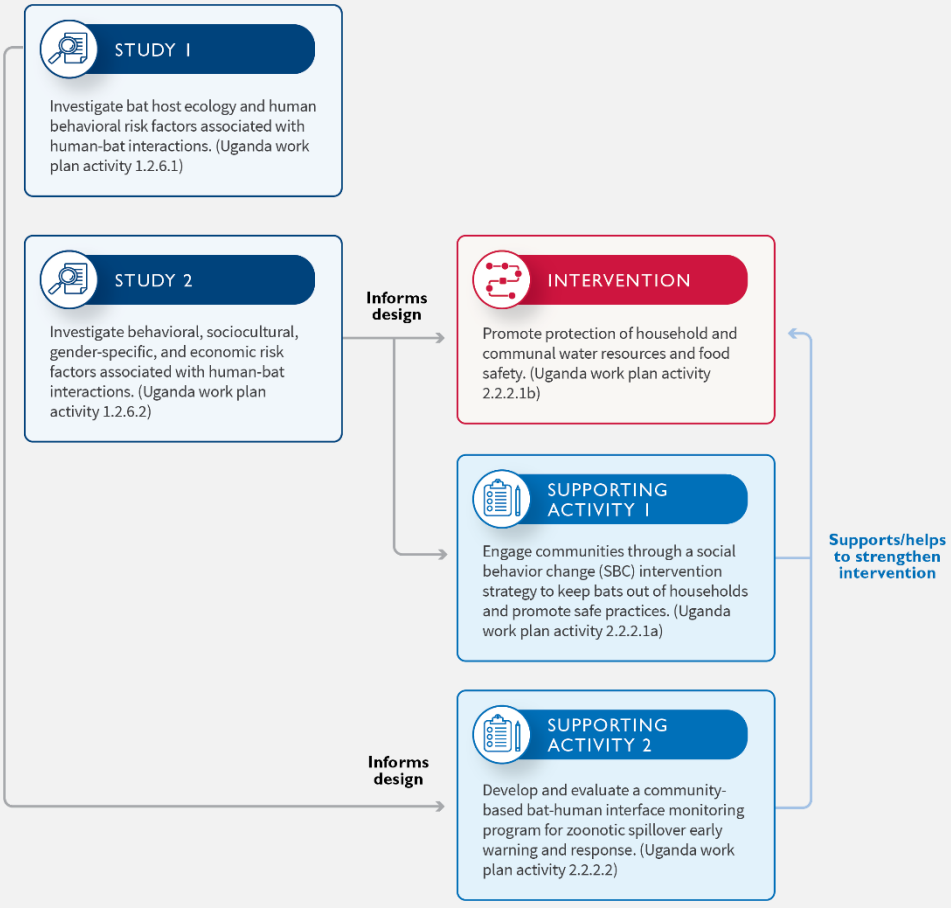
Uganda's work plan focuses on a core intervention and two supporting activities, the designs of which are informed by two studies (Box 1). A OH-DReaM working group for each of the two studies was established (Annex 1). The two OH-DReaM working groups developed a detailed action plan for their respective studies, laying out the work that the groups will pursue and the corresponding timelines. Ethical approval for conducting the studies was obtained from the institutional review boards (IRBs) of both Tufts and Makerere University School of Public Health.

The country team organized a series of meetings with stakeholders from district and sub-county level in Bundibugyo District between August 8-12, 2022. The purpose of these meetings was to discuss the action plans for the two studies (also for the three risk-reduction activities; see ***Risk-Reduction Activities at Prioritized Interfaces***) and to mobilize other stakeholders such as women's groups, schools, bat infested households and artisans. The meetings were also instrumental in allowing different district Government of Uganda staff to guide STOP Spillover as to the priority villages where the activities should be targeted.

Box 1. STOP Spillover studies in Uganda, and how they inform the design of risk-reduction activities.

Study 1 Concept: OM identified knowledge gaps about bat biology, ecology, and community uses of bats. Data on bat species and filovirus distribution in Uganda, especially for the Bundibugyo District, are limited. The goal of this study is to identify where humans are exposed to bats and associated potential risk factors for Marburg and Ebola transmission, which will inform the development of a community-driven participatory bat monitoring program for zoonotic spillover early warning and response.

Study 2 Concept: A better understanding of human and bat interactions in Bundibugyo District communities is needed to inform social and behavior change (SBC) and other risk mitigation interventions. The goal of this study is to better understand individual, social, and cultural factors that influence behaviors that put people at risk of spillover of Marburg and Ebola viruses to inform the development of SBC messages and approaches for engaging communities to keep bats out of households and to promote safe practices.



There were delays in implementing the studies related to obtaining waivers for daily allowance compensation for selected OH-DReaM working group members who supported the activities. One activity to support the design of interventions – training on participatory epidemiology – was successfully conducted in Bundibugyo District in the final week of September 2022. Participatory epidemiology involves the use of participatory rural appraisal techniques to gather epidemiological knowledge and intelligence from key stakeholders at the local level who have in-depth information on local issues. This training targeted members from all five OH-DReaM working groups established in Uganda (two for studies, and three for risk-reduction interventions), as well as research assistants and community mobilizers. Immediately after the training session, trainees applied their newfound skills and learnings by conducting participatory assessments in the communities. These assessments allowed STOP Spillover to gain information on behavioral, socio-cultural, gender-specific and economic risk factors at the bat-human interface in communities across three sub-counties of Bundibugyo District which will inform the design of the risk-reduction interventions. A report on this activity, and a summary of the key findings from the participatory assessments, will be shared early in Project Year 3.

Engaging community-level stakeholders in Bundibugyo District, Uganda. Photo credit: AFROHUN

Studies in Viet Nam

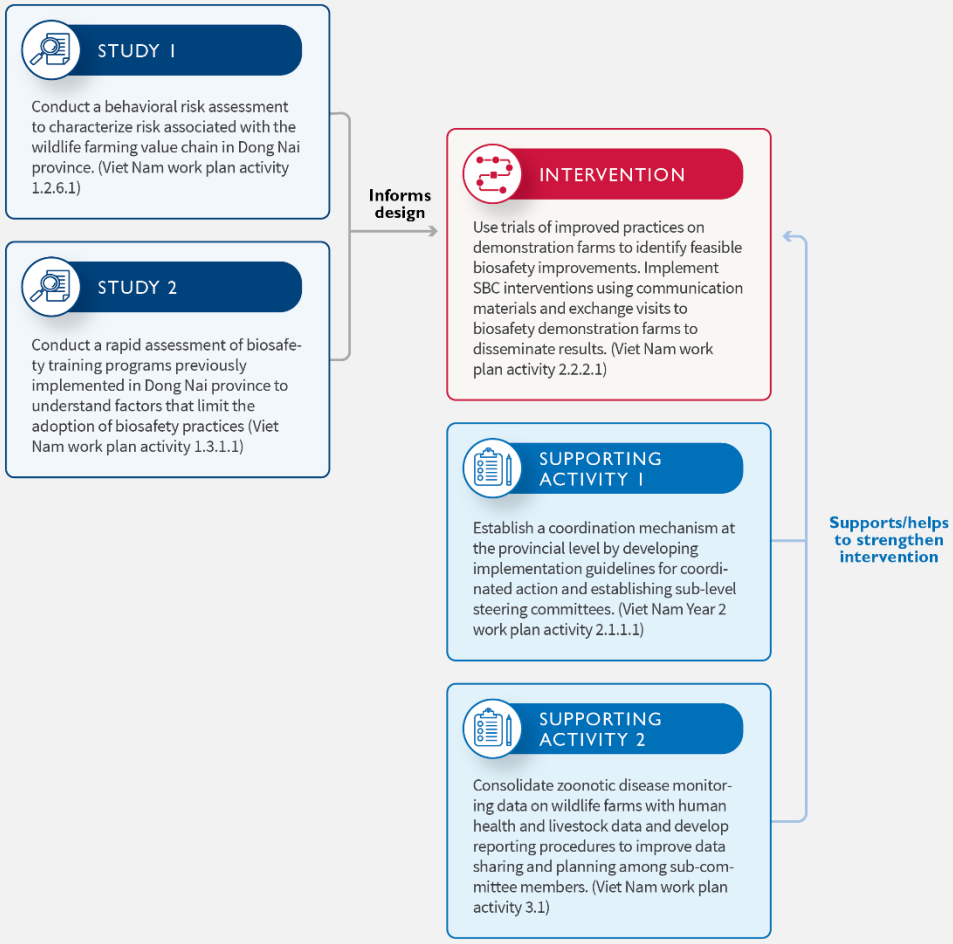
Viet Nam's work plan focuses on a core intervention and two supporting activities, the designs of which are informed by two studies (Box 2). A OH-DReaM working group for each of the two studies was established (Annex 1). The two OH-DReaM working groups developed a detailed action plan for their respective studies, laying out the work that the groups will pursue and the corresponding timelines. Ethical approval for conducting the studies was obtained from the IRBs of both Tufts and Hanoi University of Public Health.

Field work for study 1 (behavioral risk assessment) was conducted during this reporting period. The assessment focused on captive wildlife facilities involved in the trade of bamboo rats, porcupines, civets, and Sambar deer, with the objectives of identifying: (1) actors involved in the wildlife value chain (at the individual and household level); (2) social, economic, gender, cultural, environmental, and other drivers of spillover risk; (3) and the level of knowledge of biosecurity and behavior risk factors of wildlife farmers that can spread viral pathogens. Two districts (Vinh Cuu and Tan Phu) considered to be high-risk interfaces were selected as the study location based on the following criteria: their scale of wildlife farming, avoidance of duplication of previous research conducted by USAID PREDICT; and recommendations from key Dong Nai stakeholders.

Box 2. STOP Spillover studies in Viet Nam, and how they inform the design of risk-reduction activities.

Study 1 Concept: Wildlife farm owners and workers are typically not informed of disease control and prevention strategies, and lack knowledge of and incentives to adopt biosafety practices to reduce spillover risk. The goal of this study is to understand individual and community level knowledge, attitudes and practices that put stakeholders involved in the wildlife value chain in Dong Nai at risk for zoonotic disease transmission, which will inform the design of SBC messages and approaches to improve biosafety practices at wildlife farms.

Study 2 Concept: Many capacity development and training programs have been implemented in Viet Nam, including those related to biosafety. Training on biosafety does not guarantee behavior change or the adoption of recommended practices. The goal of this study is to understand the barriers that actors face in adopting biosafety practices, and what might motivate or constrain them to change their practices, which will inform the design of SBC messages and approaches to improve biosafety practices at wildlife farms.



Between July and September 2022, four techniques were used to conduct this assessment, targeting representatives of the health, veterinary, environment, agricultural and rural and forestry sub-sectors from provincial to commune levels, as well as wildlife farm operators and workers, and other value chain actors:

- 413 individual questionnaires
- 16 key informant interviews (KIIs)
- 4 FGDs
- 20 observation sessions of behaviors at farms.

Inspecting a civet cat farm in Dong Nai Province, Viet Nam. Photo credit: VOHUN

Field work for study 2 (assessment of prior biosafety training programs) was also conducted between July and September 2022. This activity comprised two components:

1. **An assessment of prior biosafety training programs conducted in Dong Nai province**. The purposes of this assessment were: (i) to develop an understanding for the training that has already occurred in Dong Nai, when, and who it targeted; and (ii) to determine the degree to which the knowledge gained from prior biosafety training was applied and recommended practices adopted. Interviews utilizing semi-structured questionnaires, as well as a FGD, were conducted, recruiting a total of 29 representatives of the health, veterinary, environment, agricultural and rural and forestry sub-sectors from all levels (national, province, district, commune),
2. **A knowledge, attitudes, and practices (KAP) survey**. The KAP survey was conducted to develop an understanding of (i) the barriers wildlife farmers face in adopting biosafety practices; and (ii) what motivates or constrains them to adopt biosafety practices. Interviews utilizing semi-structured questionnaires, as well as a FGD, were conducted, recruiting a total of 66 wildlife farmers from nine communes from Dinh Quan district.

