African Union

AFRICA CDC
Centres for Disease Control and Prevention
Safeguarding Africa's Health

Framework for One Health Practice in National Public Health Institutes

Zoonotic Disease Prevention and Control

Africa CDC – 2020

Contents

Acronyms/Abbreviations

AFI	acute febrile illness
Africa CDC	Africa Centres for Disease Control and Prevention
AMR	antimicrobial resistance
AU	African Union
AVoHC	African Volunteer Health Corps
CCHF	Crimean Congo haemorrhagic fever
CSF	cerebrospinal fluid
DFAT	direct fluorescent antibody test
DRIT	direct, rapid immunohistochemical test
ECDC	European Centre for Disease Prevention and Control
ECOWAS	Economic Community of West African States
ELISA	enzyme-linked immunosorbent assay
FAT	fluorescent antibody test
FAO	Food and Agriculture Organization of the United Nations
FEMA	Federal Emergency Management Agency
FETP	field epidemiology and laboratory training programme
HFV	haemorrhagic fever virus
IBS	indicator-based surveillance
IDSR	Integrated Disease Surveillance and Response
IHR	International Health Regulations
ILI	influenza-like illnesses
IPC	infection prevention and control
JEE	Joint External Evaluation
LIMS	laboratory information management system
LRA	laboratory risk assessment
MCM	multisectoral coordination mechanism
MoH	ministry of health
NMBC	National Multisectoral Brucellosis Committee
NPHI	national public health institutes
OIE	World Organisation for Animal Health
PCR	polymerase chain reaction
PEP	post-exposure prophylaxis
PHEIC	public health emergency of international concern
PHEOC	Public Health Emergency Operations Centre
PoE	port of entry
PPE	personal protective equipment
PVS	Performance of Veterinary Standards
RABV	rabies lyssavirus
RCC	Regional Collaborating Centre
REC	regional economic community
RIG	rabies immunoglobulin
rt RT-PCR	real-time, reverse transcriptase polymerase chain reaction
RVF	Rift Valley fever
SARI	severe acute respiratory infections
SDG	Sustainable Development Goals
SOP	standard operating procedure
TWG	Technical Working Group
TZG	Tripartite Zoonoses Guide
US CDC	United States Centers for Disease Control and Prevention
VHF	viral haemorrhagic fever
WHO	World Health Organization

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This framework was developed through an interactive, consultative process with African Union (AU) Member States, experts in One Health and zoonotic diseases, international organizations and other Africa CDC partners. An initial Technical Working Group (TWG) was convened by the Africa Centres for Disease Control and Prevention (Africa CDC) to oversee the development of the initial draft and subsequent revisions. The TWG included experts from Africa CDC, United States Centers for Disease Control and Prevention (US CDC), Chatham House and the Food and Agriculture Organization of the United Nations (FAO). To inform the framework development, the TWG reviewed published One Health plans and reports developed by Member States and synthesized common themes, as well as referencing available One Health global guidance. The resulting framework is the product of extensive work by the TWG, whose role and dedication in its creation is deeply appreciated. Africa CDC would like to thank the technical experts from US CDC who aided in the development of disease-specific content of the framework. Africa CDC is grateful to representatives of Member States who reviewed and validated the framework.

Importance of a One Health approach

Increases in globalization, urban density, ease of travel and animal movement, environmental changes and habitat overlap between humans and animals provide new opportunities for the emergence and spread of diseases that adversely impact both human and animal health, prosperity and food security. One Health is a collaborative, multisectoral and transdisciplinary approach used to attain optimal health outcomes for people, animals, plants, and their shared environment.[1,2]

Widely endorsed and promoted by organizations such as the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), and the World Organisation for Animal Health (OIE), the One Health approach helps address shared health threats such as zoonotic diseases, antimicrobial resistance (AMR), food safety, food security, vector-borne diseases, and extreme weather or conflict events, which can all disrupt and displace populations.[3–5] Many global initiatives also embrace a One Health approach in order to attain relevant Sustainable Development Goals (SDGs), improve global health security, and comply with the *International Health Regulations*.[6–10]

Practically, taking a One Health approach involves the collaboration between human, animal and environmental health sectors, as well as other relevant stakeholders, in the design and implementation of programmes, policies, legislation and research intended to achieve better health outcomes for all. In addition to the identification and control of shared health threats, strategies incorporating a One Health approach can also lead to more sustainable and cost-effective programme implementation where resources and responsibility are shared across all relevant stakeholders.

Despite the known benefits and progress that has been made over the past decade, institutionalization and operationalization of One Health can be challenging, including breaking down established professional and programmatic silos that currently exist within government and non-governmental agencies and institutions. Differences in resource allocation between human, animal and environmental health programmes, as well as disparities in education and training in the various fields and disciplines, exacerbate the ability of these sectors to coordinate effectively. Additionally, when sectors attempt to implement One Health prevention and control strategies for a single disease or across programmes, efforts may not be well integrated between sectors due to lack of effective coordination, appropriate budgeting, and/or availability of best practices to inform programme design and implementation.[11, 12]

The Africa Centres for Disease Control and Prevention (Africa CDC) recognizes that zoonotic diseases, food safety and antimicrobial resistance[a] are the three areas in greatest need of a collaborative One Health approach across African nations. Africa CDC also recognizes that a single framework cannot comprehensively cover all three of these extensive topics, and has hence chosen to focus the current framework on priority zoonotic diseases that Member States can address using a One Health approach as part of improving public health throughout Africa.

One Health and zoonotic diseases in Africa

Zoonotic diseases are diseases that are transmitted between animals and humans. Approximately 60% of existing and 75% of newly emerging infectious diseases in humans are zoonotic, for example SARS-CoV-2.[13–15] Globally, zoonotic diseases are associated with 2.5 billion cases of human illness and 2.7 million deaths annually, mostly in developing countries.[16] The impact of both endemic and emerging zoonotic diseases in underdeveloped countries is often disproportionately high because of lack of sustainable multisectoral, One Health coordination mechanisms, inadequate health infrastructure and lack of resources for investigation and control of cases and clusters.[17]

The African continent has a significant burden of zoonotic diseases; for example, it accounts for least one third of rabies deaths globally, and almost all outbreaks of Rift Valley fever (RVF).[18,19] The continent has both competent vectors and environmental conditions that support propagation of zoonotic diseases with pandemic potential such as zoonotic influenza viruses and viral haemorrhagic fevers (VHFs) including Ebola, Marburg, Lassa fever and RVF viruses. Across the continent, outbreaks of anthrax, Ebola, zoonotic influenza and RVF continue to cause severe illness and death in humans and animals, impacting livelihoods, disrupting movement of goods and people, leading to food insecurity and national health systems strain, resulting in massive economic losses for both the government and private sectors.[20]

Given the importance of preventing and controlling zoonotic diseases in Africa, several Member States have used a One Health approach to prioritize a list of zoonotic diseases to inform collaborative efforts across all relevant sectors. Beginning in 2015, multiple African countries and one region – the Economic Community of West African States (ECOWAS) – have conducted prioritization exercises, where human, animal and environmental

[a] Please see http://www.africacdc.org/ for more information on the Africa CDC AMR Framework and related activities.

health experts collaboratively rank their top zoonotic diseases of greatest concern to inform plans to address the priority zoonotic diseases using a One Health approach.[21–25] Results from these prioritization workshops have highlighted a list of the most commonly prioritized zoonotic diseases: rabies, zoonotic influenza viruses, VHFs (including Ebola, Marburg, Lassa and RVF), anthrax and brucellosis.

In this framework, we highlight two of the most commonly prioritized zoonotic diseases according to published reports by AU Member States,[21–23] namely rabies and zoonotic influenza. Minimum recommended activities are also provided that national public health institutes (NPHIs) and ministries of health (MoH) should implement for these diseases. Both diseases are of major public health concern for the continent. Specifically, rabies is endemic across the African continent and results in an estimated 20,000 deaths per year.[18] Rabies is almost always fatal with no available treatment once symptoms have begun, yet it is 100% preventable. Given the seriousness of this disease, rabies has been prioritized in all African countries that have conducted One Health zoonotic disease prioritization workshops to date.[21–24] The United Against Rabies initiative has set a goal to eliminate all canine-mediated human rabies deaths by 2030.[26,27] Thus, to ensure all Member States achieve the capacity needed to control and eventually eliminate this deadly virus from Africa, rabies-specific activities and guidance are included in this framework.

For zoonotic influenza, pandemic preparedness continues to remain a global priority and the existing surveillance infrastructure has been critical for detecting not only novel influenzas, but other emerging respiratory pathogens, such as SARS-CoV-2.[28–30] Both OIE and WHO have listed influenza as an immediately notifiable disease.[31,32] Meeting these reporting requirements ensures that countries are adhering to the *International Health Regulations 2005* (IHR). WHO and other international partners have supported influenza surveillance efforts to help Member States meet the IHR requirements through both global and regional surveillance systems[33,34] and networks.[35,36] Additionally, WHO launched the *Global Influenza Strategy*[37] to prevent seasonal influenza, control the spread of influenza from animals to humans, and prepare for the next influenza pandemic. The current framework also supports this global priority by outlining specific activities that NPHIs/MoHs can focus on to detect, respond to and control any future outbreaks of zoonotic influenza that could lead to the next pandemic.

In addition to rabies and zoonotic influenza guidance, this framework also incorporates activities and guidance for the other commonly prioritized zoonotic diseases (i.e. anthrax, brucellosis and viral haemorrhagic fevers). NPHIs and MoHs are encouraged to develop One Health capacity in collaboration with relevant sectors for at least three additional zoonotic diseases that align with the current Member State priorities. Strengthening One Health capacity for at least five zoonotic diseases within NPHIs and Members States will not only build vital capacity to combat these diseases, but will also put a country at demonstrated capacity for meeting IHR compliance as measured by the WHO Joint External Evaluation (JEE).[38]

Role of Africa CDC and national public health institutes in improving public health

The Africa CDC is a specialized technical institution of the African Union (AU) established in 2017 by African heads of states and government, with a mission to strengthen Africa's public health institutions' capacities, capabilities, and partnerships to detect and respond quickly and effectively to health threats and disease outbreaks. It delivers its mandate through scientific evidence and data-driven interventions and programmes.

To fulfil its mandate, Africa CDC works through five Regional Collaborating Centres (RCCs), based in Egypt for the Northern Africa region, Gabon for the Central Africa region, Kenya for the Eastern Africa region, Nigeria for the Western Africa region and Zambia for the Southern Africa region. Africa CDC RCCs support Member States ensuring that there is improved infrastructure and enhanced capacity for integrated regional networks for disease surveillance, including laboratories and emergency preparedness and response. The RCCs, in turn, work directly with NPHIs and MoHs in Member States. NPHIs are national-level institutions that lead and coordinate public health functions, including disease surveillance, laboratory systems and networks, emergency preparedness, response and public health research. NPHIs are science-based governmental organizations that serve as a focal point for a country's public health efforts and services to support MoH mandates. Functional NPHIs currently exist in some African countries, with many more countries developing and strengthening their respective NPHIs.

Africa CDC is working to establish a new public health order for Africa, one in which Member States are empowered to take control and responsibility for the health and wellness of their populations, by building public health workforce capacity, coordinating and enhancing partnerships, harnessing public health assets through RCCs and NPHIs, supporting public health decisions and policies through quality data, and building private philanthropic partnerships to leverage resources. To achieve these aims, Africa CDC is advocating for establishment and strengthening of NPHIs in all 55 Member States. More information on Africa CDC's strategy for NPHIs can be found in the current *Africa Centres for Disease Control and Prevention Strategic Plan (2017–2021)*.[39]

Africa CDC aims to empower the Member State NPHIs to prevent, respond to and control public health events on the continent and to achieve *Agenda 2063: the Africa We Want*, utilizing a One Health approach. As a first step, NPHIs, similar public health institutions[b] and MoHs are being supported to build One Health capacity, while simultaneously improving coordination efforts for the prevention and control of priority zoonotic diseases across other integral parts of the health sector.

Given that One Health requires a collaborative, multisectoral and transdisciplinary approach, this framework will contribute to the proposed African Union One Health strategy, which will be developed jointly by relevant African Union institutions to address these shared health threats more holistically.

Importance of integrating One Health into national public health institutes

Africa CDC recognizes that a One Health approach is necessary to deliver effective and efficient infectious disease surveillance and control, as well as emergency preparedness and response. Africa CDC is therefore committed to ensure that NPHIs, typically located within MoHs, institutionalize One Health in their planning, delivery and evaluation efforts. The practice of One Health in most countries is hampered by sub-optimal coordination within and between human, animal and environmental health programmes, which often fail to share information and resources.[11,12] Integrating One Health into NPHIs will help ensure that the human health sector is appropriately and actively working across all relevant sectors.

Africa CDC considers zoonotic disease prevention and control to be the first priority for NPHIs to incorporate One Health into public health practice. This is because effective zoonotic disease prevention and control not only requires adequate capacity in all core public health functions of an NPHI, but also coordination with other sectors.[40] Ideally, implementing effective zoonotic disease programmes will lead NPHIs to expand their work to other health threats at the human–animal–environment interface, such as AMR, climate change, and food safety.

[b] Similar public health institutions are government mandated institutions that perform at least five NPHI core functions. See: http://www.africacdc.org/ and http://www.ianphi.org/resources/toolkit/guidelinesforafricannphis.html.

Purpose of this One Health framework

The purpose of this framework is to provide a set of minimal objectives, proposed activities and focused guidance that NPHIs and MoHs should adopt in order to address priority zoonotic diseases. It further highlights how One Health approaches strengthen collaboration between relevant sectors to control these shared health threats. This document aligns with the current *Africa Centres for Disease Control and Prevention Strategic Plan (2017–2021)*[39] and its focus on NPHIs. By adopting the recommendations of this document, NPHIs are expected to:

- support and collaborate with key stakeholders across all relevant sectors to strengthen One Health coordination, collaboration and communication;
- develop and strengthen surveillance systems and data-sharing mechanisms with all relevant stakeholders;
- strengthen laboratory systems and networks to ensure early detection, surveillance, and response to priority zoonotic diseases using a One Health approach;
- ensure effective and coordinated public health emergency preparedness and response using a One Health approach;
- strengthen and support workforce development using a One Health approach to prevent and control priority zoonotic diseases.

The current framework should be used in conjunction with other resources referenced herein. It is a practical guide for NPHIs, but not an authoritative reference for individual diseases or public health approaches. Where Member States have developed capacity for activities proposed in this framework, countries are then recommended to focus on the additional activities they have not yet implemented.

How Africa CDC/RCCs will support framework implementation

This framework was developed by Africa CDC to provide a standard approach that guides prevention, control or elimination efforts for priority zoonotic diseases using a One Health approach. To support the implementation of the framework in Member States, Africa CDC and RCCs will:

- support the establishment and strengthening of NPHIs in all 55 African Union Member States, with One Health as a core guiding principle;
- support Member States to expand participation of NPHIs in multisectoral, One Health coordination mechanisms and advocating for establishment of such mechanisms where none exist;
- establish or strengthen continental and regional initiatives for addressing priority zoonotic diseases using a One Health approach;
- develop data sharing and feedback mechanisms between NPHIs and Africa CDC;
- support continental and regional meetings for sharing of experiences, challenges and best practices in prevention and control of zoonotic diseases;
- develop a One Health operational research agenda relevant to all African countries;
- develop mechanisms for tracking implementation of this framework at the national and regional levels;
- support and facilitate the deployment of a multisectoral workforce to support response to public health emergencies using the African Volunteer Health Corps (AVoHC);
- develop training materials to help build One Health workforce capacities across all Member States.

Section 1: Goals, objectives, and activities

This section focuses on five goals for implementing One Health in NPHIs: multisectoral, One Health coordination and collaboration; surveillance and data sharing; laboratory systems capacity; emergency preparedness and response; and workforce development. Each goal includes objectives, activities, resources to inform implementation, and indicators for measuring progress.

Goal #1:
Strengthen multisectoral, One Health coordination and collaboration

NPHIs should be involved in the creation and/or strengthening of multisectoral, One Health coordination mechanisms (MCM). An MCM should include representation from all relevant sectors including government sectors and partners involved in human, animal and environment health. As part of these MCMs, NPHIs should collaborate with other stakeholders to develop or strengthen control strategies and guidelines for priority zoonotic diseases.

Objective #1.1: Support creation and/or strengthening of multisectoral One Health coordination mechanisms (MCM)			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
1.1.1	Engage in the development and improved performance of MCMs[c] (e.g. formal committee or memorandum of understanding).	▪ FAO/OIE/WHO: *Taking a multisectoral, One Health approach: A tripartite guide to addressing zoonotic diseases in countries* [d 2] ▪ One Health APP (OH-APP)[41] ▪ WHO benchmarks for International Health Regulations capacities (WHO IHR Benchmarks)[6] ▪ World Bank: One Health Operational framework for strengthening human, animal, and environmental public health systems at their interface (World Bank One Health framework)[42] ▪ WHO: *Public health events of initially unknown etiology: A framework for preparedness and response in the African Region*	▪ Inclusion of the NPHI (or similar public health body) in a country's MCM ▪ Clearly defined roles and responsibilities of NPHIs in the MCMs organizational framework ▪ Defined structure of the MCM ▪ MCM has a costed budget in place
1.1.2	Routine NPHI participation in regular MCM meetings.	▪ WHO meeting reports: Libreville, 2012; Dakar, 2016	▪ Number and proportion of regular MCM meetings in which NPHI was represented, measured annually

[c] MCMs should have some type of organizational framework that identifies stakeholders and identifies their roles and responsibilities.