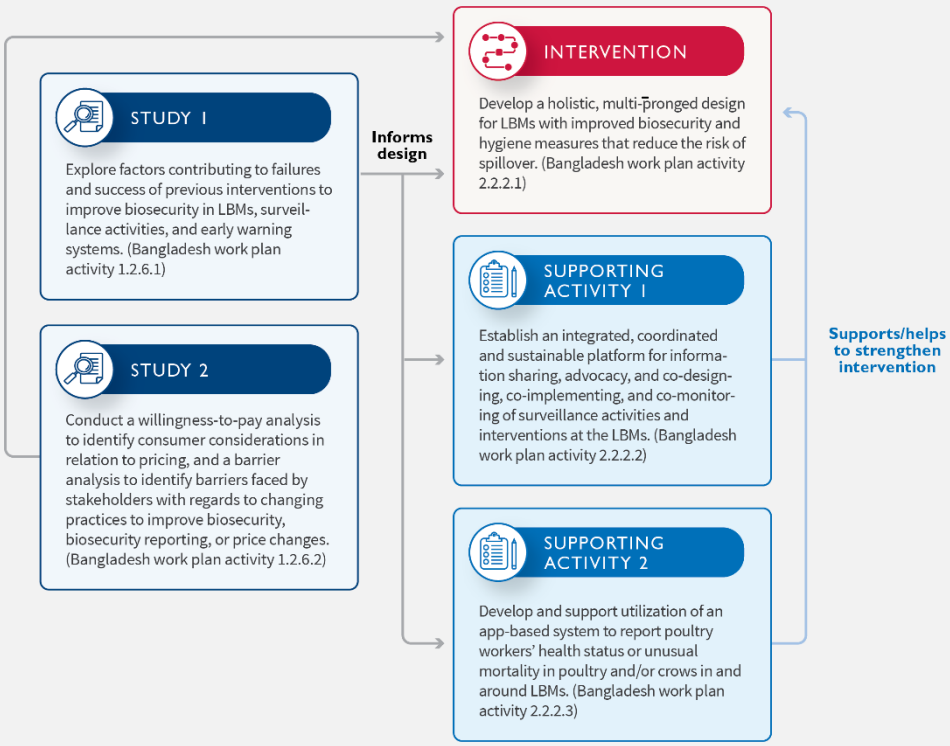
Studies in Bangladesh

Bangladesh's work plan focuses on a core intervention and two supporting activities, the designs of which are informed by two studies (Box 3). Throughout Project Year 2, extensive stakeholder engagement was conducted and maintained to ensure buy-in and a sense of ownership amongst key stakeholders for STOP Spillover activities. A OH-DReaM working group for each of the two studies was established (Annex 1). The two OH-DReaM working groups developed detailed action plans for their respective studies, laying out the work that the groups will pursue and the corresponding timelines. Ethical approval for conducting the studies was obtained from the IRBs of both icddr,b and Tufts in September, paving the way for initiation of field work.

Box 3. STOP Spillover studies in Bangladesh, and how they inform the design of risk-reduction activities.

Study 1 Concept: Various interventions have been implemented previously at by other implementers to tackle hygiene and biosecurity issues at LBMs. The goal of this study is to understand factors that have contributed to the success or failure of interventions previously implemented – in particular why prior interventions did not produce the desired outcomes – which will inform strategies for improving biosecurity and hygiene measures at LBMs.

Study 2 Concept: Improving hygiene and biosecurity at LBMs may come at a cost to stakeholders, with those costs likely being passed on to the consumer. Understanding these economic issues is critical to designing biosecurity measures that stakeholders will consider implementing. The goal of this study is to understand the willingness of LBM stakeholders and consumers to pay to pay for certain changes, and economic, customary or sociocultural barriers to implementing, adopting and maintaining the changes. Understanding these factors will inform strategies for improving biosecurity and hygiene measures at LBMs.

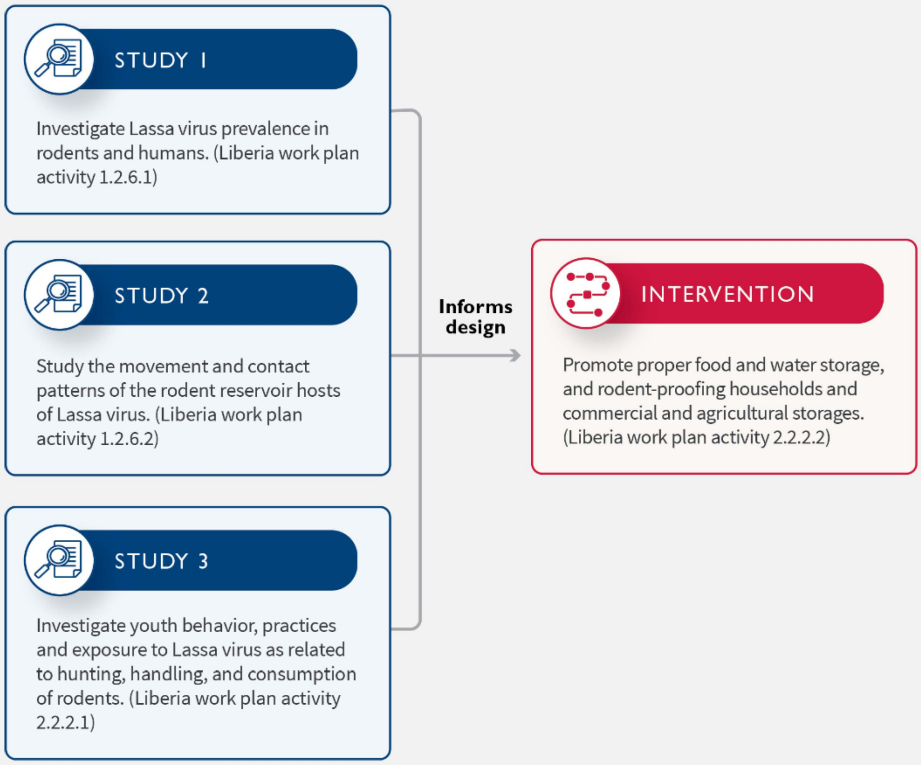


Studies in Liberia

Liberia's work plan focuses on a core intervention, the designs of which is informed by three studies (Box 4). Action plans for the three studies were developed by the country team and global technical colleagues. Two OH-DReaM working groups were established to conduct the studies (Annex 1). One OH-DReaM working group was formed to design and conduct study 1 and study 2, and another formed to design and conduct study 3. As Project Year 2 drew to a close, design of each study was ongoing.

Box 4. STOP Spillover studies in Liberia, and how they inform the design of risk-reduction activities.

Study 1 Concept: In Liberia, Lassa fever cases have predominantly been reported within the "Lassa belt" (Bong, Lofa and Nimba counties), but evidence suggests that the true distribution of Lassa fever in Liberia extends well beyond the Lassa belt. The multimammate rat (*Mastomys natalensis*), the reservoir host of Lassa virus, is found across Africa, including in Liberia. Besides *M. natalensis*, Lassa virus has been detected in *M. erythroleucus*, *Rattus rattus*, *Hylomyscus pamfi* and *Mus baoulei*, but the role these species have in transmission of Lassa to humans is not known. This study focuses on all rodent species interacting closely with humans. If Lassa virus is present in the rodents but human cases are not occurring, research into why spillover is occurring within the Lassa belt, but not outside of it, could provide important insights into how to reduce or prevent spillover within the Lassa belt. Data from this study will inform the development of strategies for rodent-proofing households and storage buildings.



Study 2 Concept: A better understanding of the movement and contact patterns of the Lassa virus reservoir hosts can help inform the development of efficient non-lethal rodent control strategies. The goal of this study is to understand the distribution of rodent populations, if/how they mix with other populations, and seasonal differences in rodent movements (e.g., if rodents move from agricultural fields into dwellings and storage areas post-harvest). Data from this study will inform the development of strategies for rodent-proofing households and storage buildings.

Study 3 Concept: Rodent hunting is a particular activity for youths (10 to 20 years old) in Liberia, which is a potential risk factor for Lassa virus exposure. While hunting represents one potential source of Lassa virus exposure, practices and conditions associated with the preparation and consumption of hunted rodents within households and communities are also likely to increase risk. The goal of this study is to identify risk factors for spillover of Lassa virus from rodents to humans by better understanding the knowledge, activities, practices, and environmental conditions at household and community levels. An enhanced understanding of the drivers, practices and health status of community members who hunt, prepare and consume rodents will inform the development of strategies for rodent-proofing households and storage buildings.

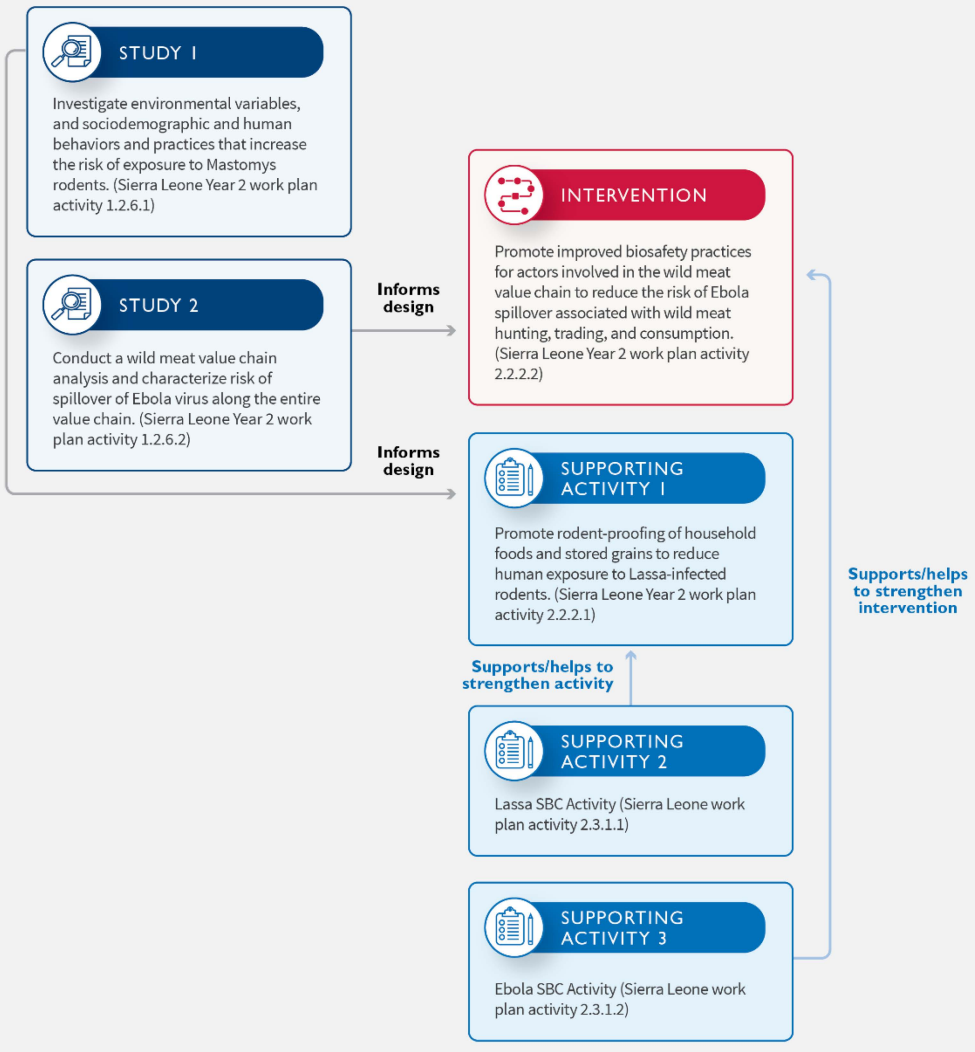
Studies in Sierra Leone

Sierra Leone's work plan focuses on a core intervention and three supporting activities, the designs of which are informed by two studies (Box 5). Since the completion of OM and Sierra Leone's ISSP, the country team established three OH-DReaM working groups with the relevant expertise to design and implement the two studies (Annex 1). As Project Year 2 drew to a close, action plans for the two studies were being finalized, laying out the work that the OH-DReaM working groups will pursue and the corresponding timelines.

Box 5. STOP Spillover studies in Sierra Leone, and how they inform the design of risk-reduction activities.

Study 1 Concept: Very few studies have investigated the short and long-term impacts of environmental conditions (e.g., temperature, humidity, rainfall), human behaviors and practices (e.g., land use patterns/changes, crop harvesting/storage, food waste management and burning practices, rodent hunting/control and consumption behavior), and rodent Lassa virus incidence on Lassa transmission, dynamics, and control. The goal of this study is to explore environmental determinants of household rodent abundance, and the connection between rodent abundance and the risk of zoonotic spillover of Lassa virus. Data from this study will be used to inform the design of activities to reduce human exposure to *Mastomys* rodents.

Study 2 Concept: Wild meat associated with Ebola in Sierra Leone include duikers, non-human primates and bats. Wild meat hunters in Sierra Leone are not species-specific for the animals they hunt. The goal of this study is to identify and categorize high-risk contact points along the wild meat value chain that represent potential spillover risks of Ebola virus. Data from this study will inform the design and implementation of cost effective, culturally acceptable safety and prevention measures to mitigate the spillover of Ebola virus.

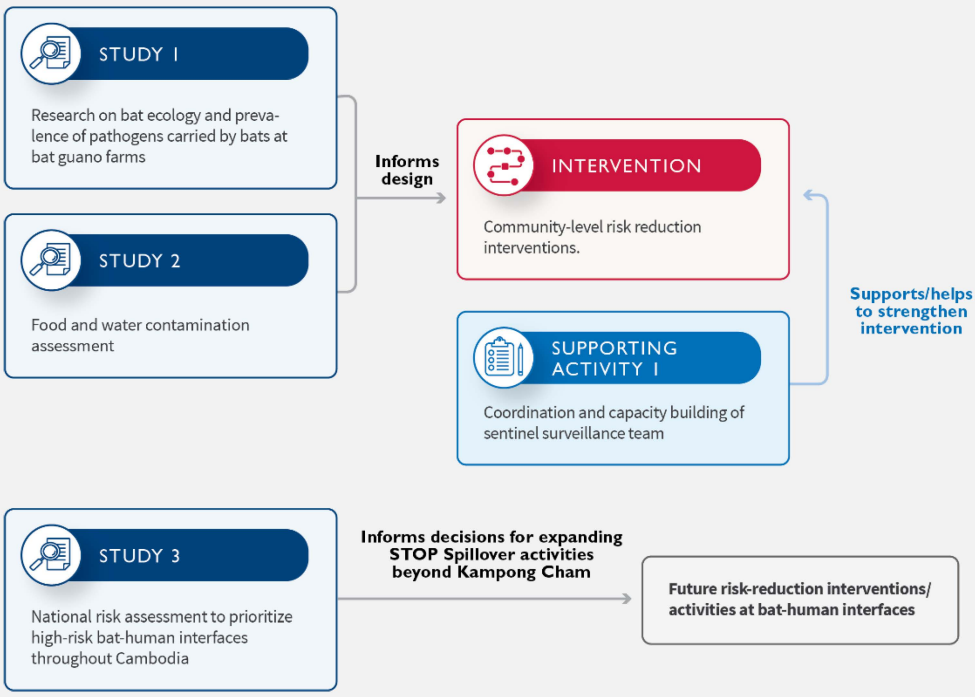


Studies in Cambodia

Following Cambodia's interface-level OM, the ISSP was conducted in late July. The recommended package of risk-reduction activities and aligned studies that emerged from Cambodia's ISSP – focusing on a core intervention and one supporting activity, the designs of which are informed by two studies, complemented by a third study to explore potential bat-human interfaces beyond Kampong Cham province (Box 6) – received concurrence from USAID during this reporting period. As Project Year 2 drew to a close, the focus for STOP Spillover in Cambodia was the establishment of OH-DReaM working groups and the development of action plans for the three studies.

Box 6. STOP Spillover studies in Cambodia, and how they inform the design of risk-reduction activities.

Study 1 Concept: The OM process in Cambodia led to bat guano farms in Kang Meas district, Kampong Cham province, being prioritized as the high-risk interface for STOP Spillover to initiate activities. However, stakeholders at OM identified knowledge gaps about bat species, pathogens, distribution, and scale of the bat guano farms in Kang Meas district. The goal of this study is to fill these knowledge gaps by documenting the bats species at the bat species at guano farms and the viruses they harbor, and the scale of the bat guano industry in Kang Meas district. Data from this study will inform the design of interventions to reduce the risk of spillover of zoonotic viruses amongst communities living on or near bat guano farms.



Study 2 Concept: Contamination of food and water intended for human use with bat excrement represents a potential pathway for spillover of zoonotic viruses. The goal of this study is to understand risky practices and behaviors amongst community members that may increase the risk of contamination of their food and water informs the design of interventions to mitigate those risks. Data from this study will inform the design of interventions to reduce the risk of spillover of zoonotic viruses amongst communities living on or near bat guano farms.

Study 3 Concept: While national-level stakeholder engagement identified the artificial roost bat guano harvest in Kampong Cham province as the first priority interface for STOP Spillover, a broad range of other high-risk bat-human interfaces exists in Cambodia, with a range of different potential spillover risks (e.g., tourism industry disturbing cave-roosting bats) in various locations. The goal of this activity is to gather together stakeholders for a national-level risk assessment process to allow us to gather, synthesize and interpret data to inform potential future work beyond bat guano farms in Kampong Cham.

OH-DReaM Working Groups

OH-DReaM working groups are central to STOP Spillover's plans for sustainable, country-led programming. OH-DReaM working groups are technical groups formed at the country level to address a specific thematic area. Once a work plan for a given country has been endorsed by USAID, OH-DReaM working groups are formed to design, implement and validate interventions to mitigate viral spillover and spread of zoonotic diseases, or close an information or data gap to inform the design of interventions. Led by a STOP Spillover country team member, with a global technical expert serving as a co-lead, and supported by global resource hub subject matter experts in areas relevant to the working group, OH-DReaM working groups comprise key in-country stakeholders and technical experts from the private sector, academia, NGOs and community services organizations (CSOs), as well as representatives from communities at the specific high-risk interface of focus and government officials. Up to five OH-DReaM working groups may be active in a given country, depending upon the activities required to implement the risk-reduction interventions and studies in the country's work plan. Guided by the activities within the approved work plan, each OH-DReaM working group creates its vision and timeline of what it wants to achieve. STOP Spillover has developed standardized processes for establishing and operationalizing OH-DReaM working groups across the countries supported by the project. We have a transparent process for constituting each group and ensuring equitable representation across genders, age, and ethnicity.

Following the approval of Project Year 2 work plans in Uganda, Bangladesh, Viet Nam, and Liberia, the respective country teams began establishing OH-DReaM working groups. Uganda, Bangladesh, and Viet Nam each established five OH-DReaM working groups, with Liberia and Sierra Leone establishing four and three, respectively (Annex 1). Over these five countries, 200 in-country stakeholders are participating on the OH-DReaM working groups. Cambodia initiated this process as the reporting period drew to a close. Côte d'Ivoire, being at a much earlier stage of implementation, will begin the process of forming OH-DReaM working groups early in Project Year 3 after the completion of OM.

Number of local One Health working groups established to design and implement interventions and/or studies: 22

Bangladesh: 5
Viet Nam: 5
Uganda: 5
Liberia: 4
Sierra Leone: 3

Number of in-country stakeholders participating in One Health working groups: 200

Bangladesh: 43
Viet Nam: 43
Uganda: 33
Liberia: 36
Sierra Leone: 44

Surveillance

Designing, implementing and validating effective interventions to reduce the risk of spillover, amplification and spread requires supporting surveillance. Much of STOP Spillover's biological sampling and laboratory testing activities will be tailored to the specific interfaces and interventions of focus in each of our countries. While surveillance that contributes to informing and assessing our intervention strategies is a priority, we will also incorporate surveillance activities outside the strict limits of specific interventions and related studies with the goal of strengthening in-country capacity to detect and mitigate the risk of spillover of prioritized pathogens. STOP Spillover aims for surveillance activities to be implemented in partnership with relevant in-country stakeholders leveraging existing in-country capacity and reinforcing One Health approaches.

During Project Year 2, STOP Spillover surveillance activities focused on (i) assessing in-country surveillance capacity to develop a more thorough understanding of existing surveillance systems, personnel and information collection activities; (ii) developing novel diagnostic tools in support of building viral surveillance platforms; (iii) planning wastewater surveillance strategies; and (iv) developing a comprehensive strategic plan for spillover surveillance and monitoring.

Surveillance Assessments

Conducting surveillance assessments increases STOP Spillover's understanding of existing surveillance resources with respect to systems, networks, personnel, expertise, and capacities. Surveillance assessments build on current activities, identify gaps at the country level, and ultimately, propose solutions toward achieving project goals while adding value to national protocols.

During Project Year 2, surveillance assessments were initiated in Liberia, Bangladesh, Viet Nam, Sierra Leone, and Cambodia (Uganda's surveillance assessment was completed in Year 1, and Côte d'Ivoire's will be initiated at the outset of Project Year 3). The surveillance assessment for Sierra Leone has been completed; those for Liberia, Bangladesh, Viet Nam, and Cambodia will be completed early in Project Year 3.

Novel Diagnostic Tools

STOP Spillover partner, the Broad Institute, leads the project's work on the development of diagnostic tools in support of building viral surveillance platforms. Working closely with surveillance experts from STOP Spillover's Surveillance, Mapping and Modeling resource hub, the Sabeti Lab from the Broad Institute has focused on the development of best-in-class PCR assays for all pathogens prioritized by STOP Spillover, as well as point-of-care (POC) assays for filoviruses (Marburg and Ebola) and Lassa using clustered regularly interspaced short palindromic repeats (CRISPR) technology.

PCR assays are currently the most widely used nucleic acid testing available for pathogen surveillance and detection. During Project Year 2, the Sabeti Lab experimentally validated PCR assays for the following viruses: Ebola, Marburg, Lassa, Nipah, SARS-CoV-2, and Influenza A. The PCR assay for influenza A has so far been developed only for low pandemic avian influenza (LPAI) strains. The team is overcoming challenges with the assay for highly pandemic avian influenza (HPAI) strains. To maximize the utility of these PCRs and make them compatible with various types of samples collected in the field, these assays are being optimized to detect

viruses from a variety of sample types (feces, urine, blood, saliva, and wastewater). During Project Year 2, priority was given to optimizing the PCR assays for SARS-Cov-2, Lassa, and Ebola for fecal and wastewater samples.

Although PCR is a global gold-standard diagnostic tool – diagnosis of infection during the current COVID-19 pandemic uses a PCR assay – there is a continued need for field-deployable, front-line, and highly accurate POC tests. To address this unmet need, the Sabeti Lab has developed SHINE (streamlined highlighting of infections to navigate epidemics), a point of care CRISPR-based assay that can be used in low-resource settings with little-to-no equipment needed. SHINE avoids the need for RNA extraction from samples, is functional at ambient temperature, and maintains the high levels of specificity and sensitivity characteristic of nucleic acid assays. Novel SHINE assays in support of STOP Spillover prioritized pathogens are being developed. In January 2022, work began on designing and validating two SHINE assays: one targeting a range of Lassa viruses, and another targeting viruses from the *Filoviridae* family (Ebola and Marburg viruses). The pan-Lassa SHINE assay was prioritized during Project Year 2.

Wastewater Surveillance

Wastewater surveillance has been shown to provide two-to-three weeks of 'early warning' for various pathogens, including viruses, and to help identify clusters of infection circulating in the population. In the context of STOP Spillover, water monitored for the presence of viruses can include, amongst others: wastewater downstream of population centers, livestock production facilities, wildlife game parks, and water sources (rivers, streams, ponds, etc.) visited by wildlife.

During Project Year 2, work on wastewater surveillance focused on Liberia. For sustainability, STOP Spillover must integrate its planned wastewater surveillance activities with surveillance activities already in place. Project Year 2 efforts by the Liberia STOP Spillover country team to advance wastewater surveillance activities were dominated by meetings with NPHIL to discuss appropriate and cost-effective strategies for wastewater surveillance, including specifics of sample collection (where samples should be collected, by whom, and at what frequency) and sample processing and analysis (where and how samples should be sent for processing and testing, by whom, and testing procedures). Discussions with NPHIL were continuing as Project Year 2 drew to a close. Drafting of a protocol was initiated, which will be finalized early in Project Year 3. STOP Spillover's plans for wastewater surveillance will leverage the PCR assays developed by the Broad Institute (see ***Novel Diagnostic Tools***) and compare these with commercially available assays. Optimization of these PCR assays for Ebola and Lassa using wastewater samples began in Project Year 2.

Strategic Plan for Spillover Surveillance and Monitoring

As part of broader surveillance strategies for Lassa, the STOP Spillover Liberia country team is supporting the development of a framework for a strategic plan for spillover surveillance and monitoring. This activity supports key stakeholders to develop a framework for wildlife surveillance, including the specific actions to be undertaken, anticipated resource needs, and policy frameworks required to conduct a sustainable and effective country-led surveillance strategy for Lassa. The intention is to encourage and empower stakeholders to use

this framework to develop a comprehensive strategic plan for surveillance and monitoring.

To support the development of the framework, the STOP Spillover Liberia country team established a OH-DReaM working group composed of representatives from the STOP Spillover country team, global technical experts, and in-country stakeholders from national and local levels (Annex 1). Between September 19-22, a workshop was convened in Nimba County to define the mission and vision of a strategic plan, discuss opportunities, gaps and challenges experienced by the wildlife sector, and discuss the applicability to Liberia of guidelines from the World Organization of Animal Health (WOAH; formerly Office International des Epizooties (OIE)) for developing wildlife surveillance. The workshop brought together 16 stakeholders from national and sub-national levels, including representatives of NPHIL, MOA, EPA, Liberia Water and Sewer Corporation (LWSC), FAO, IRC, University of North Carolina, and Nimba County Health Team Surveillance Officer.

Next steps for Objective 1

Project Year 2 focused primarily on selecting and designing appropriate studies to fill knowledge gaps identified through the OM process. With the exception of Viet Nam, field work for these studies is only set to begin in Project Year 3. Viet Nam initiated studies in Project Year 2, reports from which will be shared during quarter 2 of Project Year 3.

Another key focus of Project Year 2 was engaging relevant in-country stakeholders to determine appropriate support for surveillance of STOP Spillover prioritized pathogens. The surveillance assessments for Liberia, Bangladesh, Viet Nam, Cambodia and Côte d'Ivoire will be completed in Project Year 3. Work on the PCR and SHINE diagnostic tools will continue in Project Year 3. Once ready for field testing, personnel from NPHIL will be trained how to use the new assays and participate in testing and validating the assays in the field. It is critical that these novel assays deliver the expected results in a real-life setting by the people who will actually use them. The PCR and SHINE assays will be first deployed in Liberia; pending results, decisions will be made around deployment in other countries.