[d] Also known as the Tripartite Zoonoses Guide (or TZG).

Objective #1.1: Support creation and/or strengthening of multisectoral One Health coordination mechanisms (MCM)			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
1.1.3	Increase awareness across different countries on the One Health approach to address zoonotic diseases.	▪ FAO/OIE/WHO: TZG[2] ▪ WHO IHR Benchmarks[6] ▪ World Bank One Health framework[42]	▪ Number of stakeholder sensitization events ▪ Number of public awareness/public sensitization events ▪ Evidence of Government commitment through sensitization
1.1.4	OPTIONAL:[43] Develop an operational research agenda for how best to implement the One Health approach for the prevention and controlling priority zoonotic diseases.	▪ Zoonotic influenza: US CDC Evaluation and capacity review Tools; U.S. CDC: Pandemic modelling tools ▪ Lebov et al: A framework for One Health research[43]	▪ Priority One Health research areas identified ▪ Operational research agenda and template launched ▪ Operational research fund and board established ▪ Number of operational research project concept notes/ proposals developed and funded
Objective #1.2: Develop and implement priority zoonotic disease prevention and control programmes in collaboration with MCM			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
1.2.1	Support and revise One Health zoonotic disease prioritization efforts, as needed.	▪ European Centre for Disease Prevention and Control (ECDC): *ECDC tool for the prioritization of infectious disease threats*[44] ▪ FAO/OIE/WHO: TZG (Chapter 4)[2] ▪ US CDC: *One Health zoonotic disease prioritization tool (OHZDP)*[21]	▪ National prioritized list of zoonotic diseases of greatest concern developed using a One Health approach ▪ Annual updates of the prioritization mechanism recording new evidence, new stakeholders, updates in priorities and/ or disease epidemiology
1.2.2	Participate in regional One Health zoonotic disease prioritization workshops for region and support countries where needed.	▪ ECDC prioritization tool[44] ▪ US CDC: *One Health zoonotic disease prioritization tool (OHZDP)*[21] ▪ FAO/OIE/WHO: TZG (Chapter 4)[2] ▪ WHO: *Methodology for prioritizing severe emerging diseases for research and development*[45]	▪ Prioritized list of zoonotic diseases of greatest concern developed using a One Health approach for joint collaboration in the region

Objective #1.2: Develop and implement priority zoonotic disease prevention and control programmes in collaboration with MCM			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
1.2.3	Lead and/or support the development of a multisectoral, *One Health National Strategic Plan* or other disease specific plans for prevention and control of anthrax, brucellosis, rabies, VHFs, zoonotic influenza, and other country-specific priority zoonotic diseases. Ensure strong leadership and government engagement in the planning and delivery processes. ▪ Define roles and responsibilities for all participating sectors ▪ Assess current capacities to inform strategic and action plans.	▪ FAO/OIE/WHO: TZG (Chapter 5)[2] ▪ WHO: Joint External Evaluation[8] ▪ WHO: *National action plan for health security*[9] ▪ Georgetown University: *IHR costing tool*[46] ▪ WHO: *IHR-PVS national bridging workshop*[47] ▪ FAO *Surveillance evaluation tool* (SET)[48] ▪ Anthrax: U.S. CDC *Framework for enhancing anthrax prevention and control*[49] ▪ Brucellosis: FAO *Staged tool for the elimination of brucellosis* (STEB)[50] ▪ Rabies: *Stepwise approach for rabies elimination* (SARE);[51,52] *Practical workplan towards achieving rabies elimination* (PWARE);[53] *Canine rabies blueprint*[54] ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ Zoonotic influenza: WHO Essential steps for developing or updating a national pandemic influenza preparedness plan;[56] US CDC Evaluation and capacity review Tools; US CDC Federal resources for planning	▪ National costed One Health strategic plans developed and with clearly defined goals, objectives, action steps, roles and responsibilities for groups of stakeholders, and M&E framework ▪ National disease-specific prevention and control plans developed and implemented with clearly defined goals, objectives, action steps, and roles and responsibilities for multisectoral group of stakeholders ▪ Annual reports on status of implementation of the strategic plans
1.2.4	Develop and support working groups (or task forces) to implement national and/or disease-specific prevention and control plans for priority zoonotic diseases.	▪ FAO/OIE/WHO: TZG (Chapter 3.2.7):[2] Establish necessary sub-groups and define their tasks: Establish necessary subgroups and define their tasks ▪ Brucellosis: FAO *Staged tool for the elimination of brucellosis* (STEB)[50] ▪ Rabies: Canine rabies blueprint[54] ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ Zoonotic influenza: CDC WHO Collaborating Centre for Surveillance, Epidemiology and Control of Influenza; WHO National Influenza Centres; North American plan for animal and pandemic influenza; US CDC IRAT and WHO TIPRA	▪ Number of disease-specific multi sectoral working groups or task forces formed at country/regional levels inclusive of NPHI, with clear definition of roles and responsibilities, and terms of reference ▪ Number of bi-annual meetings convened to review evidence to refine objectives and programmatic goals
1.2.5	Identify and participate in regional initiative for priority zoonotic diseases.	▪ Rabies: Pan-African Rabies Control Network (PARACON),[57] Eastern Africa Rabies Network,[58] Regional and international rabies databases,[59] MERACON for North African countries.[60] ▪ Zoonotic influenza: African Network for Influenza Surveillance and Epidemiology (ANISE); *North America plan for animal and pandemic influenza* (NAPAPI); and *Asia Pacific strategy for emerging diseases and public health emergencies* (APSED)	▪ NPHI participation in regional initiatives for priority diseases ▪ NPHI support sharing of relevant data to international entities (WHO, OIE, or regional platforms)

Objective #1.2: Develop and implement priority zoonotic disease prevention and control programmes in collaboration with MCM			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
1.2.6 Cross-border	Work with RCCs and regional economic communities (RECs) to develop information-sharing protocols between sectors and neighbouring countries, including what information to share and when, both before and during a public health emergency.	▪ US CDC *Global Border Health Team* (GBHT) *cross-border surveillance and collaboration training modules*[61] ▪ Regional Integrated Surveillance and Laboratory Networks (RISNLET)[62] ▪ Zoonotic influenza: Global Influenza Surveillance and Response System (GISRS)	▪ A country-level multisectoral consensus and plan developed for the cross-border flow of information on priority zoonotic diseases ▪ Binational plans for sharing information on priority zoonotic diseases with all neighbouring countries ▪ Multinational (Regional) plans for sharing information on priority zoonotic diseases with all neighbouring countries
1.2.7 Cross-border	Evaluate country-level capacity to detect priority zoonotic diseases in animals and animal products at established border crossings and informal ground crossings.	▪ IHR Ports of entry (PoE) guidance[63] ▪ US CDC GBHT Border health capacity discussion guide under adaptation for animal sector[64]	▪ Coverage of country-level PoE (e.g. proportion of PoEs that are well-resourced and systematically monitor the import and export of animals and animal products) ▪ Number of PoE with continuous improvement action plans based on evaluation results

Goal #2:
Develop and strengthen surveillance systems and data-sharing mechanisms with relevant stakeholders

In countries where coordinated zoonotic disease surveillance systems between human, animal and environmental health sectors do not exist, NPHIs should contribute to the development and implementation of coordinated indicator- and event-based surveillance systems for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases. In countries with existing coordinated surveillance systems for rabies and zoonotic influenza, NPHIs should strengthen the interoperability of these systems with relevant stakeholders, to support prevention and control efforts. Efforts to establish and strengthen surveillance for other priority zoonotic diseases beyond zoonotic influenza and rabies should also be supported in established NPHIs. NPHIs should work with MCMs and other partners to establish formal data-sharing mechanisms.

Objective 2.1: Establish indicator- and event-based surveillance for rabies, zoonotic influenza, and at least three additional high-priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
2.1.1 Rabies	Establish and conduct integrated bite case management (IBCM) surveillance. ▪ Ensure surveillance activities are linked to laboratory systems.	▪ *WHO Expert consultation on rabies* (Chapter 8) [65] ▪ Rysava et al: *On the path to rabies elimination: The need for risk assessments to improve administration of post-exposure prophylaxis*[66] ▪ Borse et al: *Cost-effectiveness of dog rabies vaccination programmes in East Africa*[67]	▪ Economic analysis of implementing and running IBCM surveillance and a rabies control programme ▪ Standard case definitions and reporting criteria for the following: – animal bite event – animal rabies – human rabies

Objective 2.1: Establish indicator- and event-based surveillance for rabies, zoonotic influenza, and at least three additional high-priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
		• Anderson et al: *A bioeconomic model for the optimization of local canine rabies control*[68] • Council of State and Territorial Epidemiologists (CSTE): *Public Health Reporting and National Notification for Animal Rabies*[69] • WHO/CDC: *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*[34]	• Rate of animal bites treated by public and private health sector (number of bites treated per centre per week) • Number of trainings or workforce development activities conducted to strengthen rabies surveillance • Existing workforce and gaps in workforce to conduct rabies surveillance activities identified • Standard reporting procedure for the number of animal bites treated by a health facility per week
2.1.2 Zoonotic influenza	Establish signal criteria to investigate unusual cases or clusters of non-seasonal influenza and other emerging acute respiratory diseases. Establish and conduct indicator-based surveillance (IBS) and event-based surveillance (EBS) systems and develop capacities to detect and respond to signals indicating zoonotic influenza (novel and endemic) events for immediate notification to public health authorities, such as: • Abrupt, unexpected changes in influenza-like illnesses (ILI) and severe acute respiratory infections (SARI) disease trends or clinical course. • Clusters of ILI or SARI in families, social networks or workplaces (particularly in health care workers). • Respiratory disease in humans associated with illness in birds or other animals. • Outbreaks of suspect and probable flu-related death or illness in birds or other animals. • Human cases of infection with a novel influenza virus.	• WHO: A checklist for pandemic influenza risk and impact management[70] • WHO: Guidance for surveillance during an influenza pandemic[71] • US CDC: Unexplained Respiratory Disease Outbreaks[72] • US CDC: *Federal resources for planning*[73] • Africa CDC: *Event-based Surveillance Framework*[74] • Africa CDC: *Protocol for Enhanced Severe Acute Respiratory Illness and Influenza-Like Illness Surveillance for COVID-19 in Africa*[75] • US CDC What CDC does about novel flu: Outbreak investigations[76]	• Human and animal zoonotic influenza surveillance for non-seasonal influenza with pandemic potential in place that has the following attributes: – Timely, sensitive, specific, efficient and sustainable – Can be used for early warning and detection systems for novel or non-seasonal and seasonal influenza viruses – Available and reliable data on geographical spread, disease trends, intensity of transmission, and changes in antigenicity and antiviral sensitivity – Supports identification of factors contributing to the occurrence and severity of cases in outbreak-prone settings
2.1.3	Ensure the inclusion of at least three additional priority zoonotic diseases are on the reportable disease lists for IBS systems such as integrated disease surveillance and response (IDSR).	• WHO/CDC: *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*[34] • Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] • Brucellosis: WHO/OIE/FAO *Brucellosis in humans and animals*[78] • VHFs: WHO Ebola and Marburg strategy[55] • Zoonotic influenza: US CDC: *One Health zoonotic disease prioritization tool* (OHZDP).[21] Also, Influenza in animals.[79]	• Number of priority zoonotic diseases included on reportable disease lists • Systematic reporting of priority zoonotic diseases cases through IDSR or equivalent surveillance system • Regular feedback to data providers on the epidemiology of priority zoonotic diseases

Objective 2.1: Establish indicator- and event-based surveillance for rabies, zoonotic influenza, and at least three additional high-priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
2.1.4	Develop and share case definitions and signals (for both IBS and EBS) for priority zoonotic diseases/ events with hospitals, clinicians and other public and animal health officials at all administrative levels.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ WHO/CDC: *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*[34] ▪ Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] ▪ Brucellosis: WHO/OIE/FAO *Brucellosis in humans and animals;*[78] *CDC Brucellosis reference guide: Exposures, testing and prevention.*[80] ▪ VHFs: 2011 U.S. National Notifiable Diseases Surveillance System (NNDSS) VHF Case Definition; WHO Ebola and Marburg strategy;[55] CDC *Case Definition for Ebola virus disease;*[81] ▪ Zoonotic influenza: US CDC Viruses of special concern.[82]	▪ Case report definitions created for priority zoonotic diseases ▪ Case definitions are shared at all administrative levels ▪ Case definitions are being used by health care staff, veterinarians, para-veterinarians, and other relevant technical staff
2.1.5	Scan internet and media routinely for reports of animal deaths or outbreaks relevant to the priority zoonotic diseases to support EBS.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ WHO/WPRO: *A guide to establishing event-based surveillance*[83] ▪ WHO: *Early detection, assessment and response to acute public health events*[84] ▪ Epidemic Intelligence from Open Sources Initiative (EIOS) ▪ Global Public Health Intelligence Network (GPHIN)[85]	▪ Established protocol for media and internet scanning including verification of events ▪ Regular sharing of data on verified events ▪ Develop a communication strategy/procedure on verified events to the stakeholders
2.1.6	Develop a reliable mechanism for national hotlines to receive, assess and process reports from the public on priority zoonotic diseases to support EBS.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ WHO/WPRO: *A guide to establishing event-based surveillance*[83] ▪ WHO: Early Warning, Alert and Response System (EWARS)	▪ Establish protocol for receiving and recording information through hotlines and its verification ▪ Establish standard mechanisms for event verification ▪ Regular sharing of data on verified events
2.1.7	Integrate acute febrile illness, VHF and acute respiratory infection events into existing EBS, specifically community-based surveillance.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ WHO/CDC: *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*[34] ▪ Senegal event-based surveillance example[86] ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ WHO: Early Warning, Alert and Response System (EWARS)	▪ Established protocol for the detection of signals in the community, how to verify, report and record them ▪ Regular sharing of data on verified events
2.1.8	Conduct health facility-based surveillance for acute febrile illness (AFI), VHF, encephalitis/meningitis (E/M), and acute respiratory infection events.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ Rabies in AFI and/or encephalitis/meningitis surveillance[87] ▪ WHO: Early Warning, Alert and Response System (EWARS)	▪ Number of AFI or E/M cases that satisfy suspect human rabies case definition ▪ Number of suspect human rabies cases investigated ▪ Number of investigations resulting in samples collected in both domains (animal and public health) ▪ Number of laboratory-confirmed cases identified for both domains

Objective 2.2: Support new and strengthen existing mechanisms for information and data sharing with relevant One Health stakeholders, for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
2.2.1	Map existing mechanisms and sources for data sharing, including memorandums of understanding and data-sharing platforms established with relevant One Health stakeholders, for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases.	• FAO/OIE/WHO: TZG[2] • *One Health systems mapping and analysis resource toolkit* (OH-SMART)[88] • WHO: *Developing global norms for sharing data and results during public health emergencies*[89] • WHO: Material transfer agreements (MTA) tool[90] • Zoonotic influenza: WHO Global Influenza Surveillance and Response System (GISRS)	• Number of sectors with surveillance data sharing agreements in place for priority zoonotic diseases • Number of data sharing agreements between different relevant sectors for priority zoonotic diseases
2.2.2	Create a coordinated surveillance goal and identify and standardize data elements/variables for sharing with relevant sectors.	• FAO/OIE/WHO: TZG[2] • Anthrax: WHO *Anthrax in humans and animals – 4th ed (chapter 9)*[77] • Brucellosis: *WHO recommended standards and strategies for surveillance, prevention and control of communicable diseases* (Brucellosis chapter)[91] • Rabies: *WHO Expert consultation on rabies (Annex 12);*[65] *WHO recommended standards and strategies for surveillance, prevention and control of communicable diseases* (Rabies chapter)[92] • VHFs: WHO recommended standards and strategies for surveillance, prevention and control of communicable diseases (Acute haemorrhagic fever syndrome chapter)[93] • Zoonotic influenza: WHO Influenza surveillance and monitoring;[94] US CDC U.S. Influenza surveillance system: Purpose and methods[95]	• Coordinated surveillance goal agreed upon by all relevant sectors • Standardized variables are shared with other relevant sectors
2.2.3	Establish and operationalise mechanisms for notification to IHR and OIE (i.e. notifiable terrestrial and aquatic animal diseases) events.	• Global notification requirements: – WHO IHR (Annex 2);[96] IHR M&E Framework[97] – OIE: 2020 OIE-Listed diseases[98]	• Notification of IHR and OIE events for zoonotic influenzas, rabies, and other priority zoonotic diseases

Objective 2.2: Support new and strengthen existing mechanisms for information and data sharing with relevant One Health stakeholders, for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
2.2.4	Develop and formally constitute a joint surveillance team drawn from human, animal and environmental sectors tasked to plan, implement and regularly evaluate coordinated surveillance efforts for priority zoonotic diseases.	• Africa CDC: *Event-based Surveillance Framework*[74] • Anthrax: U.S. CDC *Framework for enhancing anthrax prevention and control*[49] • Brucellosis: FAO *Staged tool for the elimination of brucellosis (STEB)*[50] • Rabies: *Investigation of canine-mediated human rabies death, Haiti, 2015;*[99] *Establishment of a high canine rabies burden in Haiti through the implementation of a novel surveillance program*[33] • VHFs: WHO Ebola and Marburg strategy[55] • Zoonotic influenza: US CDC Flu activity and surveillance[100]	• Protocols endorsed by all relevant sectors for joint risk assessment, outbreak investigation, surveillance and response activities related to priority zoonotic diseases • Agreements are in place between all relevant sectors on surveillance data sharing for priority zoonotic diseases • Percent of EBS unit meetings with relevant sectors represented
2.2.5	Disseminate relevant surveillance information (e.g. meeting notes, weekly bulletins, etc.) to community health volunteers, health care professionals, and zoonotic and veterinary staff, and other relevant entities to inform prevention and control efforts.	• Africa CDC: *Event-based Surveillance Framework*[74] • Anthrax: U.S. CDC *Framework for enhancing anthrax prevention and control*[49] • Rabies: Canine Rabies Blueprint: *Communications plan*[101] • Zoonotic influenza: US CDC Flu activity and surveillance[100]	• Percent of surveillance products developed that are disseminated to community health volunteers, health care professionals, and zoonotic and veterinary staff • Evidence to ensure that information dissemination structures are in place and functional
2.2.6	Establish and implement integrated and inter-operable electronic surveillance tools and data repository for priority zoonotic diseases.	• Rabies: – Mission Rabies app[102] – GARC *Rabies Epidemiological Bulletin*[103] – Surveillance integrating phylogenetics and epidemiology for elimination of disease: Evaluation of rabies control in the Philippines (SPEEDIER)[104] • Zoonotic influenza: Global Influenza Surveillance and Response System (GISRS)	• Priority zoonotic disease surveillance and repository systems established and functioning in the country

Goal #3:

Strengthen laboratory systems and networks to ensure early detection, surveillance and response

Each country should have at least one reference laboratory than can test for rabies and zoonotic influenza as well as three other priority zoonotic diseases. NPHIs should conduct or support assessments of laboratory capacity (including infrastructure and workforce), develop training materials, and strengthen capacity to test for rabies, zoonotic influenza, and other high priority zoonotic diseases.

Objective #3.1: Strengthen institutional capacity (facilities, personnel, and systems) for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
3.1.1	Conduct assessments of laboratories at all administrative levels inclusive of needed capacities (e.g. biosafety/biosecurity, international standards, etc.) for priority zoonotic diseases.	▪ WHO *Laboratory assessment tool*[105] ▪ ASLM LABNET assessment tool[106] ▪ FAO Laboratory mapping tool[107] ▪ WHO: *Laboratory biosafety manual – Fourth Edition*[108]	▪ Availability of approved laboratory policy and integrated national laboratory strategic action plan with M&E framework ▪ Number of laboratories that have completed assessments at central and sub-national (administrative) levels ▪ Action and investment plan to enhance laboratory capacity based on the assessment results
3.1.2	Evaluate that required equipment is available, functioning and calibrated for running of each assay in each laboratory.	▪ Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] ▪ Brucellosis: OIE *Terrestrial Code* (Chapter 3.1.4);[98] Brucellosis: WHO/OIE/FAO *Brucellosis in humans and animals;*[78] CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80] WHO/OIE/FAO Brucellosis in humans and animals[78] ▪ Rabies: WHO Laboratory techniques in rabies;[109] OIE *Terrestrial Code*[98] ▪ Influenza: WHO A checklist for pandemic influenza risk and impact management[70]	▪ Number of notified laboratories with adequate and verified/validated equipment available for testing ▪ Number of notified laboratories with calibration and maintenance service contracts for all equipment available for testing
3.1.3	Establish a national public health reference laboratory with diagnostic capacity for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases, inclusive of proficiency testing and standardized test protocols at all levels.	▪ WHO: *Second WHO Model list of essential in vitro diagnostics*[110] ▪ OIE: *Manual of diagnostic tests and vaccines for terrestrial animals (2019)*[111] ▪ WHO: Resolution AFR/RC58/R2: *Strengthening public health laboratories in the WHO African Region: a critical need for disease control* (2008).[112] ▪ United Nations Economic Commission for Europe. *Recommendations on the transport of dangerous goods. Model regulations* (Rev 18) (2013).[113] ▪ Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] ▪ Brucellosis: OIE *Terrestrial Code (Chapter 3.1.4);*[98] *CDC Brucellosis reference guide: Exposures, testing and prevention;*[80] WHO/OIE/FAO Brucellosis in humans and animals[78] ▪ Rabies: WHO Laboratory techniques in rabies;[109] OIE *Terrestrial Code;*[98] Association of Public Health Laboratories (APHL) *Rabies Diagnostics: Assessing Your Public Health Laboratory1*[114] ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ WHO: A checklist for pandemic influenza risk and impact management;[70] WHO: *Second WHO Model list of essential in vitro diagnostics;*[110] Zoonotic influenza: Global Influenza Surveillance and Response System (GISRS); US CDC's WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza; OIE/FAO OFFLU[115]	▪ National level laboratory(ies) is/are identified as the reference laboratories for zoonotic diseases testing ▪ Number of notified laboratories with standard operating procedures (SOPs) for priority zoonotic diseases developed and in place ▪ National level laboratory(ies) is/are international/regionally accredited ▪ Costed specimen referral plan and systems are in place ▪ Highly restricted and controlled access to bio-repositories for select agents with potential as bio-weapons ▪ Number of priority zoonotic diseases national public health laboratory is testing samples for on a regular basis ▪ Action plan to increase capacity to test more priority zoonotic diseases in place

Objective #3.1: Strengthen institutional capacity (facilities, personnel, and systems) for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
3.1.4	Ensure diagnostic capacity for select priority zoonotic diseases is in place at local/sub-national public health laboratories, where appropriate.	• Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] • CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80] WHO/OIE/FAO Brucellosis in humans and animals[78] • Rabies: WHO Laboratory techniques in rabies;[109] OIE *Terrestrial Code;*[98] • VHFs: WHO WHO Ebola and Marburg strategy[55] • Zoonotic Influenza: CDC WHO Collaborating Centre for Surveillance, Epidemiology and Control of Influenza; WHO National Influenza Centres	• Number of laboratories with samples being submitted by physicians for testing of select zoonotic diseases
3.1.5	Develop a laboratory monitoring checklist to ensure all the above activities are taking place and on track.	• WHO: A checklist for pandemic influenza risk and impact management;[70]	• Number/proportion of laboratories in the country with monitoring checklist in place • Number/proportion of laboratories in the country reporting on a routine basis regarding the above capacities
3.1.6 Rabies	In collaboration with relevant partners, provide technical support to ensure OIE and WHO recognized diagnostics are in place for rabies. At least one of the following diagnostic assays should be available for confirming human and animal rabies: • Direct rapid immunohistochemical test (DRIT) • Direct fluorescent antibody (DFA) • Pan-lyssa virus real-time, reverse transcriptase PCR (rt RT-PCR).	• WHO Laboratory techniques in rabies;[109] • OIE *Terrestrial Code;*[98] • Association of Public Health Laboratories (APHL) *Rabies Diagnostics: Assessing Your Public Health Laboratory*[114]	• Completion of a laboratory assessment according to guidance developed by WHO and OIE • Identification of responsible government entity for testing of human and animal samples for rabies • Budget and implementation plan developed for establishing or improving laboratory for rabies diagnostics • Number of people trained on field sample collection • Number of samples tested • Proportion of cases confirmed by laboratory testing • Number of samples collected and submitted to laboratories • Number of people trained on rabies DFA or DRIT and rt RT-PCR procedures • Number of tested samples submitted to a regional reference laboratory (WHO or OIE) for confirmation • Proficiency testing results above 90% concordance with international reference laboratory
3.1.7 Influenza	Conduct assessment of the capacities of National public and animal health reference laboratories to perform routine influenza diagnosis, typing and sub-typing using RT-PCR.	• WHO: A checklist for pandemic influenza risk and impact management;[70] • WHO: *Second WHO Model list of essential in vitro diagnostics;*[110] • CDC WHO Collaborating Centre for Surveillance, Epidemiology and Control of Influenza; WHO National Influenza Centres • APHL: *Laboratory information systems project management: A guidebook for international implementations*[116]	• Number of laboratories (national or regional) that can provide confirmatory zoonotic influenza virus diagnostics • Number of laboratories with influenza virus diagnostic capacity including trained personnel in notifiable events for influenza under IHR (2005)

Objective #3.2: Support coordination between human, animal and environmental health laboratory networks			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
3.2.1	Establish and formally constitute a multisectoral laboratory working group and network of human, animal, and environmental health laboratory experts for developing standardized testing and reporting of the priority zoonotic diseases. Laboratories included process samples from people, animals, the environment, vectors, food and toxins, and can represent central and sub-national levels as well as academic and private laboratories participating in the national surveillance system.	▪ FAO/OIE/WHO: TZG[2] ▪ WHO: *Public health events of initially unknown etiology: A framework for preparedness and response in the African Region* ▪ Inter-Agency Standing Committee: Common framework for preparedness	▪ Notification of a multisectoral laboratory working group inclusive of all relevant sectors ▪ Number of laboratory working group meetings held per year ▪ Number of action plans developed and implemented by the network ▪ Number of reports of joint disease investigations
3.2.2	Develop near real-time reporting mechanisms for human and animal diagnostics to inform multisectoral, One Health response activities for priority zoonotic diseases.	▪ Rabies: WHO Expert consultation on rabies (2018, Chapters 8 and 10);[65] *Effect of counselling on health-care-seeking behaviours and rabies vaccination adherence after dog bites in Haiti, 2014–15: a retrospective follow-up survey;*[117] *Rabies diagnosis and surveillance in animals in the era of rabies elimination*[118] ▪ Zoonotic influenza: CDC WHO Collaborating Centre for Surveillance, Epidemiology and Control of Influenza; WHO National Influenza Centres; US CDC U.S. Influenza surveillance system: Purpose and methods[95]	▪ Enact protocol that allows for sample collection, testing, and reporting between relevant health sectors ▪ Approved One Health communication and information sharing strategy ▪ Number of NOHP meetings held to share outbreak and laboratory data including sequence information
3.2.3	Establish biological specimen referral systems to support coordinated surveillance and outbreak response of priority zoonotic diseases.	▪ Regional Integrated Surveillance and Laboratory Networks (RISLNET) ▪ US CDC Influenza Information for Laboratories	▪ National referral system established and participation in regional referral systems

Goal #4:

Ensure effective and coordinated public health emergency preparedness and response using a One Health approach

NPHIs should ensure that a joint risk assessment is conducted for priority zoonotic diseases. Preparedness and response plans should be developed for rabies, zoonotic influenza and at least three priority zoonotic diseases and include simulation, stockpiling and outbreak response.

Objective #4.1: NPHIs should conduct a joint risk assessment for at least one priority zoonotic disease event in collaboration with relevant One Health sectors			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.1.1	Conduct a joint risk assessment for at least one priority zoonotic disease including: • Technical and operational activities. • Country vulnerability and preparedness capacity. • Risk management and risk communication strategy.	• FAO/OIE/WHO: TZG[2] • OIE tool[119] • PHE Human Animal Infections Risk Surveillance (HAIRS) risk assessment process[120] • *INFORM epidemic risk index*[121] • WHO/FAO *Joint risk assessment (JRA) tool*[122] • WHO Human health risk assessment tools[123] • Zoonotic influenza: WHO *Tool for influenza pandemic risk assessment (TIPRA);*[124] US CDC Influenza Risk Assessment Tool (IRAT)[125]	• Number of joint risk assessments conducted involving all relevant sectors, to inform risk management and communication policies for effective response to zoonotic disease threat
4.1.2 Cross-border	Conduct activities to determine the baseline level of risk for cross-border spread of zoonotic diseases by both animal and human populations.	• US CDC GBHT Border health capacity discussion guide under adaptation for animal sector[64] • Flowminder: FlowKit mobile data for humanitarian and development purposes[126] • IOM: *Reducing vulnerabilities and empowering migrants*[127] • Canadian Wildlife Health Cooperative: *Health risk analysis in wild animal translocations*[128] • WHO/FAO *Joint risk assessment (JRA) tool*[122]	• Documented patterns of cross-border movements of people, animals (companion, wildlife, livestock), and animal products known and documented? • Number of routine cross border-related reports submitted to the RCC to ensure regional coordination with neighbouring countries • Number of identified areas of highest concern for cross-border spread of zoonotic diseases within the country
Objective #4.2: NPHIs and all relevant sectors to develop and implement joint preparedness and response plans for rabies, zoonotic influenza and at least three additional priority zoonotic diseases in collaboration with animal and environmental officials			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.2.1	Review existing joint preparedness and response plans (and/or contingency plans) and develop new disease-specific or comprehensive joint plans to ensure all priority zoonoses are covered.	• WHO/FAO *Joint risk assessment (JRA) tool*[122] • WHO After action review[129] • Zoonotic influenza: ECDC Country preparedness plans on zoonotic influenza;[130] US CDC Evaluation and capacity review tools; WHO Essential steps for developing or updating a national pandemic influenza preparedness plan;[56]	• Revised joint contingency and response plan developed and operationalized

Objective #4.2: NPHIs and all relevant sectors to develop and implement joint preparedness and response plans for rabies, zoonotic influenza and at least three additional priority zoonotic diseases in collaboration with animal and environmental officials			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.2.2	Develop risk communication materials and national public messaging for prevention and control of priority zoonotic diseases.	▪ CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80]WHO/OIE/FAO *Brucellosis in humans and animals*[78] ▪ Rabies: Rabies Blueprint communications plan[101] ▪ VHFs: WHO Ebola and Marburg strategy;[55] OIE EBO-SURSYS ▪ Zoonotic influenza (seasonal, zoonotic, and pandemic): US CDC Influenza Flu news and spotlights.	▪ Public messaging campaign drafted and approved ▪ Number of public awareness events jointly implemented by relevant sectors at national, provincial or district levels
4.2.3	Conduct joint table-top simulation exercises for at least for two priority zoonotic diseases including the following steps: ▪ Selecting an exercise. ▪ Planning the exercise. ▪ Developing the scenario. ▪ Describing the pandemic. ▪ Evaluating the exercise. ▪ Conducting the exercise. ▪ Post-exercise outcomes.	▪ WHO SimEx tool ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ Zoonotic influenza: WHO A practical guide for developing and conducting simulation exercise	▪ Number of table-top simulation exercises, involving all relevant sectors, conducted to test and validate their national preparedness plans ▪ Publication of lessons learnt, good practices, review and updating of action plans
4.2.4	Establish standard operating procedures (SOPs) and guidelines for case and outbreak investigation and response by multisectoral rapid response teams.	▪ Anthrax: WHO *Anthrax in humans and animals – 4th ed*[77] ▪ Brucellosis: CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80] WHO/OIE/FAO *Brucellosis in humans and animals*[78] ▪ VHFs: WHO Ebola and Marburg strategy;[55] US CDC Ebola patient transfer SOP1, SOP2 and SOP3 ▪ Zoonotic influenza: US CDC Pandemic tools;[131] and US CDC *What CDC does about novel flu: Outbreak investigations*[76]	▪ Number of SOPs in place for priority zoonotic disease investigations ▪ Number of SOPs approved and incorporated into the joint strategic plan
4.2.5	Establish and maintain a multisectoral and multidisciplinary rapid response teams at national and sub-national levels involving personnel from all relevant One Health sectors to address events that occur at the human–animal–environment interface.	▪ FAO/OIE/WHO: TZG[2]	▪ Number of One Health rapid response teams established