Discussions with NPHIL and other relevant stakeholders will continue with a view towards finalizing the protocol for wastewater surveillance of Lassa virus in Liberia. A similar protocol will serve as the basis for Uganda's strategy for wastewater surveillance of Ebola and Marburg viruses. Once the protocols and partnerships have been finalized in both Liberia and Uganda, wastewater sampling will be an on-going activity throughout Project Year 3 and beyond.

Gender Champions

Gender is a potential risk factor of zoonotic viral spillover. There are differences in the vulnerabilities to – and the impacts of – infection by emerging pathogens among women, men, girls, boys, and non-binary gender groups. To ensure risk-reduction interventions address and mitigate gender-related or gender-specific spillover risks, STOP Spillover's risk analyses include an assessment of gender as a potential risk factor of zoonotic viral spillover. Gender is a cross-cutting area for STOP Spillover, relevant for all three project objectives. In Project Year 2, STOP Spillover began convening country-level gender champions from across the project's seven countries to share experiences and strategies for integrating gender fully into their activities**. Meet STOP Spillover gender champion from Liberia, Kemah Vivian Lymas Tegli.**

Kemah Vivian Lymas Tegli, STOP Spillover's Country Technical Lead for Wildlife, Livestock, Epidemiology, Behavior Change, and Gender Strategy Resource Hub in Liberia, came to the project with 14 years of experience in global health and international development, notably on emergency preparedness and response and gender mainstreaming. Over the past seven years, she has monitored several zoonotic infectious diseases, including COVID 19, Marburg virus disease, and Ebola virus disease. As one of STOP Spillover's country gender champions, Kemah Vivian Lymas Tegli is working to ensure that the gendered impact of the risk of spillover and disease transmission is taken fully into account in Liberia.

What are you doing to incorporate gender into STOP Spillover's work in Liberia? When STOP Spillover activities are being planned and organized across different thematic areas, I work with each technical lead to ensure that women and other minority groups are represented at all levels of the intervention design and implementation stages, to ensure that women's voices are heard in identifying risk and coming up with solutions. I also work directly with the impacted communities to identify influencers who can represent different groups and help ensure we are employing culturally appropriate interventions that are relevant to women, men, girls, and boys. In Liberia, Lassa virus has been identified as the primary pathogen of interest for STOP Spillover. There are gendered labor and livelihood activities which lead to differences in the frequency and type of contact with the reservoir hosts of Lassa virus. During a three-day rat-proofing summit was held in September 2022, discussions around gendered differences in activities and practices were critical to informing the next steps for identifying and characterizing risk of rodent-human transmission of Lassa virus. For example, summit activities informed development of questions for the age- and gender-specific FGDs and KIIs, as well as the items included on observational checklists. Findings from the FGDs, KIIs and observational checklists will guide the next steps for implementing the intervention to reduce rodent-human contact and transmission.

As part of this effort of incorporating gender locally, what are you most proud of so far? Every time I see a woman raise her hand to give her feedback, I feel extremely proud of the work we are doing, and I am proud that I can empower women and girls to speak up about issues affecting their lives and communities.

ACTIVITIES & ACCOMPLISHMENTS

OBJECTIVE TWO

Monkeys in the Sacred Forest, District des Montagnes, Côte d'Ivoire.
Photo credit: AFROHUN

Objective 2 focuses on assisting countries to design and implement interventions to reduce the risk of priority zoonotic viruses spilling over from animals to people. The risk-reduction activities implemented as part of STOP Spillover are informed by OM and the research conducted as part of Objective 1. STOP Spillover works with country-level partners to design, implement, and validate interventions to reduce spillover. Our validation process will focus on whether interventions are effective, low cost, sustainable, scalable, context appropriate, gender responsive and/or culturally acceptable. This section outlines STOP Spillover's achievements and accomplishments for Objective 2 during Project Year 2.

Risk-Reduction Activities at Prioritized Interfaces

Activities conducted under Objective 1 focus on understanding the risk of spillover of zoonotic viruses at specific high-risk animal-human interfaces, while activities conducted under Objective 2 focus on utilizing that improved understanding to develop and test interventions that reduce the risk of spillover. Evidence-based interventions contextualized to specific interfaces that account for cultural, gender, economic and other factors are needed to reduce spillover of zoonotic viruses from animals to people. STOP Spillover prioritizes interventions that are most likely to be sustainable at a point in the future when there is no external funding.

During Project Year 2, STOP Spillover convened an ISSP (see box ***How STOP Spillover prioritizes risk-reduction interventions and studies***) for six countries (Uganda, Viet Nam, Bangladesh, Liberia, Cambodia, and Sierra Leone) to select the package of activities – risk-reduction activities and aligned studies to inform their design – for each country. In this section we briefly describe the risk-reduction activities and their current status (studies are described in ***Studies at Prioritized Interfaces***).

Risk-Reduction Activities in Uganda

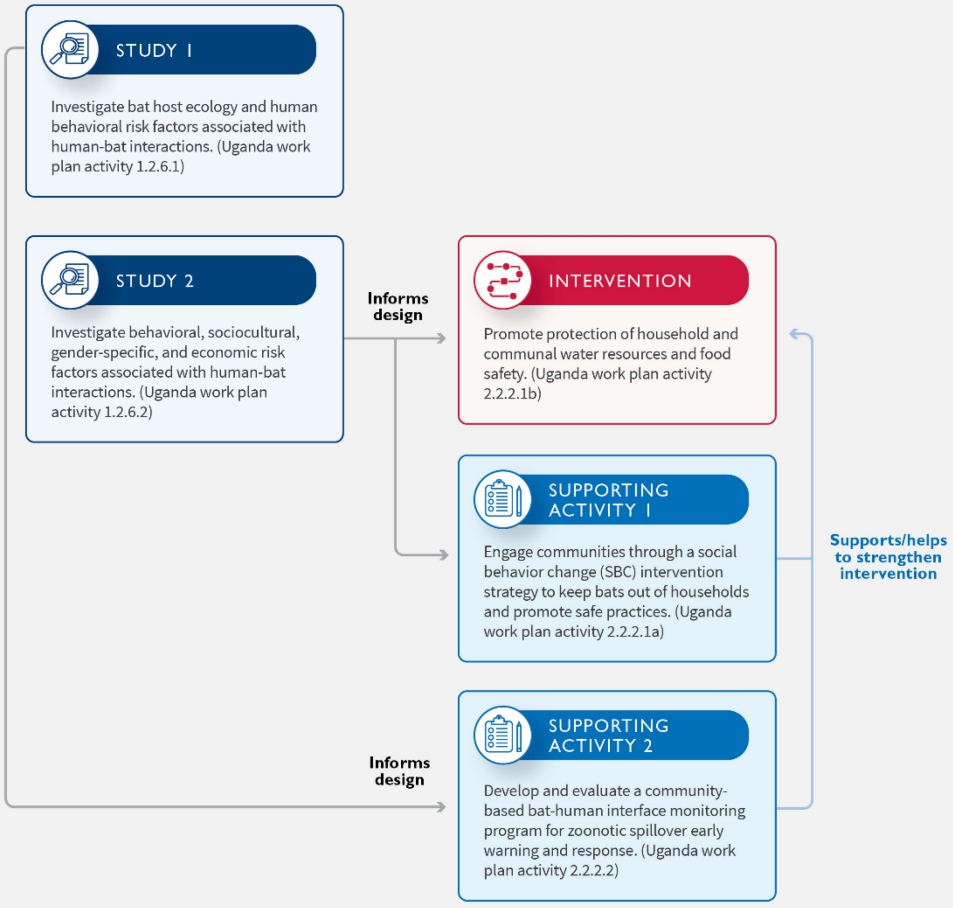
The risk-reduction activities included in Uganda's work plan comprise a core intervention and two supporting activities, the designs of which are informed by two studies (Box 7). A OH-DReaM working group for each of the three risk-reduction activities was established (Annex 1). The three OH-DReaM working groups developed a detailed action plan for their respective activities, laying out the work that the groups will pursue and the corresponding timelines. Ethical approval was obtained from the IRBs of both Tufts and Makerere University School of Public Health.

Box 7. STOP Spillover risk-reduction activities in Uganda.

Intervention Concept: A common way that people are exposed to bat excrement is through unprotected water collection and storage containers. If water containers are left open, especially during the day when bats are at rest, bats can urinate and defecate in them. The same applies to communal water resources such as free-standing wells and surface water. OM highlighted that fruit partially eaten by bats, and potentially contaminated by bat saliva and excrement, poses spillover risks that can be mitigated by promoting food hygiene practices. Informed by the findings from Uganda's study 2, this intervention involves selecting practices designed to mitigate the risk of contamination of water and food, and testing and adapting them using Trials of Improved Practices (TIPs). TIPs is a participatory formative research approach developed by the Manoff Group to test and refine potential health interventions on a small scale before promoting them broadly.

Supporting Activity 1 Concept: In Uganda, many households have bats living within their dwellings, usually among roofing materials. Opportunities for contact with infected animals occur on a daily basis. Communities' awareness of the health risks associated with wild animal contact varies but is generally low. This activity involves rolling out an SBC strategy – developed based on the findings from Uganda's study 2 – for addressing practices, behaviors, and norms that put families and communities at risk of viral spillover.

Supporting Activity 2 Concept: Knowledge gaps that emerged from OM included community challenges in identifying bat species known to be potential reservoirs of filoviruses and other zoonotic viruses, which bats roost in houses, caves and agricultural fields, and seasonal variations for different bat species. Informed by the findings from our Uganda's study 1, this activity involves developing a participatory bat monitoring program centered around community-driven participatory mobile-phone-based surveillance.



The country team organized a series of meetings with stakeholders from district and sub-county level in Bundibugyo District between August 8-12. The purpose of these meetings was to discuss the action plans for the three risk-reduction activities (also for the two studies; see ***Studies at Prioritized Interfaces***) and to mobilize other stakeholders such as women's groups, schools, bat infested households and artisans. The meetings were also instrumental in allowing different district Government of Uganda staff to guide STOP Spillover on the priority villages where the activities should be targeted.

There were delays in initiating field work for the risk-reduction activities. The process of obtaining a waiver from the USAID Mission to allow STOP Spillover to proceed with the OH-DReaM working group model – specifically, ensuring an appropriate incentive mechanism for members in line with other projects in Uganda – took time. This was finalized as Project Year 2 drew to a close, paving the way for implementation of field work.

Risk-Reduction Activities in Viet Nam

The risk-reduction activities included in Viet Nam's work plan comprise a core intervention – the design of which is informed by two studies – and two supporting activities (Box 8). A OH-DReaM working group for each of the three risk-reduction activities was established (Annex 1). The three OH-DReaM working groups developed detailed action plans for their respective activities, laying out the work that the groups will pursue and the corresponding timelines. Where necessary, ethical approval was obtained from the IRBs of Tufts and Hanoi University of Public Health.

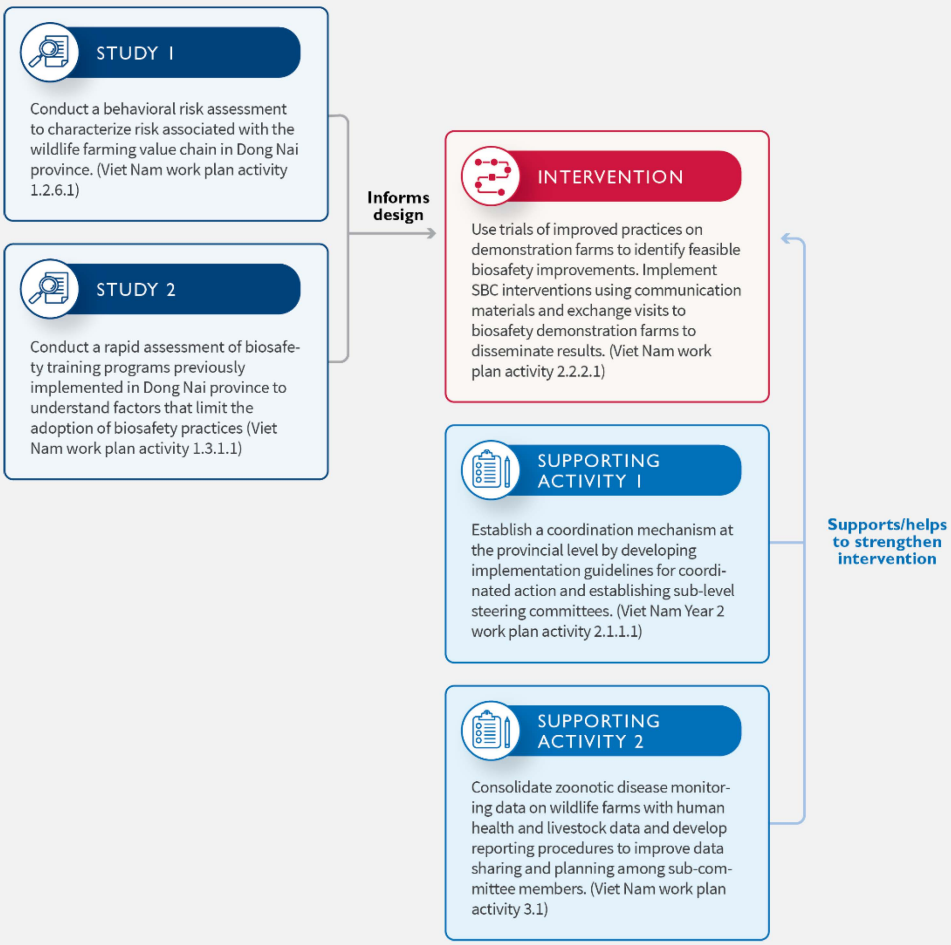
Field work for the core intervention (trials of improved practices) was initiated during this reporting period. The first phase of this intervention utilizes TIPs methodology to inform feasible and practical biosafety improvements to be utilized for the second phase, which involves showcasing these biosafety practices at demonstration farms. Three TIPs are planned, the first of which was conducted in September 2022. Ten wildlife value chain actors (eight farm owners and two workers) from Hieu Liem commune, Vinh Cuu district, in Dong Nai province involved in farming of Sambar deer were brought together to discuss biosafety practices – specifically, use of PPE.

A worker at a Sambar deer farm in Dong Nai Province, Viet Nam, participating in a TIPs. Photo credit: VOHUN

Box 8. STOP Spillover risk-reduction activities in Viet Nam.

Intervention Concept: Biosafety was mentioned repeatedly as a key concern by stakeholders during OM. It was also previously identified as a key concern by the USAID PREDICT project and has been partially addressed by numerous actors in Viet Nam. Informed by the findings from Viet Nam's studies 1 and 2, this intervention involves selecting practices designed to promote biosafety at wildlife farms and testing and adapting them using TIPs methodology.

Supporting Activity 1 Concept: Effective coordination and communication among interface-level stakeholders is critical to ensure rapid response to zoonotic spillover, and to reduce spillover amplification and spread. One Health structures have been developed at the national level but not yet effectively rolled out at the provincial level. Collaboration between human health and animal health sectors in zoonosis prevention and control has been institutionalized in Joint Circulars and decisions issued by the MOH and MARD; however, the roles of different government and non-governmental actors in identifying and responding to zoonotic spillover events is not as clear at the interface level. This activity involves creating coordination guidelines at the provincial level; developing standard operating procedures (SOPs) to inform the function of these local level coordination mechanisms; and establishing sub-level zoonotic disease spillover steering committees to strengthen One Health partnerships.



Supporting Activity 2 Concept: Wildlife disease monitoring data has been identified as an urgent need for wildlife managers, as well as in animal health protection and zoonosis prevention and control by the Government of Vietnam, MARD and Dong Nai PPC. This activity involves strengthening stakeholder capacity for evaluating risk at the interface level and promoting cross-sector sharing of data.

Work for supporting activity 1 (coordination mechanism at the provincial level) was initiated during this reporting period. Beginning in June 2022, the OH-DReaM working group worked with relevant stakeholders in Dong Nai province to draft guidelines for how actors in the One Health sector should coordinate and collaborate. Stakeholders were engaged separately, as well as through a consultation workshop convened in July. The guidelines were developed based on the existing foundation of policies, directives, circulars, and decisions from national and provincial level. The guidelines, including SOPs for informing local level coordination, were approved by DARD and DOH on September 30, 2022.

Work for supporting activity 2 (consolidate zoonotic disease monitoring) was also initiated during this reporting period. Between July and September, the OH-DReaM working group gathered information to inform next steps for consolidating monitoring and improving data sharing amongst stakeholders in the One Health sector in Dong Nai. To assess the current status of zoonotic disease data collection, management, and sharing in Dong Nai province, KIIs were conducted (49 in total) with representatives from DOH, DARD, animal health stations, health stations, district health center, forest protection division, and commune veterinary staff. To identify challenges and gather ideas on solutions to improve the collection, management, and sharing of zoonotic disease data in wildlife and human populations in Dong Nai province, three FGDs were conducted. One FGD targeted provincial-level representatives of DOH and DARD (five participants in total), with two FGDs targeting district-level human and animal health networks and a forest protection division (40 participants in total).

Risk-Reduction Activities in Bangladesh

The risk-reduction activities included in Bangladesh's work plan comprise a core intervention and two supporting activities, the designs of which are informed by two studies (Box 9). A OH-DReaM working group for each of the three risk-reduction activities was established (Annex 1). The three OH-DReaM working groups developed detailed action plans for their respective interventions, laying out the work that the groups will pursue and the corresponding timelines. Ethical approval, where required, was obtained from the IRBs of both icddr,b and Tufts in September.

Extensive stakeholder engagement has been conducted and maintained throughout Project Year 2 to ensure buy-in and a sense of ownership amongst key stakeholders for STOP Spillover activities. For supporting activity 2 (app-based system), the STOP Spillover Bangladesh country team is pro-actively ensuring the sustainability of the app beyond the funding period of STOP Spillover by engaging six key stakeholders to ensure their commitment and willingness to not only work with STOP Spillover to set-up the app, but also to adopt the system and take ownership of it once set-up and testing is complete. The six stakeholders critical for the sustainability of this app – Institute of Epidemiology Disease Control and Research (IEDCR); Department of Livestock Services (DLS); One Health Secretariat (OHS); Bangladesh Forest Department (BFD); Dhaka North City Corporation (DNCC); and Dhaka South City Corporation (DSCC) – were requested to sign a document to indicate their commitment. By the end of Project Year 2, IEDCR, DLS and OHS had signed, and engagements were continuing with BDF, DNCC, and DSCC.

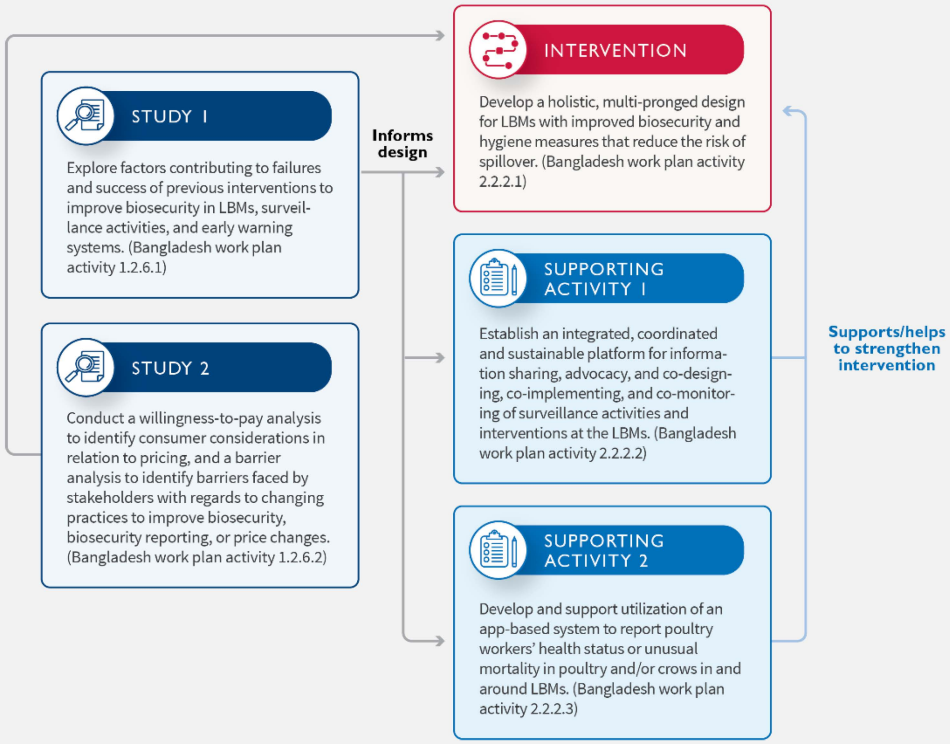
Birds being slaughtered at a live bird market, Dhaka, Bangladesh. Photo credit: icddr.b

Box 9. STOP Spillover risk-reduction activities in Bangladesh.

Intervention Concept: LBMs in Dhaka are typically not designed with biosecurity measures in mind. There is a need to strengthen infrastructure at LBMs to improve biosecurity measures and minimize the risk of spillover of zoonotic viral pathogens. Informed by findings from our Bangladesh's studies 1 and 2, this intervention involves working with international, national and local stakeholders to design infrastructural improvements, biosecurity and hygiene guidelines/SOPs, and biosecurity and hygiene compliance monitoring plans for LBMs.

Supporting Activity 1 Concept: Surveillance activities in the LBMs have been criticized for being conducted in silos, with data not being shared beyond the implementing organizations/institutes or the scientific community. This activity involves supporting local stakeholders to develop a coordinated and sustainable platform for pathogen surveillance in LBMs.

Supporting Activity 2 Concept: Early detection of zoonotic diseases allows for the implementation of early response measures which may reduce loss of human life and economic disruption. This activity involves developing a mobile phone app for workers at LBM's to report their health status or unusual mortality of poultry and/or crows in and near LBMs.



Risk-Reduction Activities in Liberia

Risk-reduction activities in Liberia's work plan focus on core intervention, the designs of which is informed by three studies (Box 10). A OH-DReaM working group was established to design and implement the "rat-proofing" intervention (Annex 1). The OH-DReaM working group developed a detailed action plan and corresponding timeline.

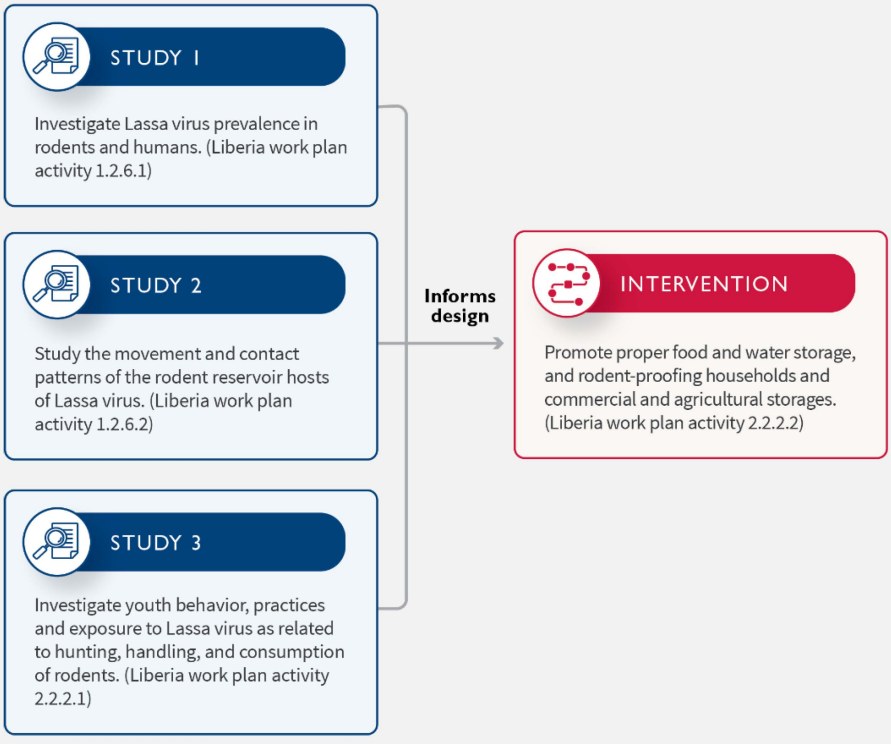
A key activity conducted during this reporting period to directly support this intervention was a "rat-proofing summit" which took place from September 26 – 28, 2022 in Ganta City, Nimba County. The summit provided a participatory platform for in-country stakeholders – including residents of Lassa fever hotspot areas in Nimba County – to discuss rat-proofing strategies, exchange ideas on local construction materials, food and water storage containers, cultural practices, and waste management and sanitation practices. The three-day summit brought together 66 participants (38 from the interface level, 13 from the national level, along with representatives from STOP Spillover [country, regional, and global level]), and USAID). A broad range of sectors was represented by the 51 in-country stakeholders in attendance – government, private sector, partners, community

Participants at the rat-proofing summit, Nimba Country, Liberia
Photo credit: AFROHUN

members, local chiefs and religious leaders, youths, local business owners, academic institutions, and vocational schools. One of the objectives of the summit was to discuss and identify specific locations in Nimba County where this intervention could be implemented. Four locations were prioritized, based on frequent Lassa fever outbreaks: Gloyee, Success, and Blegay Pa communities, and Liberia Products Marketing Corporation. During this summit, key knowledge gaps were identified, and a "Strengths, Weaknesses, Opportunities and Threats" (SWOT) analysis was conducted to better understand and identify (1) technical options and approaches for rat-proofing homes, shops, business areas, and public and healthcare facilities; and for food and water protection from rodents; and (2) waste management and sanitation concerns and practices. Teams also visited the stakeholder-identified intervention sites for observation of the physical environment, local materials available and commonly used, and waste management and sanitation practices. All of these summit activities have been key to informing the final intervention site selection, tools (e.g. FGDs, KIIs and observational checklists) to be used as part of the studies (see ***Studies at Prioritized Interfaces***), and next steps for the intervention.