Objective #4.2: NPHIs and all relevant sectors to develop and implement joint preparedness and response plans for rabies, zoonotic influenza and at least three additional priority zoonotic diseases in collaboration with animal and environmental officials			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.2.6 Rabies	Routinely investigate suspect animal and human rabies cases.	▪ *WHO Expert consultation on rabies*[65] (Annex 11: human rabies investigation form; section 8.3.1: risk assessment for exposed humans; Annex 12: animal bite investigation form) ▪ WHO/CDC: *Technical Guidelines for Integrated Disease Surveillance and Response in the African Region*[34]	▪ Joint (One Health) risk assessment for rabies response protocols developed in line with the WHO guideline ▪ Approved budget and operational for the implementation of the joint response ▪ Number of animal rabies cases investigated ▪ Number of people who receive post-exposure counselling from relevant health sector ▪ Number of human rabies deaths investigated by the multisectoral team ▪ Number of samples collected from suspected human rabies cases
4.2.7 Zoonotic influenza	Provide capacity development support to outbreak investigation and rapid response personnel. Establish trigger and threshold criteria to investigate unusual cases or clusters of non-seasonal influenza and other emerging acute respiratory diseases. Establish SOPs for systematic event verification, outbreak investigation, and communication of results. Establish multidisciplinary outbreak investigation and rapid response teams (with clear terms of reference), and identify team members who can be deployed. Review and update existing case reporting forms for outbreak investigations aligned with WHO guidelines. Establish a mechanism to review case definitions and public health interventions, based on investigation results. Develop protocols for safe work practices, infection prevention and control (IPC) procedures and use of personal protective equipment (PPE).	▪ WHO: A checklist for pandemic influenza risk and impact management[70] ▪ US CDC: *What CDC does about novel flu: Outbreak investigations*[76] ▪ OIE/FAO OFFLU[115] ▪ US CDC: Guidelines for safe work practices in human and animal medical diagnostic laboratories[132]	▪ Number of days required to complete investigation of unusual cases or clusters of respiratory illness ▪ Number of unusual cases or clusters of zoonotic influenza viruses jointly investigated (in a timely manner and, when applicable, involve multisectoral representation during investigations) ▪ Standardized protocols in place for case reporting, outbreak investigation and contact tracing ▪ Number of IPC protocols or guidance documents in place

Objective #4.2: NPHIs and all relevant sectors to develop and implement joint preparedness and response plans for rabies, zoonotic influenza and at least three additional priority zoonotic diseases in collaboration with animal and environmental officials			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
	Develop guidance to define and manage possible contacts of cases. Ensure that contacts are informed of and understand proposed management measures (e.g. isolation, prophylactic antiviral drug treatment, medical follow-up and hygiene measures). Assess the need to enhance existing surveillance systems (in locations where cases reside, where animal outbreaks are occurring or where the source of infection is suspected. If needed, target surveillance at groups with greater occupational risk of exposure). Develop and implement study protocols for basic epidemiological studies.		
Objective #4.3: Include animal and environmental health experts in staffing of Public Health Emergency Operations Centres			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.3.1	Establish mechanisms to include and mobilize animal and environmental health experts for shared outbreak responses and ensure multisectoral staffing in Public Health Emergency Operations Centres, where feasible.	▪ WHO *Framework for a Public Health Emergency Operations Centre* (PHEOC)[133] ▪ Sustainable model for Public Health Emergency Operations Centres for global settings[134] ▪ *US National pandemic strategy*[135] ▪ US Federal Emergency Management Agency (FEMA) *National response framework:* Emergency Support Functions #8 and #11	▪ Mechanism in place for including and mobilizing multisectoral response staff for outbreaks

Objective #4.4: Liaise with country and regional stockpiles to ensure adequate and just in time procurement and distribution of supplies for outbreaks of priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
4.4.1 Zoonotic influenza	Based on national/local risk assessments, resources and needs: ▪ Develop pandemic risk management plans throughout the health sector, including for health facilities, laboratories and other allied health services. ▪ Plan for the increased need for antibiotics, antipyretics, hydration, oxygen and ventilation support within the context of national clinical management strategies. ▪ Develop mechanisms and procedures to select, procure, stockpile, distribute and deliver antivirals, essential pharmaceuticals, personal protective equipment, diagnostics tests and vaccines, when available and based on national goals and resources. Consider whether these mechanisms are adequate to conduct containment measures. ▪ Develop a deployment plan to deliver pandemic influenza vaccines to national and sub-national distribution points within seven days from when the vaccine is available to the national government and develop a mass vaccination campaign strategy.	▪ WHO Pandemic influenza risk management[137] ▪ US CDC *Vaccine storage and handling toolkit*[138] ▪ US CDC Influenza *Antiviral drug supply*[139] ▪ OIE/FAO OFFLU[115]	▪ Established goals and priorities for the stockpiling and use of pandemic influenza vaccines and antiviral drugs ▪ Established plan for stockpiling and use of pandemic zoonotic influenza vaccines and antiviral drugs ▪ Number of pandemic risk management plans developed ▪ Procedure in place to select, procure, stockpile, distribute and deliver materials ▪ Existence of a deployment plan
4.4.2 Rabies	Ensure sustainable access to canine and human rabies vaccines, working with relevant global and regional organizations where possible.	▪ OIE *Vaccine banks*[140] ▪ PAHO Revolving Fund[141] ▪ Global Dog Rabies Elimination Pathway (GDREP)[142] ▪ US CDC *Vaccine storage and handling toolkit*[138]	▪ Number of facilities providing cell culture post-exposure prophylaxis (PEP) for human rabies exposures ▪ Proportion of domestic dogs vaccinated annually

Goal #5:

Strengthen and support workforce development to prevent and control priority zoonotic diseases

NPHIs should support multisectoral, One Health training opportunities for key technical staff including laboratory, health care and animal health workers.

Objective 5.1: Support workforce development to prevent and control for rabies, zoonotic influenza and at least three additional high priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
5.1.1	Ensure health care personnel and public health staff at the national and sub-national levels, and community health workers receive training in detection of priority zoonotic disease cases, emphasizing the One Health aspects of these diseases.	▪ WHO OpenWHO courses[143] ▪ Brucellosis: CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80] WHO/OIE/FAO Brucellosis in humans and animals[78] ▪ VHFs: WHO *Clinical management of patients with VHFs;1*[44] WHO CCHF;[145] WHO Lassa fever;[146] WHO RVF;[147] US CDC Ebola;[148] US CDC Ebola for ER staff;[149] US CDC Ebola ER staff training[150] ▪ Zoonotic influenza: US CDC Pandemic influenza;[151] US CDC Influenza Surveillance, epidemiology and laboratory;[152] Community mitigation guidelines to prevent pandemic influenza – United States, 2017;[153] US CDC *Influenza training;*[154] OIE/FAO OFFLU[115]	▪ A national workforce strategy/plan inclusive of priority zoonotic diseases ▪ Development of educational material (e.g. case studies) ▪ Number of staff trained
5.1.2	Ensure laboratory staff are trained and competent on each assay in each laboratory for priority zoonotic diseases.	▪ CDC *Brucellosis reference guide: Exposures, testing and prevention*[80] ▪ VHFs: WHO Ebola and Marburg strategy[55] ▪ Zoonotic influenza: US CDC Surveillance, epidemiology and laboratory[152] ▪ WHO Global Laboratory Leadership Programme (GLLP)[155]	▪ Number of trainings held and competency assessed ▪ Number of laboratory technicians trained ▪ Number of laboratory technicians, trained and deemed competent at 6 and 12 months post-training in all assays ▪ Number of laboratories with testing capability 6–12 months after training
5.1.3 Zoonotic influenza	Ensure health care professionals and public health staff can use guidelines during respiratory disease outbreaks when the pathogen is unknown.	▪ US CDC Unexplained Respiratory Disease Outbreaks[72] ▪ US CDC Influenza Surveillance, epidemiology and laboratory[152] ▪ Document providing specimen collection guidelines for health care professionals and public health staff during an unknown respiratory disease outbreak ▪ Document providing guidelines for storage and handling of clinical specimens during respiratory disease outbreaks when the pathogen is unknown ▪ OIE/FAO OFFLU[115]	▪ Percentage of existing influenza surveillance networks that rely on data from domestic and international public health partners to monitor seasonal influenza viruses, novel influenza A viruses, and influenza A viruses circulating among animals ▪ Number of training courses conducted for the multisectoral, One Health workforce on surveillance, epidemiology and laboratory activities to monitor seasonal influenza, novel influenza A, and influenza A viruses circulating in animal populations ▪ Number of multisectoral workforce trained to develop community outreach materials related to at-risk populations for seasonal influenza, novel influenza A, and influenza A viruses circulating in animal population ▪ Percentage of trained multisectoral workforce deployed to support community outreach and preparedness materials related to at-risk populations for seasonal influenza, novel influenza A, and influenza A viruses circulating in animal population

Objective 5.1: Support workforce development to prevent and control for rabies, zoonotic influenza and at least three additional high priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
5.1.4 Rabies	Ensure the following groups are trained for: ▪ Surveillance officers: Integrated bite case management (IBCM). ▪ Laboratorians: Rabies diagnostics. ▪ Veterinary sector: Field investigation of suspected rabid animals and sample collection. ▪ Human health sector: Risk assessment for rabies exposures, counselling of bite victims and advising on vaccination recommendations. ▪ Vaccination staff: Mass canine rabies vaccination training.	▪ See previous rabies-related activities and the rabies technical section for potential sources needed to develop training materials	▪ Number of surveillance officers trained in IBCM ▪ Number of laboratoriy staff trained in rabies diagnostics ▪ Number of veterinary staff trained in rabies field investigations and sample collection ▪ Number of hospital, clinical, and public health staff trained in rabies exposure risk assessments, counselling bite victims and vaccination recommendations ▪ Number of vaccination staff trained on mass vaccination of canine rabies
Objective 5.2: Advocate for multisectoral, One Health training opportunities for rabies, zoonotic influenza and at least three additional high priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
5.2.1	Establish and maintain relationships with in-service training programmes and networks offering curriculums in field epidemiology, disease surveillance and outbreak investigations that use a One Health approach (e.g. FETP, ISAVET, AFENET, EMPHINET, etc.).	▪ Field Epidemiology Training Programme (FETP): AFENET African case studies in public health; EMPHINET Case studies for public health in the Eastern Mediterranean Region; TEPHINET case studies; ▪ ISAVET: Core competencies for veterinarians	▪ Development or modification of educational material such as case studies to incorporate the One Health approach ▪ Number of staff trained

Objective 5.2: Advocate for multisectoral, One Health training opportunities for rabies, zoonotic influenza and at least three additional high priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
5.2.2	Collaborate with university partners or national/ international organizations to offer training courses or workshops on best-practices for surveillance on zoonotic diseases.	▪ FAO/OIE/WHO: TZG[2] ▪ One Health Central East Africa University Networks (OHCEA) ▪ Ohio State Global One Health Institute ▪ Togami, et. al. *Core Competencies in One Health Education: What Are We Missing?*[156] ▪ WHO *IHR implementation at the human–animal–environment interface* (HAE)[157] ▪ WHO OpenWHO courses[143]	▪ Development or modification of educational material such as case studies to incorporate One Health approaches ▪ Number of staff trained
5.2.3	Conduct multisectoral trainings on how to implement event-based surveillance (EBS) using a One Health approach.	▪ Africa CDC: *Event-based Surveillance Framework*[74] ▪ WHO/WPRO: *A guide to establishing event-based surveillance*[83] ▪ WHO *IHR implementation at the human–animal–environment interface* (HAE)[157] ▪ OIE EBO-SURSYS	▪ Development of educational material incorporating other sectors ▪ Number of staff trained ▪ Number of staff from other sectors trained
5.2.4	Support the implementation of biosafety and biosecurity trainings for professionals representing all sectors working at the human–animal–environment interface.	▪ WHO *IHR implementation at the human–animal–environment interface* (HAE)[157] ▪ Brucellosis: US CDC *Brucellosis reference guide: Exposures, testing and prevention;*[80] ▪ VHFs: WHO Lassa fever;[146] WHO RVF;[147] WHO CCHF;[145] WHO Ebola and Marburg strategy;[55] US CDC Guidance for collection, transport and submission of specimens for Ebola virus testing;[158] US CDC PPE; ▪ Zoonotic influenza: US CDC Influenza training	▪ Development of educational material incorporating other sectors ▪ Number of staff trained ▪ Number of staff from other sectors trained

Objective 5.2: Advocate for multisectoral, One Health training opportunities for rabies, zoonotic influenza and at least three additional high priority zoonotic diseases			
Activity #	**Activity description**	**Resources**	**Activity indicator(s)**
5.2.5	Support multisectoral trainings and technical guidance on the integration of zoonotic disease modules into national IBS platforms (e.g. IDSR, DHIS-2). A One Health workforce uses: (1) discipline-specific technical competencies; (2) multisectoral, One Health competencies; and (3) the institutional environment(s) to address zoonotic diseases and other shared health threats at the human–animal–environment interface.	▪ FAO/OIE/WHO: TZG[2] ▪ Electronic Integrated Disease Surveillance and Response (eIDSR)	▪ Development of educational material incorporating other sectors ▪ Number of staff trained ▪ Number of staff from other sectors trained ▪ Understand the national needs and develop an evidence-based workforce strategy so that governments can plan education and training to build a competent national One Health workforce that can meet current and future national workforce needs and has the skills to work collaboratively across sectors to address zoonotic diseases
5.2.6	Ensure multisectoral participation in trainings on Leadership and Management for Laboratories, laboratory-clinical interface, laboratory quality management, laboratory biosafety and biosecurity and laboratory data management and supply chain.	▪ WHO Global Laboratory Leadership Programme (GLLP)[155]	▪ Development of educational material such as case studies ▪ Number of staff trained

Section 2: One Health technical guidance

This section provides technical guidance and a list of valuable resources to aid NPHIs with implementation of the activities listed in Section 1. This section first highlights general One Health considerations then specifically focuses on the following commonly prioritized zoonotic diseases: anthrax, brucellosis, rabies, common viral haemorrhagic fevers (VHF) and zoonotic influenzas. Cross-border considerations are then examined. For each of these topics, key thematic areas such as surveillance (i.e. event-based and indicator-based), laboratory capacity, emergency preparedness and response, and workforce development are included, with specific guidance with links to the available resources provided.

General One Health considerations

Several international guidance documents and tools have been recently developed to assist countries with establishing One Health capacity, including *Taking a multisectoral, One Health approach: A tripartite guide to addressing zoonotic diseases in countries*,[2,e] and the *World Bank One Health framework*.[38] Using these guides as reference, Member States can take a variety of approaches to building One Health capacity. When no or minimal capacity exists, focusing initially on a few priority zoonotic diseases can be a good strategy to undertake until more formal national and regional coordination can be established. The Tripartite Zoonoses Guide (TZG) speaks extensively on how countries can establish multisectoral, One Health coordination mechanisms (MCMs) that can be used to establish formal communication, coordination and collaboration mechanisms across all relevant sectors for both routine and emergency operations. To support these One Health capacity-building efforts, NPHIs within Member States should support the creation or strengthening and institutionalization of these MCMs: not only to address zoonotic diseases, but also to address other One Health priorities such as antimicrobial resistance, climate change, food safety and food security. These MCMs should include an operational framework to outline the sector-specific roles and responsibilities of the NPHIs and other relevant One Health partners. NPHIs should also be involved in the development of national and regional level One Health strategies or frameworks inclusive of goals, objectives and activities that the relevant sectors will work on together to address the identified One Health priorities.

Surveillance and information sharing

Both sector-specific and coordinated surveillance across all relevant sectors should be considered for early detection of zoonotic disease events and data sharing.[2,160] Coordinated surveillance systems provide a platform for data to be shared across sectors, enabling all parties to receive and collaborate in a timely manner. One of the objectives of a coordinated and interoperable system for zoonotic disease surveillance is to identify zoonotic disease events by using information from all relevant sectors and to support coordinated response, prevention and mitigation measures. Coordinated surveillance systems can support operational research needs by helping to understand existing disease burden, monitoring disease trends, and assessing the impact of deployed interventions.

[e] Also known as the Tripartite Zoonoses Guide (or TZG).

The WHO JEE[38] and IHR benchmarks[6] include capacity measures and goals for countries to conduct coordinated surveillance for zoonotic diseases. A coordinated surveillance system for zoonotic disease events includes a mechanism to ensure that each relevant sector is engaged in, or is at least aware of, what is happening in other sectors. Best practice is for common data elements or variables to be identified or created and standardized within a coordinated surveillance system to meet common analytical goals for priority zoonotic diseases. Having common variables ensures that data collected from any one sector can be disaggregated and combined with data from other sectors or stakeholders for further analysis or investigations. Common variables include linking variables such as identification numbers, and for time-series data, common exposure sites or sources, and geospatial data. Depending on national needs, the same data collection forms may be used by both animal and human health surveillance teams.

Some aspects of the coordinated surveillance system need to be standardized in all geographic areas, at all administrative levels, and across all relevant sectors, including: case definitions for surveillance; case detection methods; data sources and case registration mechanisms; the populations under surveillance; and procedures for case confirmation, including laboratory results.[161,162]

Within NPHIs it is important to consider the most relevant type of surveillance needed to respond to outbreaks, improve general health outcomes as well as inform policy and programmatic activities. Both event-based surveillance[74,83,84,86] and indicator-based surveillance are components of early warning and response (EWAR) and epidemic intelligence.[163]

Event-based surveillance (EBS) is defined as the organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding health events or risks, which may represent an acute risk to human health. Indicator-based surveillance (IBS) consists of the routine collection of data from mainly health-based sources and is the conventional form of surveillance in many countries.