Box 10. STOP Spillover risk-reduction activities in Liberia.

Intervention Concept: One of the main routes of Lassa virus transmission is through the contamination of food, water or household items with rodent saliva, urine or feces. Rodent-proofing of homes, commercial buildings, and agricultural storage areas, and storing food and water in rodent-proof containers helps to discourage rodent entry, invasion and contamination. Informed by findings from Liberia's studies 1, 2 and 3, this intervention involves reducing rodent-human interactions by preventing rodents from entering space where humans live or store their food/water.



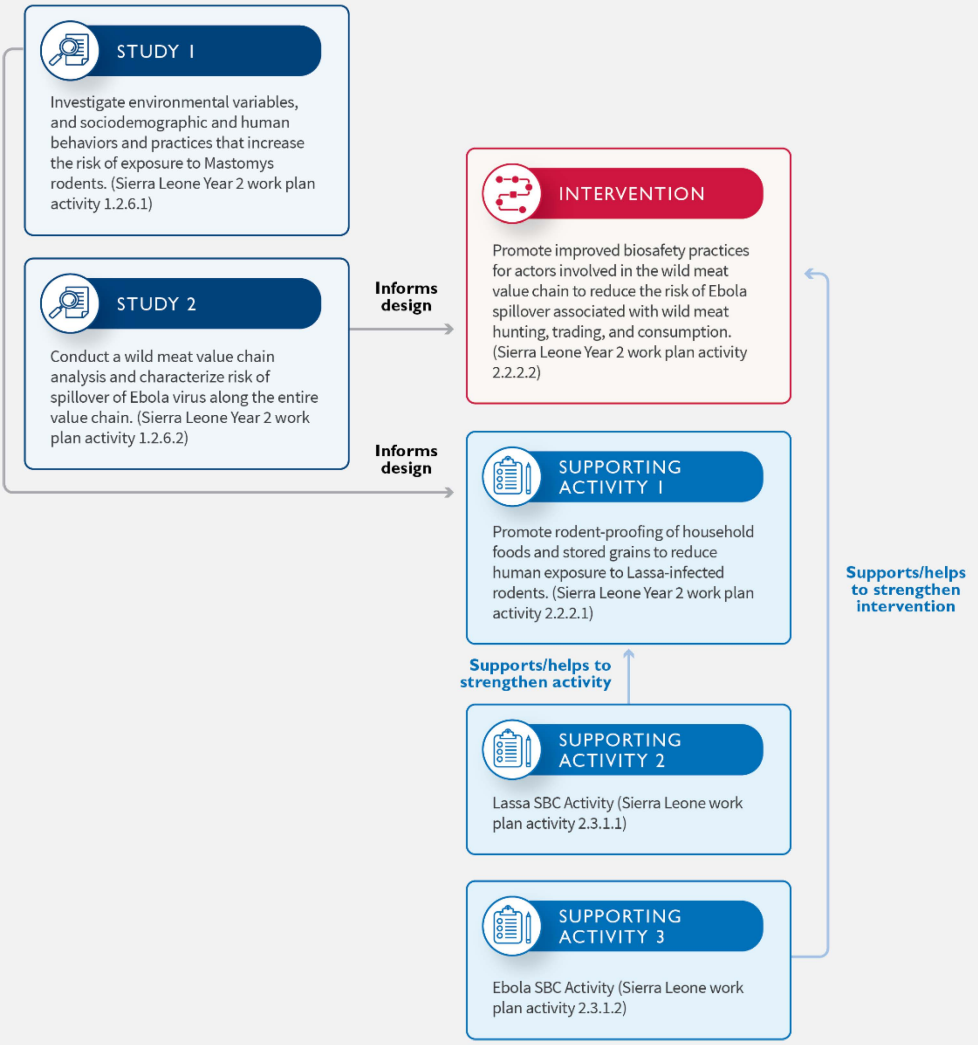
Risk-Reduction Activities in Sierra Leone

The risk-reduction activities included in Sierra Leone's work plan comprise a core intervention and three supporting activities, the designs of which are informed by two studies (Box 11). Since the completion of OM and Sierra Leone's ISSP, the country team worked towards establishing OH-DReaM working groups with the relevant expertise to design and implement the interventions. As Project Year 2 drew to a close, action plans were being finalized, laying out the work that the OH-DReaM working groups will pursue and the corresponding timelines.

Box 11. STOP Spillover risk-reduction activities in Sierra Leone,

Intervention Concept: Actors involved in the wild meat value chain are considered at high risk of infection with the Ebola virus. Informed by findings from Sierra Leone's study 2, this intervention involves the promotion of safe wild meat handling practices to reduce the risk of Ebola virus transmission.

Supporting Activity 1 Concept: Rodents often gain entry and aggregate in rural dwellings, contaminating food for human consumption with their saliva, urine or feces. Studies have shown that effective control of *Mastomys* rodents within rural households can be achieved by improving grain storage systems. Informed by the findings from Sierra Leone's study 1, this activity involves collaborating with local stakeholders and communities to develop locally-appropriate improved grain storage systems to reduce rodent access to stored grains, thereby reducing human exposure to rodents potentially harboring Lassa virus.



Supporting Activity 2 & 3 Concept: There has been limited formative research and few SBC tools and approaches designed specifically to prevent or reduce Lassa and Ebola virus spillover risks. SBC tools and approaches are most effective when they employ a range of approaches at different levels (interpersonal communication, social mobilization, structural interventions, etc.) and are tailored to specific audience segments, based on demographic, psychographic and behavioral factors. The overall goal of these two supporting activities is to develop effective and evidence-based SBC strategies to promote improved food safety and biosafety practices.

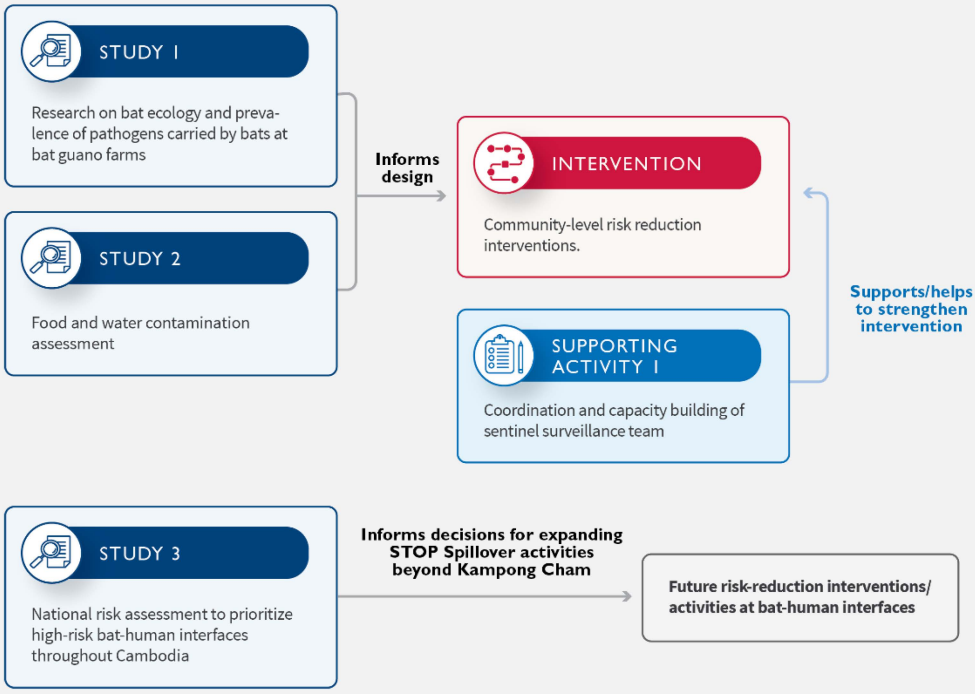
Risk-Reduction Activities in Cambodia

The recommended package of risk-reduction activities and aligned studies that emerged from Cambodia's ISSP – a core intervention and one supporting activity, the designs of which are informed by two studies, complemented by a third study to explore potential bat-human interfaces beyond Kampong Cham province (Box 12) – received concurrence from USAID towards the end of Project Year 2. As Project Year 2 drew to a close, the country team worked towards establishing OH-DReaM working groups with the relevant expertise to design and implement the risk-reduction activities, and action plans were being finalized, laying out the work that the OH-DReaM working groups will pursue and the corresponding timelines.

Box 12. STOP Spillover risk-reduction activities in Cambodia.

Intervention Concept: OM revealed poor knowledge of spillover risk and a number of high-risk practices and behaviors at bat guano farms and in surrounding communities. Informed by Cambodia's studies 1 and 2, this intervention uses TIPs methodology to identify feasible interventions and related SBC activities to improve biosafety and risk-reduction practices and behaviors of bat guano producers and their communities.

Supporting Activity 1 Concept: OM in Kampong Cham province highlighted limited surveillance activities – and limited capacity for conducting surveillance – for zoonotic diseases. For the zoonotic disease surveillance that is implemented, OM highlighted inadequate coordination among national and sub-national levels, and limited cross-sectoral engagement, which results in significant delays in flow of information pertinent to zoonotic disease. A Zoonosis Technical Working Group (Z-TWG) was formed to coordinate zoonosis surveillance across Cambodia. Although recognized by line ministries, the Z-TWG has not been officially institutionalized via a joint circular nor has it been fully integrated into the decision-making process. It is currently inactive, leading to lack of coordination and collaboration among the stakeholders from human, animal and environment sectors. The overall goal of this activity is to support the reactivation of the Z-TWG and strengthen its capacity to function as a sentinel surveillance team at the community level to enable rapid detection of – and fast response to – spillover at the bat-human interface in Kampong Cham province.



Artificial bat roost, Kampong Cham Province, Cambodia. Photo credit: CAMBOHUN

Next steps for Objective 2

The detailed design of most risk-reduction activities across STOP Spillover will be informed by data collected through aligned studies conducted under Objective 1. With the exception of Viet Nam, these studies are set to begin in Project Year 3. Early stages of the design process for risk-reduction activities may overlap with ongoing studies and may utilize preliminary data, if appropriate.

Viet Nam initiated studies and risk-reduction activities in Project Year 2. Two more TIPs are planned as part of Viet Nam's intervention. The choice of the biosecurity practices to test is dependent on the analysis of data gathered from the two assessments conducted in Viet Nam at the end of Project Year 2 (see Viet Nam's study 1 and 2 in ***Studies at Prioritized Interfaces***) and prioritization by local stakeholders. The guidelines developed as part of Viet Nam's supporting activity 1 to improve the coordination and collaboration of stakeholders in the One Health sector in Dong Nai province were approved by Dong Nai's DOH and DARD at the very end of Project Year 2. In quarter 1 of Project Year 3, the team in Viet Nam will develop a plan for dissemination of the guidelines to all administrative levels in Dong Nai province and will work with a range of stakeholders to encourage compliance for these guidelines. A framework for monitoring improved information sharing and evidence-based decision-making based on the guidelines will be developed. For Viet Nam's supporting activity 2, data collected from the KIIs and FGDs conducted in the final quarter of Project Year 2 are currently being synthesized by the country team, OH-DReaM working groups and global technical experts from STOP Spillover. A report will be shared in quarter 2, Project Year 3, which will inform next steps for this activity.

ACTIVITIES & ACCOMPLISHMENTS

OBJECTIVE THREE

Bats flying in Sierra Leone.
Photo credit: Bruno Chavez Ghersi

Recognizing that it will not be possible to prevent all spillover events from wildlife, Objective 3 focuses on assisting countries to limit the impact of spillover events should they occur. Minimizing the amplification and spread of zoonotic viruses within a human population, and containing the spillover event as much as possible, will limit the public health impact. During Project Year 2, priority was given to activities under Objective 1 and 2. This section outlines STOP Spillover's achievements and accomplishments for Objective 3 during Project Year 2.

Media Capacity Strengthening

The role of STOP Spillover's partner Internews is to work with local media organizations and networks to strengthen the capacity of local journalists, support their content production, and spread timely and accurate news and information about zoonotic spillover and how to prevent it. This aims to enhance local media and journalist understanding of risk, including specific risks relevant to STOP Spillover priority pathogens and interfaces. Ultimately, communities at the prioritized interface and at risk of spillover will benefit from improved access to information through media sources about the risk of spillover and ways to prevent it.

Journalists and communicators from all STOP Spillover countries were selected through a competitive process in Project Year 2 to receive small grants and mentorship to publish or broadcast at least one story in a mainstream media outlet with a large audience base. This will allow the communicator to gain confidence and serve as a resource for their organization to build skills for reporting related to infectious disease and health risks. Grants were awarded to 11 local journalists across all seven priority countries. Mentors from Internews were assigned to guide the selected grantees to produce locally relevant, informative and gender-balanced stories with specific focus on STOP Spillover priority viral zoonotic pathogens.

Internews also worked with AFROHUN to organize a webinar aimed at journalists. This webinar, entitled ***"Two Viral Zoonotic Diseases Journalists Should Know About: A Webinar on Lassa Fever and Nipah Virus"***, explored the science behind Lassa and Nipah viruses, highlighted the challenges journalists face while reporting and shared tips on how to cover these outbreaks effectively. Two of the four panelists were from the STOP Spillover Liberia country team, which provided expert insight for Lassa fever.