Event-based surveillance is not meant to replace other forms of surveillance. IBS and EBS are complementary with each having a different role to play and purpose. EBS is likely to be better at picking up emerging and re-emerging outbreaks early, while IBS is better suited for monitoring disease trends over time and is useful for signalling the start of regular seasonal outbreaks of endemic disease. The following steps are recommended to NPHIs to implement EBS for priority zoonotic diseases:

- To establish a Technical Working Group (TWG) on EBS:
  - The TWG should consist of stakeholders from at least the animal and human health sectors, as well as other relevant sectors such as border health, education, wildlife/fisheries, etc.
- Objectives of conducting an EBS stakeholder technical meeting:
  - To identify priority zoonotic diseases to be included.
  - Drafting a list of signals for health facilities and community levels.
  - Designing guidance documents, SOPs, training materials, reporting tools and mechanisms.
  - Defining roles and responsibilities at all administrative levels.
  - Setting up a timeline for implementation.
  - Drafting an implementation plan and SOPs.
- EBS materials (designing and elaborating):
  - Technical guidelines.
  - Training materials.
  - Reporting tools.
  - Communication materials (e.g. posters and flyers).
- Training of EBS:
  - Conducting training-of-trainers.
  - Conducting training workshops at community, district and health facility levels.

- Monitoring and evaluation:
  - Elaborating a monitoring and evaluation plan.
  - Conducting supportive monitoring visits (monthly or bi-monthly).
  - Conducting a comprehensive evaluation one year after implementation, and biannually following that.

Laboratory capacity

As with surveillance capacity, both sector-specific laboratory capacity and multisectoral laboratory coordination are advisable for the greatest successes in a zoonotic disease programme. NPHIs should ensure that both diagnostic testing methods and diagnostic laboratory proficiency reach a high standard and also ideally follow international guidance and recommendations established for each priority zoonotic disease. In addition, where feasible, coordinating joint trainings and shared laboratory protocols with animal or environmental health laboratories for detection of the same pathogens can help standardize procedures and enable data comparability. Public health laboratories can serve as reference laboratories for other sectors when capacity is lacking and sharing reagents, equipment or personnel for diseases that are rarely tested can also reduce programme costs. Where possible, linking databases or networks across sectors can also improve data sharing, reporting and facilitate early detection of unknown pathogens or source identification for zoonotic outbreaks. Finally, coordinated laboratories can be used as surge support during emergencies when they are equivalently trained and resourced.[164–166]

Emergency preparedness and response

In zoonotic disease emergencies, ensuring that relevant sectors are trained to respond together can increase coordination and allow for sharing of resources, thus reducing the time and cost associated with controlling outbreaks.[160] NPHIs can develop their own sector-specific preparedness frameworks for their priority diseases. When feasible, however, NPHIs should support participatory approaches that include all relevant sectors in preparedness and response activities. These activities might include developing and implementing joint risk assessments, simulation exercises and preparedness planning. Additional considerations for implementing coordinated investigation and response activities are listed in the TZG.[2]

Workforce development

A competent global public health workforce is critical in preventing and responding to outbreaks and other public health emergencies. This workforce should include not only public health practitioners, but also professionals working within animal (domestic and wildlife) and environmental health sectors as well as other relevant sectors. Many global health security initiatives support building epidemiology workforce capacity across all relevant sectors, including the Global Health Security Agenda Workforce Development Action Package, OIE's Performance of Veterinary Standards (PVS) and the WHO JEE tool. Specifically, these initiatives set a country target of at least one trained field epidemiologist per 200,000 population and one trained veterinary epidemiologist per 400,000 animal units, who can systematically cooperate to meet relevant IHR and PVS core competencies.[38] NPHIs can ensure that their country is prepared to prevent, control and respond to zoonotic diseases by ensuring a diverse workforce – comprising physicians, veterinarians, laboratory technicians, epidemiologists and other relevant professions such as wildlife health specialists and social scientists – is trained to combat health threats at the human–animal–environment interface.

Risk communication

Ensuring that any risk communication strategy incorporates the appropriate stakeholders and audiences is paramount. When developing a communication strategy, NPHIs should consider how they will engage with these different sectors and stakeholders to communicate and share information. This will ensure that formal channels of communication are developed, programmes and messaging are aligned, and trust between the relevant One Health sectors is built. Aligned messaging can allow for shared resources, maximized public support, and increased health programme uptake and success.[2]

Considerations for commonly prioritized zoonotic diseases

The following section gives some disease-specific guidance and links to available resources for the most commonly prioritized zoonotic diseases in Africa. These include: anthrax, brucellosis, rabies, zoonotic influenza, and common VHFs including Ebola, Marburg, Lassa fever, Rift Valley fever (RVF) and Crimean Congo haemorrhagic fever (CCHF). For each disease a brief description of One Health considerations for prevention, detection and control of that disease is listed.

Anthrax

Anthrax is a zoonotic bacterial disease caused by *Bacillus anthracis*, occurring primarily in herbivorous wildlife and livestock, and is usually fatal among these animals. Human infections may result in a high mortality rate if not diagnosed and treated promptly. Humans contract cutaneous anthrax through direct skin or mucous membrane contact with *B. anthracis*-infected animals as they are slaughtered or butchered, or by handling by-products. Gastrointestinal anthrax results from consuming raw or undercooked meat from infected animals. Inhalation anthrax causes severe symptoms, but rarely occurs naturally in humans; it is acquired through inhaling *B. anthracis* spores aerosolized during contact with or processing of contaminated hides, bones, hair or wool. In addition, injection anthrax has been reported in Europe associated with use of heroin contaminated with *B. anthracis* spores. Among these forms, cutaneous anthrax is the most common, comprising approximately 95% of naturally occurring human infections. In addition to the naturally acquired forms of anthrax, *B. anthracis* is designated as a potential bioweapon, and the risk of acquiring *B. anthracis* spores for malicious use accentuates the importance of anthrax surveillance, prevention and control in endemic countries.

Anthrax control is primarily achieved through vaccination of livestock against anthrax, which is the principal method for prevention and control of anthrax in animals and subsequently, anthrax prevention in humans. Surveillance of animal and human cases is important to identify suspect cases, estimate incidence, and evaluate the impact of control programmes. Enhancing outbreak response is key to rapidly implementing control programmes and halting any outbreak. Laboratory diagnostic capacity at biosafety level 2 is critical to the rapid identification of animal and human cases. These steps augment effective and efficient vaccination of livestock to prevent and control anthrax.

An effective surveillance system relies on both diagnostic laboratory capacity and epidemiological surveillance, on both animal and human sides. The One Health approach, involving both human and animal health stakeholders, should be used to promote multisectoral integration and coordination for the detection, prevention and response to anthrax. The development of an anthrax working group involving One Health partners, and of a strategic plan for prevention and control of anthrax, are among the first steps to address anthrax surveillance in a country. This should be followed by assessment of the surveillance and outbreak response systems in place, laboratory assessment and vaccination assessment. These assessments provide a good picture of the current situation in a country and informs the implementation of enhancements to surveillance, outbreak response and diagnostics. Studies and activities aimed at understanding anthrax epidemiology in a country are very helpful, as well as the development of educational materials for health care and community.

Surveillance and information sharing

Part 1: Assessment

- Review the case definitions for human and animal cases:
  - Are these in line with international case definitions?
- Evaluate process of case reports of human cases:
  - Sensitivity of reporting from health care provider to local health authority to state to national.
  - Is the number of human cases associated with each animal case similar to the regional-level ratios?
  - Are the data timely? Is any action taken when cases are reported? Are specimens collected for laboratory diagnosis?

- Is the quality of the data adequate for human case surveillance?
  - Are case records complete? Are there known errors?
  - Do human health authorities trust the data reported from these systems?
- Evaluate the process of case reports of animal cases:
  - Sensitivity of reporting from veterinary provider or owner to local veterinary authority to state to national.
  - Are the data timely? Is any action taken when cases are reported? Are specimens collected for laboratory diagnosis?
- Is the quality of the data adequate for animal case surveillance?
  - Are case records complete? Are there known errors?
  - Do animal health authorities trust the data reported from these systems?

Part 2: Implementation

- Encourage reporting of cases by local animal/human health providers.
- Conduct training, provide resources and equipment to conduct work.
- Integrate human and animal disease epidemiologic and laboratory surveillance data, as well as clinical and environmental laboratory data:
  - Hold meetings with the public, animal and wildlife health groups to discuss importance of integrated surveillance, develop protocols for joint investigations and build relationships.
  - Implement a system to recognize and reward good quality reporting.
  - Share and combine case data in maps and reports.
  - Use combined surveillance data to identify anthrax foci, guide vaccination, and plan communication.

Laboratory capacity

Part 1: Assessment

- Describe current capabilities at national and regional laboratories:
  - Which laboratoriess, if any, are performing anthrax diagnosis?
- Describe current safety measures, procedures, training and equipment.
- Describe current capabilities at clinic and hospital levels.
- Describe the current diagnostics available and performed:
  - Are polymerase chain reaction (PCR), cultures and stains routinely performed for other bacterial illnesses (or is most treatment empirical)?
  - Describe current safety measures, SOPs, training and equipment.

Part 2: Implementation

- Consider options to improve timeliness of testing and result reporting:
  - Add anthrax diagnostics to laboratories located in region(s) where cases are occurring.
  - Implement shipping, testing and reporting procedures that facilitate rapid turnaround.
  - Establish relationships between laboratory, veterinary and public health groups.
  - Develop or update existing procedures on actions to take based on presumptive or confirmatory results, for example quarantine, vaccination and public health messaging.
- Implement diagnostics that are recommended for presumptive or confirmatory identification of *B. anthracis.*

- Conduct training, implement protocols, provide resources and equipment to safely and effectively conduct laboratory work:
  - Implement the following at peripheral and reference laboratories as needed to ensure safe handling of anthrax samples and accurate results:
    - » Update laboratory infrastructure and equipment to safely receive and test suspect anthrax samples.
    - » Diagnostic service procedures – ensure laboratories are performing tests that are appropriate for the biosafety level, equipment and have adequate control measures in place.
    - » Review and provide training, if needed, in biosafety protocols – physical and operational.
    - » Ensure awareness about and adherence to protocols on good laboratory practices.

Preparedness and emergency response

Preparedness and control plans

- Development of a national and/or regional multisectoral, One Health anthrax working group.
- Development of a national strategic plan for the prevention and control of anthrax.
- Development of SOPs and guidelines for anthrax surveillance, response and reporting.

Contingency and response plans

- Conduct training and provide resources and equipment to conduct work.
- Develop SOPs describing how to conduct joint investigations with human and animal health authorities, including a clear description of roles and responsibilities by agency.
- Human case as sentinel – investigate source of exposure, additional human cases with same exposure, source of animal exposure.
- Animal case – trace meat and animal products to destination (e.g. market, neighbours, owner); investigate additional animal cases nearby, human exposures and cases, source of animal exposure (contaminated feed or grazing); determine animal vaccination status.
- Safely collect samples and perform diagnostic testing of suspect cases.
- Remove contaminated meat or products from consumer supply, safely dispose of animal carcasses, and implement ring vaccination. Follow guidelines for control of outbreak in animals.

Risk communication

Initiate community education

- Develop messages based on sources of exposure, identified barriers, other information identified in investigations and studies.
- Train local animal/human health providers to disseminate messages.
- Identify and utilize other mechanisms to disseminate messages (e.g. radio, print materials, etc.), and use images in areas with low literacy.

Brucellosis

Brucellosis is a zoonotic disease affecting humans, domesticated livestock and wildlife and is considered one of the most common and economically important zoonotic diseases globally. Human infection occurs from exposure to infected animals or contaminated animal products such as unpasteurized (raw) milk or dairy products. In humans, brucellosis is a debilitating and disabling disease, often misdiagnosed due to the resemblance with other acute febrile illnesses. In domestic livestock, the disease is primarily caused by *Brucella abortus* and *Brucella melitensis* in cattle and small ruminants and is associated with production losses (e.g. abortion, decreased milk production and infertility).

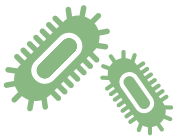
It is recommended that before starting or improving upon brucellosis prevention and control activities, countries evaluate their existing capacity and identify the goals and objectives of these efforts. The *Staged tool for the elimination of brucellosis* (STEB)[167] provides practical guidance on how to implement brucellosis control activities, and how to monitor and advance progress toward elimination in livestock. The STEB was developed by the US CDC and links to the FAO *Stepwise approach for the progressive control of brucellosis (SAPCB)* guidance.

Brucellosis is an example of a zoonotic disease where the main disease control activities focus on controlling the disease in the livestock population, which results in a reduction of the disease burden in the human population. The responsibilities of the MoH generally fall under activities for: preventing the disease in humans; case finding, diagnosing and reporting new cases; ensuring availability of and effective treatment of cases; and measuring brucellosis incidence trends over time. Prioritizing brucellosis as a zoonotic disease of national or regional importance can be helpful to generate advocacy and support for brucellosis control efforts.

An effective surveillance system relies on both diagnostic laboratory capacity and epidemiological data, as human and animal cases cannot be diagnosed based on symptoms or clinical signs alone. Adequate diagnostic capacity is part of the International Health Regulations (IHR, 2005)[32] eight core capacities,[168] which, when combined, reflect the ability of a member State to "detect, assess, notify and report events". Thus, the first step prior to establishing national laboratory diagnostic capacity for human brucellosis is to conduct laboratory assessments if they have not been done previously, or if the latest assessment was completed a long time ago. There is no laboratory assessment specifically for brucellosis as there are for other human diseases (e.g. polio). However, a general laboratory assessment tool developed by WHO is available that offers guidance to assess laboratories and can be adapted to different contexts. Once brucellosis diagnostic capacity is established at local/regional and national levels, it is recommended to incorporate brucellosis surveillance into already existing systems, such as the Integrated Disease Surveillance and Response (IDSR), for example. Case definitions for brucellosis should be based on the availability of laboratory diagnostic methods, the capacity to diagnose and treat infections, and on existing surveillance capacity within the country. The cornerstone of effective surveillance is a clear reporting structure that allows data to be traced from cases in the field, to laboratories for diagnostic testing, and then both upward for aggregation in national reporting centres and back down regional/local level for dissemination of information.

A One Health approach for the prevention and control of brucellosis is critical. As an initial step, a formalized National Multisectoral Brucellosis Committee (NMBC) or a similar multisectoral, One Health coordination mechanism, should be created – or strengthened if one already exists – to support implementation and subsequent monitoring of brucellosis control programme activities.

Rabies



Rabies, a disease caused by rabies virus (a member of the Lyssavirus genus), presents as an acute, progressive encephalitis that begins days or months after infection and concludes in the death of the infected individual, typically within 30 days of the onset of symptoms. Clinical diagnosis in humans and animals is possible but, given the variability of the incubation period and the non-specific nature of clinical signs, laboratory confirmation is essential for an accurate diagnosis. Lyssaviruses can infect any mammal but are typically associated with discrete animal reservoir species. Rabies lyssavirus (RABV) is just one member of the Lyssavirus genus but is responsible for more than 99% of all human rabies deaths. Cross-species transmission events, the transmission of RABV from a reservoir species into a non-reservoir species, is commonly reported. Host-shift events, the sustained transmission within a non-reservoir species after a cross-species transmission event, are less common but can have profound public and animal health implications when they do occur. An RABV that circulates in discrete animal populations and can be molecularly differentiated from surrounding RABVs is referred to as a 'variant.' There are more than 30 reported RABV variants globally, affecting at least 150 countries, and more continue to be reported each year as surveillance systems improve in rabies-affected countries.[65,169]

Effective real-time surveillance, combined with proficient, decentralized and validated laboratory testing is a prerequisite for successful rabies control and elimination. The selection and prioritization of surveillance methodologies, in conjunction with appropriate diagnostic techniques, should reflect the goals of the disease control and elimination programme (Stage 1: proof of burden; Stage 2: human rabies prevention; Stage 3: monitoring and assessment of control measures; Stage 4: verification of rabies elimination; and Stage 5: post-elimination). The development of minimum surveillance requirements, in accordance with Chapter 1.4 of the OIE *Terrestrial Animal Health Code*,[98] and routine evaluation of disease elimination indicators are of the utmost importance if the goal of eliminating dog-mediated human rabies by 2030 is to be achieved.[30]

Surveillance and information sharing

Disease surveillance, the systematic observation of the presence or absence of a disease, can have numerous applications within a rabies control programme, and often depends upon the stage of rabies control practised by the country concerned, as well as the resources available. Surveillance of both human and animal rabies is essential to rapidly detect outbreaks and monitor disease trends, as well as to assess the effectiveness of intervention programmes (i.e. parenteral or oral vaccination, population management) and provide support for the maintenance of rabies-free status.[5,170,171] National and regional rabies control programmes should consider regular consultation with OIE Reference Laboratories for Rabies to ensure that globally acknowledged practices and diagnostic assays are implemented, and that routine diagnostic proficiency testing is performed.