Outbreak Response Scenario Planning

STOP Spillover partner University of Nebraska Medical Center (UNMC) worked with selected country teams to draft country-specific exercise scenarios for use by in-country stakeholders involved in outbreak management preparedness and response activities. These scenarios are not meant to impose or assert a prescribed response framework. Rather, they are intended to serve as tools in the routine course of preparedness activities to start conversations on current situations as well as best practice of One Health outbreak risk management. They provide a common frame of reference for in-country stakeholders to discuss capacities and their employment through a One Health lens, preparing them to consider operational requirements of integrated One Health coordination. This activity facilitates development of skills associated with outbreak management. Practice leads to readiness.

To serve as useful tools for in-country stakeholders involved in outbreak risk management, these scenarios need to be contextualized. Through an iterative process, UNMC worked closely with STOP Spillover country teams to identify and elaborate on facets incorporated into scenarios (geography including travel times, environmental aspects, populations involved, resources available, and conventional host-pathogen-environment-vector-interactions). This relied upon lessons learned from previous risk management events coupled with project teams' extensive local knowledge. Where appropriate, country teams conferred with outbreak risk management stakeholders.

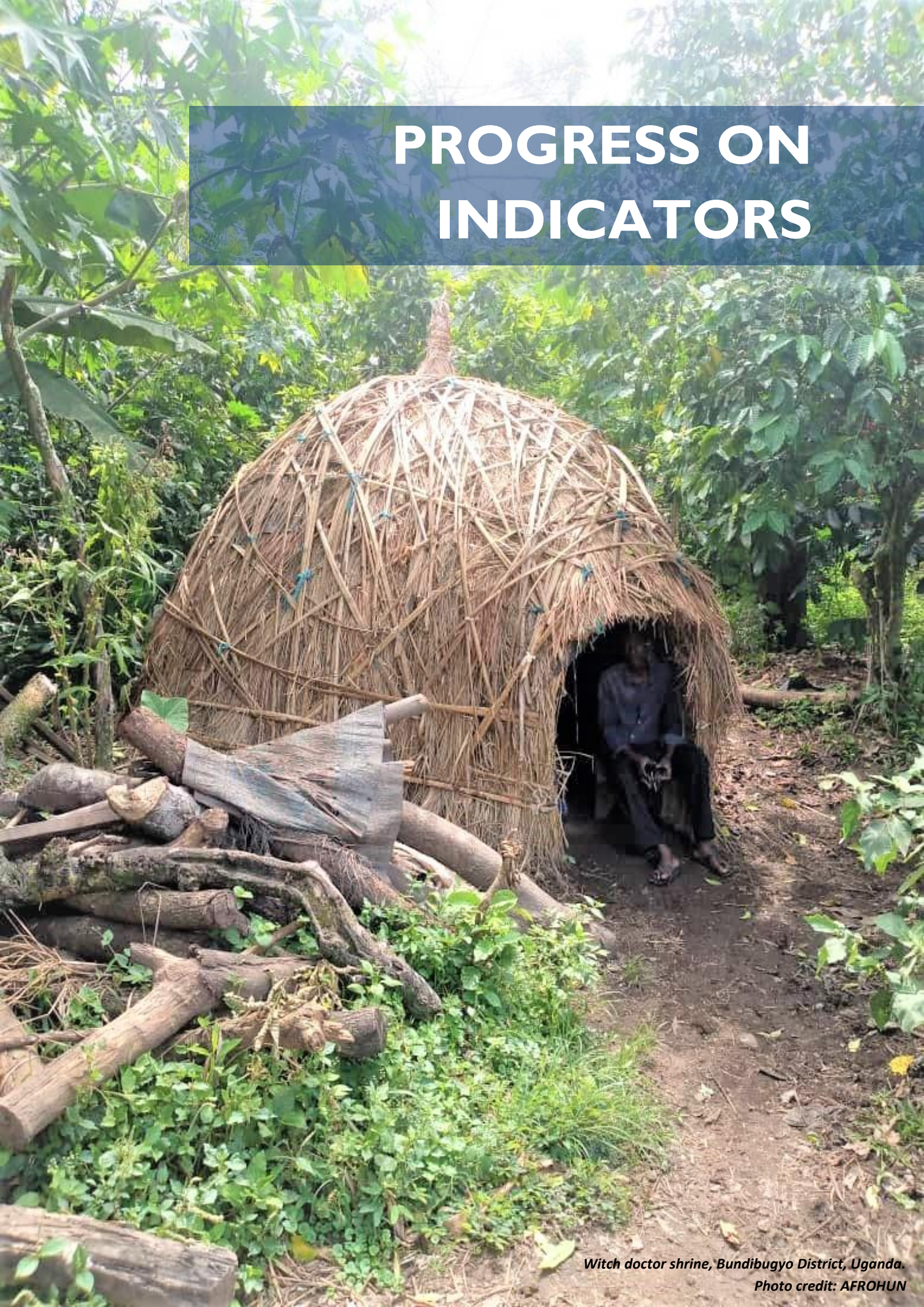
Next Steps for Objective 3

In Project Year 3, assigned mentors from Internews will work with each grantee to develop their skills in communication of zoonotic risks and to begin to build a network of contacts important to timely reporting in this area. The stories will be published or broadcast by the end of quarter 1.

In Project Year 3, Internews will initiate a related capacity strengthening activity for media organizations, distinct from the call to individual journalists in Year 2. Internews will solicit applications for capacity-strengthening projects that seek to train journalists and other communicators in select countries as to how to cover zoonotic diseases and ways to prevent the spread of dangerous pathogens. At least three media training projects focused on One Health will be selected for implementation under the supervision of Internews and in collaboration with the relevant country teams.

Select country teams may continue to perform the iterative process of refining scenarios for One Health outbreak risk management into Project Year 3. The next phase of development involves further in country stakeholder engagement by country teams. In Cambodia, the scenario will be further developed for use in an embedded tabletop exercise in a workshop with in-country stakeholders involved in outbreak risk management at the bat-human interface in Kampong Cham. Planned for quarter 4 of Project Year 3, this workshop will assist stakeholders in scoping the operational requirements of integrated One Health coordination, with a focus on within-province, province-to-national, and human and animal health coordination aspects. In addition to further elaboration and stakeholder engagement to refine the scenario for this purpose, tools for conducting this specific exercise will be developed. They may serve as a template for other country teams that pursue similar activities.

PROGRESS ON INDICATORS



Witch doctor shrine, Bundibugyo District, Uganda.
Photo credit: AFROHUN

STOP Spillover's Activity, Monitoring, Evaluation, and Learning Plan (AMELP) defines a set of key performance indicators (KPIs) for the project. Progress on KPIs is described in Table 1. Project Year 2 focused primarily on selecting and designing interventions and aligned studies, with actual implementation set to begin in Project Year 3. Accordingly, the majority of indicators do not have progress to report at this point in the project because there has not been data to track. Tracking of more indicators will increase when more activities are implemented.

Table 1. STOP Spillover KPIs. Progress during Project Year 2 is shown in the PY2 column. Progress updates are only included if implementation commenced for a given activity and data collection began during Project Year 2.

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
Objective 1: Strengthen country capacity to monitor, analyze and characterize the risk of priority emerging zoonotic viruses spilling over from animals to people										
1.a	% of unique individuals whose capacity has been strengthened to monitor and address spillover issues	# of unique individuals attending trainings and other capacity building activities achieving proficient or higher in skills assessments / # individuals attending trainings and other capacity building activities	Training rosters, trainee surveys	Quarterly	Annual	Region, Country, Training Type, Gender, Sector,	Outcome	–	--	
1.b	% of risk-based surveillance activities that generate evidence about the spillover ecosystem	# of risk-based surveillance activities generating evidence / total # of risk-based surveillance activities	Wastewater, surveillance data	Semi-annual	Annual	Virus, country	Outcome	–	--	
1.c	# of laboratory and field-based surveillance activities that incorporate innovative assay technology for detection of known zoonotic viruses in animals	# of laboratory and field-based surveillance activities that incorporate innovative assay technology for detection of known zoonotic viruses in animals	Surveillance data	Semi-annually	Annually	Species, virus, country	Outcome	–	--	
1.d	% of wastewater surveillance activities that capture signals of zoonotic pathogens of public health importance	# of wastewater activities detecting zoonotic priority viruses / total # of wastewater activities	Wastewater surveillance data	Semi-annually	Annually	Virus, country	Outcome	–	--	
Strategy 1.1 Participatory Outcome Mapping for stakeholder and gap analysis										
1.1.a	# of OM related activities engaging national and community stakeholder knowledge, priorities, and perspectives	# of OM activities (workshops/meeting) leveraging national and community stakeholder knowledge, priorities, and perspectives	Activity documentation; OM journals	Annual	Annual	Region, country, location	Output	6	14	Cambodia - 2 Sierra Leone - 4 Liberia - 1 Bangladesh - 3 Vietnam - 3 CDI – 1
1.1.b	# of unique stakeholders engaged through OM process	# of organizations/groups participating in the OM processes	Internal project records, OM workshop reports	Semi-annual	Semi-annual	Region, country, Sector, Gender	Output	214	594	

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
Strategy 1.2. Characterize risk associated with spillover, amplification and spread, using One Health-Design Research and Mentorship (OH-DReaM) working groups										
1.2.a	# of unique sectors included in OH-DReaM working groups conducting hypothesis-driven epidemiological, ecological, behavioral and socio-economic studies	# of unique sectors included in OH-DReaM working groups conducting hypothesis-driven epidemiological, ecological, behavioral and socio-economic studies	Project documents	Semi-annual	Annual	Region, country, Sector	Outcome	–	5	
1.2.b	# risks of spillover, amplification or spread, identified by OH-DReaM working groups	# risks of spillover, amplification and spread, identified by OH-DReaM working groups	Project reports, publications	Annual	Annual	Region, country, Sector	Outcome	–	–	
Strategy 1.3. Support Country Teams, OH-DReaM Working Groups, and other stakeholders with training, courses, and mentorship										
1.3.a	# of new/amended virtual courses developed and conducted	# of new/amended virtual courses developed and, conducted	project reports, Training materials	Semi-annual	Semi-annual	Course Topic	Output	–	–	
1.3.b	% of trainees and mentees who report using new knowledge and skills to address spillover risks	# of One Health STOP Spillover virtual course and training attendees who report using new knowledge and skills to address spillover risks / # of One Health STOP Spillover trainees and mentees	Trainee follow-up surveys	Semi-annual	Annual	Region, country, sex/gender	Output	–	–	
Strategy 1.4 Targeted Strengthening of Risk-Based Surveillance										
1.4.a	# of labs relevant to the objectives of STOP Spillover	# of individual labs relevant to the objectives of STOP Spillover	Project reports	Annual	Annual	Region, country, type (animal, human, enviro, other)	Outcome	–	–	
1.4.b	% of labs relevant to the objectives of STOP Spillover with increased capacity for diagnostics, biosecurity management, and other activities related to target pathogens	# of labs with increased capacity for target pathogens	Laboratory surveys	Annual	Annual	Region, country, type (animal, human, enviro, other)	Outcome	–	–	
1.4.c	# and type of surveillance activities being implemented	# and type of new surveillance activities being implemented	Surveillance reports	Monthly	Semi-annual	Region, country, virus, method	Output	1	5	Surveillance assessments initiated in 5 countries in Y2 (BG, VN, CM, LB, SL), but only finalized in 1 (SL)

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
1.4.d	# of wildlife and ecological surveillance activities reporting data to national surveillance systems	# of wildlife and ecological surveillance activities reporting data to national surveillance systems	Surveillance reports	Annual	Annual	Region, country, method (active, passive, syndromic)	Outcome	–	–	
1.4.e	# of individuals trained to use innovative assay technology	# of individuals trained to use Custom PCR and/or CRISPR assay technology and integrate these skills into practice	Activity reports	Semi-annually	Semi-annually	Region, country	Output	–	–	
1.4.f	% of labs integrating innovative assay technology into practice	# of labs reporting use of Custom PCR and/or CRISPR assay technology during reporting period/ # of labs trained in innovation assay technology	Activity reports	Semi-annually	Semi-annually	Region, country	Output	–	–	
Strategy 1.5 Supporting the Development of a One Health Information Assessment Tool (OHIAT)										
1.5.a	# and instances of use of the OHIAT tool in STOP Spillover focal countries	# and instances of use of the OHIAT tool in STOP Spillover focal countries	OHIAT documentation; Google Analytics	Annual	Annual	Region, country	Output	–	1	Vietnam activity 3.1
1.5.b	# of OHIAT downloads, website visits, requests for OHIAT technical support	# of OHIAT downloads, website visits, requests for OHIAT technical support	Google Analytics; website requests data	Annual	Annual	Region, country,	Output	–	–	
Objective 2: Strengthen country capacity to develop, validate, and implement interventions to reduce risk of priority emerging zoonotic viruses spilling over from animals to people										
2.a	# of unique individuals whose capacity has been strengthened to develop, validate, and implement interventions to reduce risk of priority emerging zoonotic viruses spilling over from animals to people	# of unique individuals whose capacity has been strengthened to develop, validate, and implement interventions to reduce risk of priority emerging zoonotic viruses spilling over from animals to people	Intervention documentation, training data, post-training surveys	Annual	Annual	Training Type, Gender, Sector, region, country	Outcome	–	–	
2.b	# of community groups and other stakeholders that have increased capacity to implement interventions, policies and regulations to reduce spillover of priority emerging zoonotic viruses	Increased capacity measured based on evidence gathered in Y2-5	Annual self-report survey, assessments, semi-structured interviews	Annual	Annual	Region, country, Sector, Training Type	Outcome	–	–	