Rabies surveillance programmes should, at a minimum, include case definitions and investigation protocols for rabies exposures, animal rabies cases, and human rabies cases. Case definitions, the standard criteria used to define a disease, are the foundation upon which surveillance systems are built. For the purposes of this document, the following case definitions are recommended:

- Human rabies exposures: In countries or areas enzootic for rabies, exposure to *suspected, probable or confirmed* rabid domestic or wild animals is categorized as follows:
  - **Category I:** Touching or feeding an animal or licks on intact skin.
    - » Action: This is not considered a rabies exposure. PEP is not indicated and there is no need for a field investigation of the animal.
  - **Category II:** Nibbling of uncovered skin, minor scratches or abrasions without bleeding.
    - » Action: This is considered a rabies exposure. PEP is indicated with vaccine only (rabies immunoglobulin (RIG) is not necessary) and a field investigation should be undertaken to confirm the health status of the offending animal.
  - **Category III:** Single or multiple transdermal bites or scratches, contamination of mucous membranes with saliva from licks, licks on broken skin, exposure due to direct contact with bats.
    - » Action: This is considered a severe exposure. PEP is indicated with vaccine and RIG. Field investigation of the offending animal should be prioritized.

- Animal rabies cases
  - **Suspected rabies case** (clinical diagnosis): An animal that presents with any one of the following signs: hyper salivation, paralysis, lethargy, unprovoked abnormal aggression (biting two or more people or animals, and/or inanimate objects), abnormal vocalization, or diurnal activity of a nocturnal species.
  - **Probable rabies case** (clinical diagnosis): A suspected rabid animal that has had a known exposure (i.e. bite, scratch or contact with saliva) to a suspected, probable or confirmed rabid animal, and that is not known to be alive within ten days of the observed clinical signs, or a suspected rabid animal that dies, is killed or disappears within ten days of the observed clinical signs.
  - **Confirmed rabies case** (laboratory diagnosis): A suspected or probably infected animal, whose infection is confirmed using a primary diagnostic test, as defined by the OIE.[172]
  - **Not a rabies case** (laboratory diagnosis or observation outcome): A suspected or probably infected animal in which rabies is ruled out, either by laboratory diagnosis or an appropriate observation period (note that observation periods only apply to dogs, cats and ferrets).
- Human rabies cases
  - **Suspect rabies case**: A person presenting with an acute neurological syndrome (encephalitis) dominated by forms of hyperactivity (furious rabies) or paralytic syndromes (dumb rabies) progressing towards coma and death, usually by respiratory failure, within 7–10 days after the first symptoms if no intensive care is instituted.
  - **Clinical description**: Paresis or paralysis, delirium, convulsions. Without medical attention, death in about six days, usually caused by respiratory paralysis.
  - **Probable rabies case**: A suspected case plus history of contact with a suspected rabid animal.
  - **Confirmed rabies case**: A suspected case that is laboratory-confirmed:
    - Laboratory criteria – one or more of the following:
      - Detection of rabies viral antigens by direct fluorescent antibody test (FAT) or by enzyme-linked immunosorbent assay (ELISA) in clinical specimens, preferably brain tissue (collected post-mortem).
      - Detection by FAT on skin biopsy (ante-mortem).
      - FAT-positive after inoculation of brain tissue, saliva or cerebrospinal fluid (CSF) in cell culture, or after intracerebral inoculation in mice/suckling mice.
      - Detectable rabies-neutralizing antibody titre in the serum or the CSF of an unvaccinated person.
    - Detection of viral nucleic acids by PCR on tissue collected post-mortem or intra vitam in a clinical specimen (e.g. brain tissue or skin, cornea, urine or saliva).
  - **Not a rabies case**: A suspected case that is ruled out through rabies confirmatory testing or if an alternative confirmatory diagnosis is made.

Figure 1. Animal case definitions and corresponding surveillance activity

Case	Definition	Surveillance activity
Suspected	A case that is compatible with a clinical case definition of animal rabies Clinical case definition: An animal that presents with any of the following signs: ▪ hypersalivation ▪ paralysis ▪ lethargy ▪ unprovoked abnormal aggression (biting two or more people or animals and/or inanimate objects) ▪ abnormal vocalization and ▪ diurnal activity of nocturnal species	Notify appropriate local authorities of a suspected rabid animal Collect the primary history of an animal if available (ownership status, vaccination status, previous exposure, date of onset of signs) Collect central nervous system samples for laboratory diagnosis, if available
Probable	A suspected case plus a reliable history of contact with a suspected, probably or confirmed rabid animal and/or An animal with suspected rabies that is killed, died or disappears within 4–5 days of observation of illness	Systematically record secondary information, and link to primary history Notify the appropriate authorities for follow-up of any human or animal exposure
Confirmed	A suspected or probable animal case confirmed in a laboratory*	Systematically record laboratory diagnosis, and link with case record Notify the appropriate authorities according to national protocols
Not a case	A suspected or probable case that is ruled out by laboratory test or epidemiological investigation (i.e. appropriate quarantine period in eligible animals)	Notify the appropriate authorities for follow-up of any human or animal exposure Systematically record laboratory diagnosis, and link with primary history

Adapted from: WHO Expert Consultation on Rabies Third report.[65]

* Laboratory confirmation should be performed with a standard diagnostic test, as defined by WHO (see section 5) or the OIE manual (8). If other diagnostic test are used, depending on their sensitivity and specificity, confirmation with a validated secondary test many be required, particularly in the case of native results.

Examples of commonly used case definitions and programme indicators for rabies surveillance programmes:

- Rabid animals:
  - Case Based Surveillance (Fig. 1):[65]
    - » Clinical case definition for rabies suspect animal (see above).
    - » An animal that bites two or more people.
  - Event-based surveillance:
    - » Unexpected deaths of two or more domestic animals within a 1-month period. Deaths should be consistent with the clinical case definition for rabies.
  - Recommended programme indicators:
    - » Minimum of 50% of suspect reported dogs are investigated by veterinary professional to determine case status of the animal.
    - » Minimum of 90% of probable rabies cases (where a sample is available) are tested and results reported to health officials.
- Rabies exposures:
  - Case-based surveillance:
    - » Any WHO Category I or II exposure (see above).
  - Event-based surveillance:
    - » Two or more bite victims with an epidemiologic link to the same animal, within a 2-week period.

- Recommended programme indicators:
  - » Minimum of 80% of WHO Category III human rabies exposures are investigated by a veterinary professional to determine case status of the animal.
  - » Minimum of 90% of probable rabies cases (where a sample is available) are tested and results reported to health officials and exposed persons.

- ► Rabies post-exposure prophylaxis (PEP):
  - Exposure event (risk assessment indicates PEP is necessary).
  - Recommended programme indicators:
    - » Ensure that only cell-cultured human rabies vaccines are used (no nerve-tissue vaccines).
    - » Ensure that at least 50% of residents have easily accessible human rabies vaccine.
    - » 100% of people with suspected, probable or confirmed rabies exposures receive PEP.
    - » >90% of PEP regimens are documented and reported to health officials.

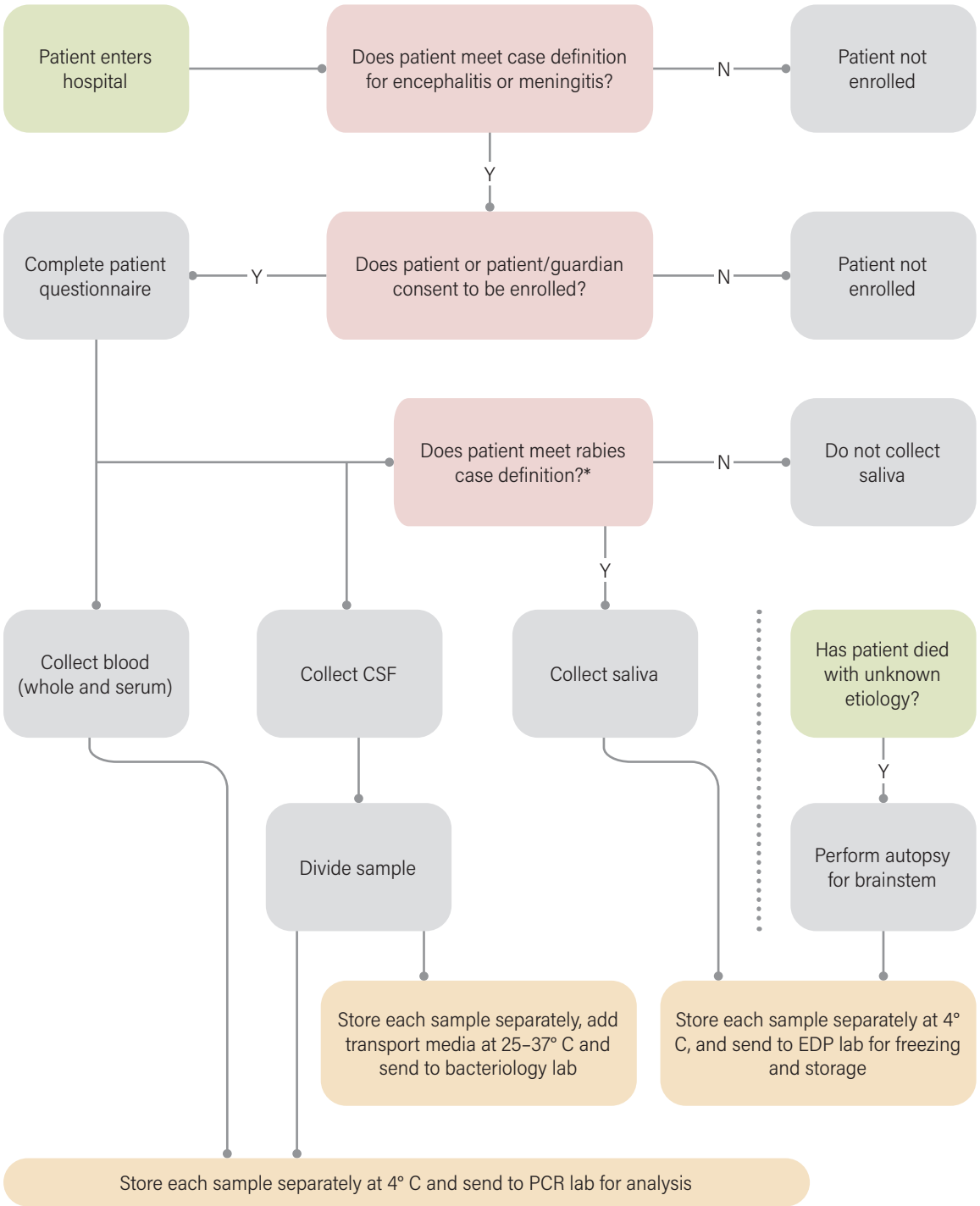
- ► Human rabies
  - Case-based surveillance:
    - » Any person compatible with the clinical case definition (see above).
  - Event-based surveillance:
    - » Two or more unexplained encephalitis deaths, consistent with the clinical case definition, within a 3-month period.
  - Recommended programme indicators:
    - » Inclusion of human rabies consideration into existing acute febrile illness (AFI) or encephalitis detection programmes (see Fig. 2):
      - At least 90% of compatible human cases are investigated (see WHO Annex 11 for suggested case investigation form).[65]

Laboratory capacity

Laboratory diagnosis of rabies, by the detection of lyssavirus antigen or nucleic acid, is a prerequisite for effective rabies surveillance.[173] Testing should be decentralized, allowing rapid confirmation of cases, even in remote areas. Such decentralization is necessary for real-time decision-making on PEP, as well as for establishing the local disease burden and confirming that the disease is absent from a declared area. Many diagnostic laboratory techniques for rabies have been assessed and evaluated, but only very few have shown adequate sensitivity and specificity to be considered primary or confirmatory tests by the OIE and WHO.[172] For decades, the direct fluorescent antibody test (DFAT) performed on impression smears of brainstem and cerebellum has been the only primary laboratory diagnostic assay for rabies.[174,175] However, the DFAT is not necessarily conducive to decentralized testing due to its requirements for an expensive fluorescent microscope and staff with highly specialized training. In 2017, WHO and the OIE recognized the direct, rapid immunohistochemical test (DRIT) as an alternative primary diagnostic assay. DRIT is a technique that can be executed in the field within an hour, without the need for electricity, and requires only a minimum number of reagents and a light microscope.[176,177] Most recently, the OIE has included pan-lyssavirus, rt RT–PCR assays that have been well validated against the DFA or DRIT as a suitable primary diagnostic assay for rabies.

- ► Minimum capacity for sample collection should include the ability to collect a full cross-section of brainstem and partial sample of the cerebellum from deceased, rabies suspect animals. Examples of sample collection can be found in the WHO *Laboratory techniques in rabies: Brain removal in the field* (page 69).[109]

Figure 2. Example of a sample collection algorithm that can be used to identify causative agents among persons with undiagnosed encephalitis and meningitis



* Rabies case definition: An acute neurological syndrome (encephalitis) dominated by forms of hyperactivity (furious rabies) or paralytic syndromes (dumb rabies) progressing towards coma and death, usually by respiratory failure within 7-10 days after the first symptom if no intensive case is instituted.

[CSF = cerebrospinal fluid; EDP = especially dangerous pathogens; PCR = polymerase chain reaction]

Preparedness and emergency response

Preparedness and control plans

A country should have a national rabies control plan that is produced by a multisectoral committee or One Health technical working group inclusive of the relevant sectors responsible for rabies control. The plan should be reviewed at a minimum of once every five years. The plan should include clear indicators that can be periodically evaluated to ensure that the programme is accomplishing its desired goals.

Developing a national plan

- The Stepwise Approach towards Rabies Elimination (SARE) tool can be used to both evaluate an existing rabies programme and develop a national plan.[f51,178]
- The *Global dog rabies elimination pathway* is an excel-based tool that can be used to estimate the time and cost for a country to achieve elimination and has been used to advocate for adequate funding levels.[179]

Contingency and response plans

Rabies control activities should be part of routine government programmes, with core services consisting of animal control, suspect case investigation, ensuring accessible PEP, and maintaining adequate dog vaccination coverage. Response plans to bite events, suspect rabid dogs and suspected rabid humans should be part of routine activities, with protocols developed and included in the national rabies control strategy, as these events are commonplace in rabies-endemic countries and should not constitute an emergency requiring specialized response protocols.

Less common events that are likely to impact a rabies control programme include outbreaks in the reservoir population and vaccine shortages. At a minimum, there should be contingency actions developed for these two events.

Rabies outbreaks

- Appropriate response plans for rabies outbreaks should be developed with consideration of the current status of rabies control in the country:
  - Settings in which rabies is still endemic should avoid conducting ring vaccination around rabies cases. The rationale is that rabies is occurring throughout the programme area, and only a small fraction of cases are likely to be detected by a public health surveillance programme; resources are better used to establish strong foundational approaches to dog vaccination rather than allocating resources to ring vaccination.
  - Settings in which rabies is very well controlled, with few or no cases occurring, may wish to pursue ring vaccination, with the rationale that the vaccination activity is providing additional coverage to the routine (presumably effective) dog vaccination programme.
  - Settings in which rabies has been eliminated should thoroughly investigate any report of a suspected rabies case and, if confirmed, all potential animal contacts should be quarantined for six months or euthanized. Additional requirements from OIE may be applicable and should be followed.
- During a rabies outbreak, public health officials should ensure that community members are aware of the situation and appropriate preventive measures. This can be accomplished through official rabies alerts or grassroots educational messaging.
- During a rabies outbreak, public health officials should ensure that community members have access to high quality and affordable rabies vaccines and that suspected cases are adequately investigated by qualified personnel.

Vaccine shortages

- Contingency plans for human rabies vaccine shortages should be developed.
- In the event of a vaccine shortage, public health officials should develop and disseminate clear risk assessment criteria to reduce misuse of the vaccine.
- Triaging of bite victims based on level and severity of exposure may be required.

[f] Examples of national rabies control plans can be found at: https://canineraviesblueprint.org/Canine-Rabies-Blueprint-PDF-of.

Risk communication

- Communication plans are available as part of the Rabies Blueprint[101] and within the WHO/FAO/OIE Zero by 30 strategic plan.[27]

Workforce

Rabies workforce needs can be categorized as follows: laboratory, surveillance and mass vaccination. A comprehensive rabies programme will also require workforce for education, animal welfare, legislation and various other activities. The three mentioned below should be considered minimum competencies.

Laboratory workforce

- One national reference laboratory:
  - Laboratory staff conducting OIE- and WHO-recognized assays should be capable of testing at least two samples per day. Each sample should have at least two qualified readers. Therefore, the number of laboratory staff to support a diagnostic laboratory should be:
    - » ((# of samples submitted per month)/(2 samples tested per day X 20 working days per month)) X 2 = staff per sample.
    - » *Example:* ((80 samples submitted per month)/(2 samples tested per day X 20 working days)) X 2 = 4 laboratory staff.

- Disseminated laboratory capacity:
  - Number of regional laboratories should be based on number of samples that need to be tested and proximity to the national reference laboratory.
  - Samples of public health importance should be tested within five days of the exposure event. If samples can reliably be delivered and tested at the national laboratory within this timeframe, then regional laboratories may not be necessary.

Surveillance workforce

- Surveillance coordinators should supervise teams of no more than 15 field investigation staff.