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
2.c	% of submitted papers which first and senior authors are country national	# of country national first/senior authors/ total number of manuscripts submitted	Reports and publications tracker	Semi annual	Annual	Region, Country, gender	Outcome	–	–	
Strategy 2.1: Promote effective policies and regulatory changes that enhance understanding and reduction of risk of zoonotic viral spillover, amplification and spread										
2.1.a	# policies and practices recommended by STOP Spillover's team that have been adopted at the local and national level in priority countries	# policies and practices recommended by STOP Spillover's team that have been adopted at the local and national level in priority countries	Policy documentation	Annual	Annual	Country	Outcome	–	1	
Strategy 2.2: Use OH-DReaM Working Groups to design interventions to reduce the risk of priority zoonotic viruses spilling over from animals to people										
2.2.a	# of research studies designed and implemented to inform interventions	# of research studies designed and implemented to inform interventions	Intervention reporting	Semi annual	Annual	Region, country	Output	–	2	Vietnam (Year 2 work plan activity 1.2.6.1 and 1.3.1.1)
2.2.b	# of interventions designed and implemented	# of interventions designed and implemented	Intervention reporting	Semi annual	Annual	Region, country, sector, type (prevent, detect, respond)	Output	–	3	Vietnam (Year 2 work plan activities 2.1.1.1, 2.2.2.1, and 3.1)
Strategy 2.3: Validation of interventions to prevent spillover										
2.3.a	# of interventions tested and validated for effectiveness	# of interventions with documented outcomes /# of interventions assessed	Project Documentation	Annual	Annual	Country, Sector	Output	–	–	
2.3.b	# of STOP Spillover-related reports disseminated or manuscripts submitted / accepted for peer-reviewed publication	# of STOP Spillover-related manuscripts submitted and accepted for peer-reviewed publication	Reports and publications tracker	Semi annual	Annual	Region, Country	Output	–	–	
2.3.c	# of publications (peer-reviewed pubs, white papers, policy briefs, blog posts, etc.) characterizing risks for pathogen spillover	# of publications (peer-reviewed pubs, white papers, policy briefs, etc.) characterizing risks for pathogen spillover, resulting from OH-DReaM Working Groups pathogen spillover risk research	Publications tracker; Google Analytics	Annual	Annual	Region, country, type, gender of first and senior author	Outcome	–	–	
Objective 3: Strengthen country capacity to mitigate amplification and spread of priority zoonotic diseases in human populations										

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
3.a	# of countries with increased capacity to mitigate risks and plan an appropriate response to contain amplification and spread of zoonotic disease events originating from wildlife	# countries with strengthened surveillance systems and new or revitalized One Health platforms, and have instituted new tools to evaluate risk (e.g. forecasting tools, early warning systems, etc.) demonstrating increased capacity to mitigate risk	Annual survey	Annual	Annual	Country	Outcome	–	–	
3.b	% of high-risk stakeholders who can rapidly recognize and effectively respond to suspected zoonotic disease events originating from animals	# high-risk stakeholders who can rapidly recognize and effectively respond to suspected zoonotic disease events originating from animals / # of high-risk stakeholders engaged	Community capacity reporting via post-training surveys, semi-structured interviews, surveillance reports, and updated surveillance systems	Annual	Annual	Country, Gender	Outcome	–	–	
Strategy 3.1: Strengthen existing systems and One Health platforms for coordinated, country owned, and sustained surveillance										
3.1.a	Timeliness of reporting from enhanced surveillance systems	Timeliness includes number of sites reporting by the deadline of reporting / number of sites reporting	Surveillance systems, HMIS, One Health Information Systems	Quarterly	Semi-annual	Country, Sector	Outcome	–	–	
3.1.b	Completeness of reporting from enhanced surveillance systems	Completeness of reporting (number of sites reporting 95% or more of expected information) / total number of those reported).	Surveillance systems, HMIS, One Health Information Systems	Quarterly	Semi-annual	Country, Sector	Outcome	–	–	
3.1.c	% of One Health sectors integrated or sharing zoonotic surveillance data	# of One Health sectors integrated or sharing zoonotic surveillance data / # of OH sectors	Surveillance systems, HMIS, One Health Information Systems	Semi-annual	Annual	Country, Sector	Outcome	–	–	
3.1.d	# of outbreak investigations triggered based on data reported in OH information systems	# of outbreak investigations triggered based on data reported in OH information systems	Surveillance systems, HMIS, One Health Information Systems	Semi-annual	Annual	Country, Sector	Outcome	–	–	
Strategy 3.2: Introduce new tools and platforms, including climate risk reduction, to improve preparedness and build partnerships										
3.2.a	# of countries with new forecasting and preparedness tools developed	# of countries with forecasting tools developed	Forecasting tools; Forecasting tool implementation tracker	Annual	Annual	Country, type (including climate risk reduction)	Output	–	–	

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
3.2.b	# of people trained in the use of forecasting and preparedness tools	People trained in the use of the tool	Training agendas; training rosters; trainee surveys	Annual	Quarterly	Country, Gender, Sector	Output	–	–	
3.2.c	% of quarterly risk assessments conducted and results disseminated through appropriate mechanisms	The forecasting tool should be used routinely to assess the factors associated with spillover and gauge risk. The results should be disseminated to appropriate stakeholders.	Climate Risk Trends Analysis tool output	Quarterly	Quarterly	Country	Output	–	–	
3.2.d	# of countries with risk communication plans developed and operational updated annually	# of countries with risk communication plans both developed and operational	Risk communication plans and project reporting	Annually	Annually	Country	Output	–	–	
Strategy 3.3: Build media capacity for risk communication and media-based interventions by partnering with local stakeholders										
3.3.a	# of training events hosted by local stakeholders/partners with the support of STOPS, that are conducted to build the capacity of journalists to cover issues related to zoonotic spillover and how to prevent it	# of training events that emerge from local partnerships. Training is based on the findings of the analysis of the information ecosystem.	Training agendas; training rosters; trainee surveys	Quarterly	Quarterly	Country	Output	–	–	
3.3.b	# of journalists trained to cover zoonotic spillover	# of unique journalists trained during events	Training agendas; training rosters; trainee surveys	Semi-annual	Semi-annual	Country, Gender	Output	–	–	
3.3.c	# systems in place for monitoring media and communication channels for rumors, misinformation	# of established monitoring systems actively collecting information on media and communication channels for rumors, misinformation	Project reporting	Semi-annually	Semi-annually	Country	Output	–	–	
3.3.d	# of countries adapting the information ecosystem toolkit for local use and applying it in country	country has adapted and applied the toolkit	Adapted information ecosystem toolkits	Annually	Annually	Country	Output	–	–	
3.3.e	# of applications for Media Grants	# of applications for media grants receiving funding/total # of application for media grants	Media grant applications	Semi-annually	Semi-annually	Country	Output	–	–	

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
3.3.f	# of inter-agency teams instituted for communications with the public	inter-agency team is one that has representation from relevant stakeholder organizations with appropriate expertise to deliver necessary information to the public via country appropriate mechanisms and frequency	Country reporting	Semi-annually	Semi-annually	Country	Output	–	–	
Strategy 3.4: Assist countries with applied research, training, and "after-action reviews" related to reducing risk of amplification and spread of zoonotic pathogens in high-risk human populations										
3.4.a	# of countries with virtual Resource Hubs and S2S networks	# of countries with virtual resource hubs and S2S networks	Resource hub reporting	Semi-annually	Semi-annually	Country	Output	–	–	
Strategy 3.5: Support Zoonotic Disease Outbreak Investigations										
3.5.a	# of outbreak investigation capacity assessments conducted	Countries conducted outbreak investigation capacity assessments	Capacity assessments	Semi-annual	Annual	Region, country	Output	–	–	
3.5.b	# of countries implementing strategies to improve capacity for outbreak investigation	Countries outlined gap analysis and outbreak investigation capacity strengthening plans	Gender gap analysis, action plans for outbreak investigation	Semi-annual	Annual	Country, Region	Output	–	–	
3.5.c	# of people trained to conduct outbreak investigations	# unique individuals trained to conduct outbreak investigations	Training rosters	Semi-annually	Semi-annually	Country, sex, cadre	Output	–	–	
3.5.d	# of countries with outbreak investigation contingency plans developed	# of countries with outbreak investigation contingency plans developed and available in draft form	Contingency plans, outbreak reports	Semi-annually	Annually	Country, Region	Output	–	–	
4. Cross Cutting										
4.1 Monitoring, Evaluation, & Learning (MEL)										
4.1.a	% of relevant individuals trained on Digital M&E system	# relevant staff trained / # of relevant staff	MEL monitoring log	Quarterly	Semi-annual	Country, region, Gender	Output	100%	100%	GENOME users
4.1.b	# of unique individuals trained in monitoring and evaluation topics	# of unique individuals trained in monitoring and evaluation topics	MEL training documentation, participant rosters	Quarterly	Semi-annual	Country, region, Gender	Output	–	39	All country team members
4.1.c	% of planned research, evaluation, and learning activities launched	# of planned research, evaluation, and learning activities launched / Total planned research, evaluation, and learning activities launched	MEL monitoring log	Quarterly	Annual	Country, region,	Output	–	3	CLA, two research studies launched in Vietnam

	Indicator	Definition	Data Source/ Method	Data Collection Frequency	Data Reporting Frequency	Dis-aggregations	Type of Result (output, outcome, impact)	PY1	PY2	Notes
4.2 Gender Strategy										
4.2.a	% of activities in annual workplan including gender and sex-specific topics	# of activities in annual workplan including gender and sex-specific topics / all activities	Workplan, Activity Template	Semi-annual	Annual	Country	Output	N/A	80%	24/30 USAID approved activities (75% target) Bangladesh – 5 Liberia – 3 Cambodia – 5 Uganda – 4 Sierra Leone – 3 Vietnam - 4
4.2.b	% of interventions that address gender associated risks	# of interventions that directly address gender associated risks / all interventions	Project documentation	Semi-annual	Annual	Country	Output	N/A	100% (3/3)	N=3/3 from Vietnam interventions
4.3 Communications										
4.3.a	# of unique IP addresses visiting Stopspillover.org	# of unique IP addresses visiting Stopspillover.org	Google analytics	Semi-annual	Annual	Country	Output	3000	4400	
4.3.b	# of social media engagement	# of engagements with Facebook and LinkedIn (clicks, likes, shares); and Twitter (clicks, likes, retweets, expands)	Social media analytics	Semi-annual	Annual	Country	Output	8600	44000	

Annex 1: OH-DReaM Working Groups

Country	Study / Risk-Reduction Activity	Total Group Size	Country Team Members	Global Technical Resource Hub Members	In-Country Stakeholders	In-country stakeholders, by sector					
						Private Sector	Academia	NGO/CSO	Community	Gov (national)	Gov (regional)
UGANDA	Study 1	7	1	1	5	-	3	1	-	-	1
	Study 2	10	1	3	6	-	4	-	1	-	1
	Intervention	9	1	1	7	-	3	-	-	1	3
	Supporting Activity 1	11	1	1	9	1	3	-	1	3	1
	Supporting Activity 2	11	1	3	7	-	4	-	-	-	1
BANGLADESH	Study 1	17	3	4	10	1	-	2	-	7	-
	Study 2	13	3	5	5	-	-	1	-	4	-
	Intervention 1	16	3	7	6	3	-		-	3	-
	Supporting Activity 1	22	5	6	11	1	1	1	-	8	-
	Supporting Activity 2	20	5	4	11	1	-	1	-	8	1
VIET NAM	Study 1	15	3	5	7	-	-	-	-	1	6
	Study 2	13	2	2	9	-	-	1	-	-	8
	Intervention	13	2	2	9	-	-	1	-	-	8
	Supporting Activity 1	13	2	1	10	-	-	-	-	2	8
	Supporting Activity 2	13	2	3	8	-	-	1	-	3	4
LIBERIA	Study 1 + Study 2	22	3	8	11	2	3	-	1	5	-
	Study 3	16	4	8	4	-	3	-	-	-	1
	Intervention	23	4	8	11	-	3	1	1	3	3
	Surveillance	23	3	10	10	-	2	1	-	7	-
SIERRA LEONE	Study 1	23	2	3	18	-	3	10	-	2	3
	Study 2	15	2	2	11	-	2	3	-	5	1
	Supporting Activity 3	20	1	4	15	-	2	3	1	5	4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