- Field investigators should be capable of conducting at least 15 field investigations per month, with reports primarily originating from health care centres:
  - » (# of bites at health centres per month/Investigator's capacity)/(% of job description allocated to rabies field investigations)/(Proportion of investigations instigated by health care facility reports)

  Example: A programme area has a total of 100 bites treated monthly among their two bite clinics. They employ rabies surveillance investigators part-time, with 50% of their time allocated to rabies and 50% of their time required to staff government operated veterinary clinics. They are capable of conducting 25 investigations per month when they work full-time. About 80% of rabies reports originate from the bite clinics, while an additional 20% of rabies reports come from private veterinarians and direct reports from community members.

  - » (100 bites per month/25 investigations per month)/(50% work time)/(80% bite clinic reports) = 10 rabies investigators need to be recruited for the programme area.

Dog vaccination workforce

- Resources for planning, staffing, and budgeting dog vaccination campaigns are available from US CDC.[179]

- Vaccination staffing needs are dependent on numerous factors that impact the efficiency of the vaccinators. Importation factors to consider include the accessibility of the dog population, the engagement of the community to vaccinate their dogs, the methods of vaccination being utilized, and the experience of the vaccinators. Vaccinator efficiency has varied greatly in studies, ranging from a low of just eight dogs vaccinated per vaccinator per day to programmes that achieved vaccination of over 100 dogs per vaccinator per day. To appropriately plan a vaccination campaign, evaluations should be routinely conducted to understand the efficiency of vaccinators in the programme area.

- In general, estimating dog vaccination staff should be:
  - (# of dogs targeted for vaccination)/(Daily vaccinator capacity)/(Duration of vaccination programme).

    Example 1: A rabies programme is planning to vaccinate a community that has 25,000 dogs. During last year's campaign the vaccinators were able to vaccinate on average 40 dogs per vaccinator for each day they operated. This year, the programme manager would like to complete vaccination within 14 working days.

    (25,000 dogs)/(40 dogs per vaccinator per day)/14 working days = 45 vaccinators

    Example 2: A rabies programme is planning to vaccinate a community that has 25,000 dogs. During last year's campaign the vaccinators were able to vaccinate on average 40 dogs per vaccinator for each day they operated. This year the programme manager would like to complete vaccination within 14 working days and is considering including oral rabies vaccines into the programme, which she thinks will increase vaccinator efficiency and allow them to vaccinate 100 dogs per vaccinator per day.

    (25,000 dogs)/(100 dogs per vaccinator per day)/14 working days = 18 vaccinators

Viral haemorrhagic fevers

Viral haemorrhagic fevers (VHFs) refer to a group of illnesses that are caused by several distinct families of viruses: Filoviridae (Ebola and Marburg), Arenaviridae (Lassa fever), Phenuiviridae (Rift Valley fever), Nairoviridae (Crimean-Congo haemorrhagic fever), and Flaviviridae (yellow fever).[180] These VHFs are all present in Africa and have potential for secondary human-to-human transmission after zoonotic spill over into human populations. Pigott et al depicts the transmission stages from animal reservoir to global pandemic in the following figure.[181]

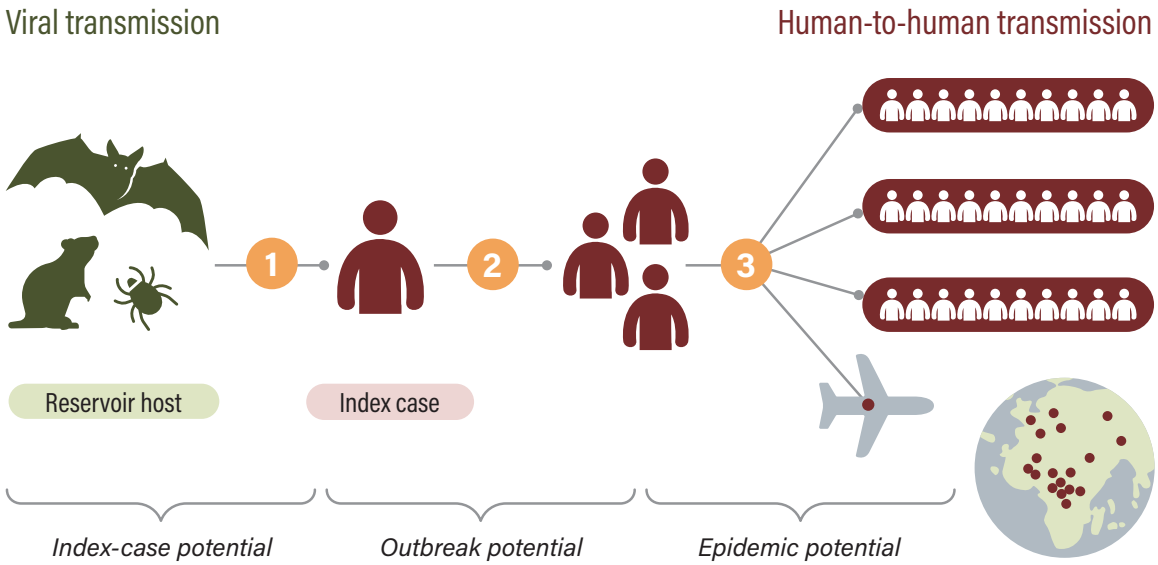


Figure 3: Conceptual progression of VHF from an animal reservoir to global pandemic: 1) spill over of virus occurs from an animal reservoir to the index-case; (2) an index case infects individuals within the local community or in a care-giving setting; and (3) widespread transmission of the virus occurs both regionally and internationally[181]

In general, the term 'viral haemorrhagic fever' is used to describe a severe multi-organ syndrome. Characteristically, the vascular system is damaged resulting in decreased vascular integrity. In severe disease, this damage may be accompanied by haemorrhage (bleeding). While some types of haemorrhagic fever viruses (HFVs) can cause relatively mild illnesses, many of these viruses may cause severe, life-threatening disease. As initial clinical presentation may be similar to many other diseases (e.g. malaria, influenza and typhoid fever), these VHFs pose a particular risk to populations in locations with low rapid diagnostic capacity.

These diseases are also extremely infectious. Surveillance officers, clinical staff and laboratory technicians should consider: (1) safety precautions, including wearing protective clothing (masks, gloves, gowns and goggles); (2) using infection control measures (e.g. complete equipment sterilization and not re-using needles); and (3) patient isolation. Vaccination and/or appropriate disposal of infected animals needs to be considered based on the type of disease and affected animal to minimize further transmission.

The severe outcomes and transmission rates associated with many VHFs, like influenza, make implementing a One Health approach a critical component of preventing and controlling these zoonotic diseases.

Surveillance and information sharing

As stated previously, many of these diseases present with similar non-specific clinical signs (e.g. fever and malaise) and may progress to include haemorrhage in severe disease. Active cased-based syndromic surveillance, targeting acute febrile illness (AFI) or VHF, may assist in early detection of cases.[182–184] As disease reservoirs and transmission routes all differ by pathogen, taking a thorough exposure history including occupation and any contact with animals and/or vector species will be helpful in narrowing down the suspected VHF. Non-human primates can serve as transmission sources for HFVs like yellow fever virus, Ebola virus, and Marburg virus. In addition, bats are known reservoirs for Marburg virus and implicated as reservoirs for Ebola virus, thus occupational exposure with bats or their habitats (e.g. in caves, mines, etc.) should be noted on case history forms.[185] The multimammate

mouse (*Mastomys natalensis*) is the reservoir for Lassa virus; exposure to rodents, specifically *Mastomys*, their infected excretions or virus-contaminated objects, including improperly stored food is considered a transmission risk factor. RVF is also a disease in livestock, causing characteristic abortion clusters. Identification of outbreaks in animal populations can provide early indication of potential spill-over events, or concurrent outbreaks in human populations. Monitoring weather patterns can also be used as a predictive tool for vector-borne diseases such as mosquito-borne Rift Valley fever and tick-borne Crimean Congo haemorrhagic fever.

Laboratory capacity

Given that most VHFs are classified as either biosafety level (BSL)-3 or -4 pathogens, countries need to have access to highly specialized reference laboratories to diagnose them in both humans and animals.[186] Viral isolation, serology and molecular approaches have been helpful in discovering and describing newly emerging viruses. However, they can be quite challenging to use diagnostically since obtaining samples from vectors, animal reservoirs and suspected clinical human cases demands time, special and sometimes uncommon protective gear and equipment, specialized laboratory facilities, and technical skills.[184,187] Newer field-based SOPs and near point-of-care techniques are being used to allow for more rapid diagnostics in emergency and clinical settings with regard to setting up mobile lab units, multi-pathogen assays, and rapid diagnostics.[188] Given that specialized capacity is needed for these highly infectious pathogens, it may make the most sense financially and logistically to collaborate with the animal and environmental health sectors to develop a common laboratory network for this type of testing across all sectors. WHO regional collaborating centres and regional laboratory networks in Africa have already provided assistance such as this in Africa for countries who do not already have this diagnostic capacity in place.

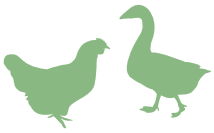
Emergency preparedness and response

Effective response to VHFs requires an integrated One Health response to characterize the extent of the outbreak and implement control measures, health communication and intervention strategies. Case management, contact tracing and biosafety are all critical elements to emergency response for VHFs across all sectors. Some countries have developed One Health response plans for VHFs,[189] which can be referenced for this type of work.

Workforce

Maintaining a well-trained workforce with the ability to accurately use and remove PPE, establish quarantine zones, and safely and accurately diagnose cases is critical. These skills not only apply to the staff responding to the human cases, but also those working at the human–animal interface who are exposed to infectious animals and or associated materials. Several SOPs and guidance documents have been developed by WHO and the US CDC to inform and train public health professionals on these topics (see Section 1: Goals 4 and 5).

Zoonotic influenzas



Surveillance and information sharing

Animal influenza viruses are distinct from human seasonal influenza viruses and do not easily transmit between humans. However, zoonotic influenza viruses – animal influenza viruses that may occasionally infect humans through direct or indirect contact – can cause disease in humans ranging from a mild illness to death.

Influenza pandemics occur when a new (novel) influenza virus emerges in the human population, where there is little or no immunity, and rapidly spreads around the world. To quickly confirm suspected human cases of a new influenza strain, it is essential to have access to laboratories with influenza virus diagnostic capacity. In countries with limited resources, it may be efficient to establish links with laboratory networks that can provide this capacity.

Any cases of human infection with a new sub-type of influenza are required to be notified to WHO under the IHR (2005).[32] Accurate and timely human and animal influenza surveillance systems are used to monitor the influenza viruses that routinely circulate in respective populations, such as, human, avian or swine, to detect any possible changes in the various viruses.

Influenza virus surveillance in humans acts as a potential pandemic early warning system by detecting animal influenza viruses as they begin to enter human populations as novel virus infections. Animal influenza virus surveillance also allows for early detection of virus changes that could affect their severity in the host population and affect their transmissibility to other species including their ability to infect humans.

Case-based surveillance

Zoonotic influenza surveillance is a collaborative effort with many partners, including national and sub-national human and animal health departments, laboratories, vital statistics offices, health care providers, health and medical clinics, and emergency departments. Information in five categories is collected from different data sources that allow NPHIs to:

- find out when and where influenza activity is occurring;
- track influenza-related illness;
- determine what influenza viruses are circulating (including the detection of novel influenza A viruses);
- detect changes in influenza viruses;
- measure the impact influenza is having on hospitalizations and deaths of humans and animals.

Using one common human case definition globally will allow national public health authorities to interpret their data in an international context. The WHO Severe Acute Respiratory Infection case definition is an acute respiratory infection with:

- history of fever or measured fever of ≥ 38 C°;
- and cough;
- and with onset within the last 10 days;
- and requires hospitalization.

Event-based surveillance

For each respiratory disease case of novel flu or seasonal outbreak, sectors determine the appropriate level of public health response. Public health officials must consider many factors in making the decision, such as availability of resources and competing sector priorities. However, several characteristics of respiratory outbreaks in people typically warrant further investigation and an urgent response. The characteristics below, while not comprehensive or definitive, can help determine which outbreaks merit further investigation:

- Outbreaks of unknown aetiology.
- Outbreaks associated with severe disease manifestations, such as need for hospitalization or death.
- Outbreaks that may be useful to answer epidemiological, laboratory or infection control questions.
- Outbreaks of possible vaccine-preventable diseases.

- Outbreaks associated with institutional settings or with a likely (controllable) environmental source.
- Clusters of respiratory infection potentially caused by a bioterrorism agent.
- Outbreaks among a vulnerable population.
- Outbreaks that have generated excessive public anxiety.
- Outbreaks that are either very large or rapidly progressing.
- Outbreaks associated with massive animal die-offs.
- Outbreaks associated with sick and dead animal remediation efforts (such as culling, controlled slaughtering for food, or burying/burning).

Laboratory capacity

Health department and commercial laboratories offer a number of diagnostic tests, including serology, culture and rapid diagnostic tests. These tests can look for either single or multiple pathogens. It is important to use validated tests and reagents. Identifying and characterizing the pathogen causing a respiratory disease outbreak in outbreaks associated with humans and animals:

- ensures effective clinical management;
- ensures implementation of appropriate infection control measures;
- informs notification and appropriate national response, including medical countermeasures, community mitigation, and possible animal source identification;
- allows clinicians to test patients for the pathogen, which can help investigators understand when the outbreak is over.

Emergency preparedness and response

Preparedness and control plans (steady-state)

- US CDC Influenza National Pandemic Strategy[135]
- What CDC does regarding human, novel and pandemic influenza[76]
- US CDC Influenza Planning and Response[190]

In 1997, avian influenza A(H5N1) viruses first spread from poultry directly to infect humans in Hong Kong, resulting in the deaths of 6 of 18 infected persons. Concerned about the possibility that this A(H5N1) virus could easily infect humans and eventually spread from person-to-person, the WHO and United States Government increased pandemic preparedness planning. Since 2000, the world has experienced a pandemic and there have been other instances of novel influenza A viruses infecting people, including avian and swine influenza A viruses. An influenza pandemic could place extraordinary demands on public health and health care systems as well as on essential community services. Preparing for such a threat is an important priority.

In 2005, officials at the United States Department of Health and Human Services (HHS) developed a Pandemic influenza plan,[191] later updated in 2017,[192] to coordinate and improve efforts to prevent, control and respond to A(H5N1) viruses as well as other novel influenza A viruses of animal (e.g. from birds or pigs) with pandemic potential. Although it is impossible to predict when the next pandemic will occur, the United States Government has developed three tools to guide national, state and local planning and response. These tools align with the WHO global framework of pandemic phases and risk assessment activities for preparedness, response and recovery.[137]

Contingency and response plans (emergency)

- US CDC Influenza planning and preparedness resources[193]

Outbreaks of acute respiratory illness are common and can occur in many settings (such as communities, nursing homes, military barracks). Specific therapies, infection control practices, and other preventive measures may be necessary to control outbreaks. Investigation into the clinical and epidemiological features and the aetiology of outbreaks is particularly important to public health. Severe unexplained respiratory outbreaks may be of particular importance to rule out zoonotic influenza or new health threats.

The primary objective of surveillance monitoring during the pandemic is to track the course of the pandemic, including geographical spread, disease trends, intensity of transmission, impact of the pandemic on health care services, and changes in antigenicity and antiviral sensitivity.

Although pandemics occur infrequently, planning and preparing for a pandemic is important to ensure an effective response. Planning for and responding to a pandemic is complex and pandemics can affect everyone in a community. Therefore, public health officials, health care professionals, researchers and scientists across the world are working together to plan and prepare for possible pandemics. Many resources are available to help international, national, state and local governments, public health and health care professionals, corporations, and communities develop pandemic preparedness plans and strengthen their capabilities to respond to different pandemic scenarios. Focusing on the processes of national pandemic influenza preparedness planning, the aim is to ensure that, when countries develop or update a plan, the objectives are clear, and the essential steps and actions are taken; this is imperative if the plan will be guiding pandemic preparedness and response practices.

Risk communication

- US CDC Influenza communication and public outreach[194]

Any public health emergency presents significant risk communication challenges, and an influenza pandemic will be no different. Clear, accurate and timely communication is key to keeping the general public informed about the influenza pandemic.

Workforce

- US Influenza healthcare system preparedness and response[195]

Pandemic influenza has the potential to place great strain on health care systems. Effective pandemic preparedness will require the engagement of the entire health community, and health care assets from across the spectrum of care will need to be prepared to meet the increased demands. All health care organizations must both exhibit day-to-day resilience and be prepared to respond when an influenza pandemic arises. An effective health care response to a pandemic event requires an overall awareness of the system's capabilities and capacities to form a 'common operating picture'. Individual health care facilities must be prepared to adjust to varying stressors on the system over time through collaboration with diverse partners, effective information sharing, and coordination of response activities. Over the past decade, significant investments have been made to assist the health care sector in identifying gaps in preparedness, determining specific priorities, and developing plans for building and sustaining health care delivery.

Cross-border considerations

The increase in international travel by people, animals and animal products, combined with the porous nature of international land borders, heightens the potential for spread of a public health threat, including transmission of zoonotic diseases, across administrative boundaries. In order to strengthen national, district and point of entry capacity to prevent, detect and respond to public health threats at international borders, in border regions, and throughout a nation, it is important to identify recent association with travel to or through geographic areas of interest at the time of or soon after a public health event. Integrating a travel associated variable into the national surveillance and reporting system independent of an outbreak will allow for the routine collection and analysis of data that will assist with the rapid notification of a potential public health emergency of international concern (PHEIC). The integration into national surveillance and reporting systems of a travel variable designed to reflect recent travel history or intent to travel can assist in identifying potential bi- or multinational cases or case contacts, and indicate when further cross-border response or investigation is required. The term 'travel associated' refers to a confirmed or probable case of disease or other health event in an individual:

- who recently travelled from, or had recent contact with persons/animals who travelled from another country; or
- who is thought to have acquired the disease in another country or to have been in another country during the incubation period of an infection and was possibly contagious during this period; or
- who is thought to have acquired the disease exposure in another country; or
- who has imminent plans to travel to another country; or
- whose case requires the collaboration of another country(ies) for the purposes of disease investigation and control, regardless of the presumed site of infection or exposure.

The objective of the travel variable is to integrate travel history or intent to travel notification into national surveillance and reporting systems to guide public health surveillance and response activities for 'travel associated' cases and case contacts. Travel history or intent to travel of a case or case contact will be collected by community health volunteers, district surveillance officers, health care/animal health facilities, and other stakeholders involved in the collection and reporting of surveillance data. Where community-based surveillance systems are in place, a community surveillance volunteer would simultaneously record and submit a public health event alert, following standard protocol, and a yes/no alert for general travel history or intent to travel for a suspect case or case contact. In response to receiving a 'yes' travel alert, the surveillance team will determine the level of response needed considering available epidemiological information including the associated public health event alert, the geographic location, the case's demographic characteristics, etc. Possible response actions include, but are not limited to, completing a travel history or intent module during a case investigation or initiating an event-based surveillance cross-border collaboration activity. Of note, officials at points of entry should be treated as another community surveillance volunteer with regard to their responsibility to report public health, including travel association, alerts. The following signals indicate a probable positive travel-associated case or case contact with whom surveillance officers should conduct follow-up travel history or intent investigations:

- Case responds yes to having recently travelled to another country(ies).
- Case responds yes to having contact with someone who has recently travelled to another country(ies).
- Case has imminent plans to travel to another country.

The following steps are considered if one of the signal criteria is met:

- District surveillance officer, or other personnel as assigned, conducts a follow-up interview to gather additional travel history or intent information.
- Regional and/or national authorities are notified when appropriate, as per protocol.
- Counterparts in other countries are notified when appropriate, as per protocol.

Section 3: Monitoring One Health progress

To measure and track the progress of One Health implementation within NPHIs, the following One Health scorecard has been provided. This One Health scorecard links framework activities to the existing Africa CDC scorecard for NPHIs.[196]

The One Health scorecard is an evaluation tool developed to help countries with existing NPHIs/MoHs in Africa with interest in developing One Health capacity to assess and measure progress in reaching these framework goals: 1) Strengthen multisectoral, One Health coordination and collaboration; 2) Develop and strengthen surveillance systems and data sharing mechanisms with relevant stakeholders; 3) Strengthen laboratory systems and networks to ensure early detection, surveillance, and response; 4) Ensure effective and coordinated public health emergency preparedness and response using a One Health approach; and 5) Strengthen and support workforce development to prevent and control Priority zoonotic diseases.

This tool can be used directly by NPHI's to conduct an internal assessment or by an external group if an independent evaluation is desired. It can be used as a stand-alone document or as an addendum to the NPHI scorecard for those interested in additionally measuring their One Health capacity. This One Health scorecard will help NPHIs across Africa identify their most urgent needs, track progress over time, and provide information to Africa CDC and RCCs that can advocate for resources to support ongoing development. As this builds on the existing NPHI scorecard, it complements both the IANPHI Staged Development Tool and the WHO JEE.

The first time the scorecard is administered, it will establish a baseline measurement of an NPHI's One Health capacity and capabilities. Subsequent assessments will help monitor progress. The results from implementing the scorecard will be used to inform NPHI development and strengthening.

Format

The One Health scorecard is organized by framework goal and objective and denotes which NPHI function it links to in the existing NPHI scorecard. Under each goal there is a set of high-level indicators that enable NPHIs to assess their One Health capacity and progress toward framework implementation. Each indicator can be scored as 0 (No), 1 (Partial) or 2 (Yes), depending on the current One Health capacity. The scorecard also describes the type of documentation NPHIs need to provide to justify the scores.

Scoring the scorecard

During a self-assessment or an external NPHI independent assessment, assessors should score all the indicators in the scorecard. This will ensure that final scores accurately reflect the capacity of the NPHI.

Based on the NPHI's current capacity, each indicator in the scorecard receives a unique score ranging 0–2. Assessors should score an indicator 0 if the NPHI has absolutely no capacity in the area being assessed by that indicator – if the key attributes are completely absent. If the NPHI has some capacity and meets some of

the attributes specified in an indicator, but not all, they should receive a score of 1. The assessors should score an indicator 2 if the NPHI completely meets all the requirements and key attributes specified in the indicator. Distinguishing between a 0 versus 1 must solely depend on the presence or absence of the key attributes specified in a given indicator. Even if an NPHI demonstrates capacity in only one of the few areas indicated in an indicator, the NPHI should receive a score of 1 and not a 0. All the responses should be supported by documentation as indicated in the scorecard. The scorecard provides guidance to the assessors on when and how to score each indicator.

Based on the assessor's entries, the scorecard generates two final scores for the NPHI: an overall performance score and a performance score broken down by each One Health framework goal. For each framework goal, the scorecard automatically calculates a ratio, by dividing the total number of points the NPHI scores in that framework goal by the maximum possible points (total number of indicators per framework goal multiplied by 2) for the framework goal. The scorecard converts the ratio to a percentage by multiplying it by 100. The percentages are very useful in estimating and tracking how much progress the NPHI has made in improving its capacity and attaining the standards described in the scorecard.

NPHI performance score by OH framework goal
1. X = Sum of scores for items within a goal
2. Y = Total possible points that can be earned for the goal
3. NPHI score by goal (%) = X/Y x 100

The scorecard automatically calculates the overall performance score by dividing the sum of points obtained for each framework goal by the sum of the maximum possible points from all the framework goals. The scorecard then multiplies this ratio by 100 to get an overall NPHI percentage score. The scorecard is thus able to present the percentage scores by framework goals as well as the overall NPHI overall performance, in colour-coded histogram bars.

NPHI overall performance score
1. X = Sum of total points from all goals
2. Y = Sum of maximum possible points from all goals
3. Overall NPHI score (%) = X/Y x 100

Colour-scoring system

The bars of the chart generated by the scorecard are colour-coded based on the NPHI's performance. Colour-coded charts allow for a straightforward visual representation of scoring. Scores are colour coded into three categories, based on the following cut-offs:

- Minimal Performance (Red): 0–59%
- Average performance (Yellow): 60–79%
- Optimal performance (Green): 80–100%

One Health Scorecard

OHF objective[9]	NPHI function	Indicator	Comments	Score
Goal #1: Strengthen multisectoral, One Health coordination and collaboration				
1.1	10. Structure	**1.1 – A multisectoral, One Health coordination mechanism, (inclusive of the NPHI) in place for coordination and collaboration of relevant activities across participating sectors (e.g. ministry of agriculture, ministry of environment, etc.).** **Note:** Score 0 if no MCM in place; score 1 if an MCM is being established or the NPHI is actively becoming part of an existing MCM; score 2 if the NPHI is actively engaged and a member of a functioning MCM. **Documentation required:** A memorandum of understanding (MOU) or other official document establishing an MCM between the NPHI and other relevant sectors.		2
1.1	7. Finance	**1.2 – The MCM has decision-making authority, including the authority to commit financial and human resources and this funding mechanism is inclusive of the NPHI.** **Note:** Score 0 if there is no MCM or the MCM has no established financial mechanism in place; Score 1 if there is work to establish a financial mechanism in the MCM or engage the NPHI into an mechanism; Score 2 if there is a MCM financial mechanism, inclusive of the NPHI, in place. **Documentation required:** National MCM budget line item or some other evidence of financial sustainability within the MCM.		2
1.1	6. Legislation	**1.3 – The NPHI or MCM (inclusive of the NPHI) has legal authority or a policy framework that is inclusive of other relevant sectors and its mandate (e.g. mission and functions) is inclusive of a One Health approach.** **Note:** Score 0 if the NPHI does not have a legal authority or policy framework inclusive of other sectors or a One Health approach; Score 1 if the NPHI's legal authority or policy framework is partially inclusive of other sectors and/or a One Health approach; Score 2 if the NPHI legal authority or policy framework includes and authorizes the NPHI and other sectors to: conduct coordinated surveillance, coordinate emergency preparedness and response, conduct and coordinate One Health research activities, and identify and report on priority zoonotic diseases through an established national laboratory network/system. **Documentation required:** Data use and sharing agreements for surveillance, laboratory, research and response related data.		2
1.1 – *optional*	5. Public health research and institutes	**1.4 – The NPHI or the MCM (inclusive of the NPHI) has an operationalized research agenda/guideline/plan inclusive of One Health and priority zoonotic diseases.** **Note:** Score 0 if the NPHI or MCM does not have a research plan in place; Score 1 if the NPHI or MCM is drafting or initiating implementation of a research plan; Score 2 if the NPHI or MCM is systematically using research plan evidence to design priority zoonotic disease policies, strategies and response interventions AND routinely communicates the priority zoonotic disease research findings with the relevant sectors. **Documentation required**: A research guideline/plan inclusive of priority zoonotic diseases and a One Health approach, publications or reports from the plan		N/A – (bonus of 2 if completed)

[9] One Health Framework (OHF) objectives: **Objective #1.1**: Support creation and/or strengthening of multisectoral, One Health coordination mechanisms (MCM); **Objective #1.2**: Develop and implement priority zoonotic disease prevention and control programmes in collaboration with MCM; **Objective #2.1**: Establish indicator- and event-based surveillance for rabies, zoonotic influenza, and at least three additional high-priority zoonotic diseases; **Objective #2.2**: Support new and strengthen existing mechanisms for information and data sharing with relevant One Health stakeholders, for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases; **Objective #3.1:** Strengthen institutional capacity (facilities, personnel, and systems) for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases; **Objective #3.2:** Support coordination between human, animal and environmental health laboratory networks; **Objective #4.1:** NPHIs should conduct a joint risk assessment for at least one priority zoonotic disease event in collaboration with relevant One Health sectors; **Objective #4.2:** NPHIs and all relevant sectors to develop and implement joint preparedness and response plans for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases in collaboration with animal and environmental officials; **Objective #4.3:** Include animal and environmental health experts in staffing of Public Health Emergency Operations Centres; **Objective #4.4:** Liaise with country and regional stockpiles to ensure adequate and just-in-time procurement and distribution of supplies for outbreaks of priority zoonotic diseases; **Objective #5.1:** Support workforce development to prevent and control rabies, zoonotic influenza, and at least three additional high-priority zoonotic diseases; **Objective #5.2:** Advocate for multisectoral, One Health training opportunities for rabies, zoonotic influenza, and at least three additional high priority zoonotic diseases.

OHF objective[g]	NPHI function	Indicator	Comments	Score
Goal #1: Strengthen multisectoral, One Health coordination and collaboration				
1.2	9. Strategic plan	**1.5 – The NPHI or MCM (inclusive of the NPHI) has an operationalized strategic plan and action/implementation plans inclusive of other sectors, priority zoonotic diseases, and a One Health approach.** **Note:** Score 0 if the NPHI or MCM does not have a One Health strategic plan in place; Score 1 if the NPHI or MCM is drafting or initiating implementation of a One Health strategic plan and associated action plans; Score 2 if the NPHI or MCM is systematically using the One Health strategic plan and associated action plan outcomes/evidence to design priority zoonotic disease policies, strategies and response interventions AND routinely communicates the priority zoonotic disease findings with the relevant sectors. **Documentation required**: A strategic plan and associate action plans inclusive of priority zoonotic diseases and a One Health approach, publications or reports from the plan		2
1.2	N/A	**1.6 – The NPHI or MCM (inclusive of the NPHI) One Health legal authority or policy framework is expanded to address cross-border and regional efforts.** **Note:** Score 0 if the NPHI/MCM does not have a One Health legal authority or policy framework inclusive of cross-border and regional efforts; Score 1 if the NPHI/MCM's One Health legal authority or policy framework is being revised to include cross-border and regional One Health efforts; Score 2 if the NPHI/MCM One Health legal authority or policy framework includes and authorizes the NPHI and other sectors to: conduct cross-border/regional coordinated surveillance, coordinate cross-border/regional emergency preparedness and response, conduct and coordinate cross-border/regional One Health research activities, and identify and report on priority zoonotic diseases through an established national laboratory network/system linked to bordering or regional countries. **Documentation required:** Multinational (regional) data use and sharing agreements for cross-border/regional surveillance, laboratory, research and response related data.		2
			Goal # 1 TOTAL	**10**
Goal #2: Develop and strengthen surveillance systems and data-sharing mechanisms with relevant stakeholders				
2.2	1. Surveillance and disease intelligence	**2.1 – The NPHI has functional indicator- or event-based surveillance in place for at least five priority zoonotic diseases, including rabies and zoonotic influenza, to shape public health policy.** **Note:** Score 0 if no surveillance in place for priority zoonotic diseases at the NPHI; Score 1 if the NPHI is working to establish surveillance for at least one priority zoonotic disease; Score 2 if the NPHI has surveillance functionally in place for rabies, zoonotic influenza, and three other priority zoonotic diseases AND is regularly using surveillance outcomes to shape zoonotic disease prevention and control policy. **Documentation required:** Evidence of policy informed by surveillance efforts.		2
2.2	2. Information systems	**2.2 – The NPHI systematically uses coordinated surveillance data for five priority zoonotic diseases, including rabies and zoonotic influenza, to shape One Health policy.** **Note:** Score 0 if no coordinated surveillance with other relevant sectors for priority zoonotic diseases is in place at the NPHI; Score 1 if the NPHI is working to establish coordinated surveillance for at least one priority zoonotic disease; Score 2 if the NPHI has coordinated surveillance functionally in place for rabies, zoonotic influenza, and three other priority zoonotic diseases AND is regularly using surveillance outcomes to shape One Health policy. **Documentation Required:** Evidence of policy informed by coordinated surveillance efforts.		2

OHF objective[g]	NPHI function	Indicator	Comments	Score
Goal #2: Develop and strengthen surveillance systems and data-sharing mechanisms with relevant stakeholders				
2.2	2. Information systems and 6. Legislation	**The NPHI has a coordinated surveillance data sharing policy/framework with all relevant One Health sectors for at least five priority zoonotic diseases, including rabies and zoonotic influenza.** **Note:** Score 0 if no coordinated surveillance data sharing policy with other relevant sectors is in place; Score 1 if the NPHI is in the process of establishing a coordinated surveillance data sharing policy for at least one priority zoonotic disease; Score 2 if NPHI has fully established coordinated surveillance data sharing policy for Zoonotic influenza, Rabies and other three priority zoonotic diseases. **Documentation required:** Data use agreement or equivalent documentation between relevant sectors. ***See Also 1.3 regarding coordinated surveillance.***		2
			Goal # 2 TOTAL	**6**
Goal #3: Strengthen laboratory systems and networks to ensure early detection, surveillance and response				
3.1	3. Laboratory systems and networks	**3.1 – The NPHI's laboratory network has the capacity to test for five priority zoonotic diseases, including rabies and zoonotic influenza.** **Note:** Score 0 if NPHI laboratory network has no capacity to test for any priority zoonotic diseases; Score 1 if NPHI laboratory network can test for at least one priority zoonotic disease; Score 2 if laboratory network can routinely test for at least five priority zoonotic diseases, including rabies and zoonotic influenza. **Documentation required:** SOPs and routine laboratory reports inclusive of priority zoonotic diseases.		2
3.2	3. Laboratory systems and networks	**3.2 – A functional laboratory information management system (LIMS) or equivalent mechanism established that allows for laboratory data sharing between relevant One Health sectors for priority zoonotic diseases.** **Note:** Score 0 if there is no LIMS or equivalent mechanism established; Score 1 the LIMS is in development; Score 2 there is an established and functional LIMS or equivalent mechanism in place that allows for data sharing between relevant One Health sectors for at least five priority diseases (including rabies and zoonotic influenza). **Documentation required:** Examples of laboratory reports shared with other sectors. ***See Also 1.3 regarding laboratory networks.***		2
			Goal # 3 TOTAL	**4**
Goal #4: Ensure effective and coordinated public health emergency preparedness and response using a One Health approach				
4.1	4. Preparedness and response	**4.1 – NPHI completes a joint risk assessment (JRA) in collaboration with relevant sectors for at least one priority zoonotic disease that occurred in the past 12 months.** **Note:** Score 0 if the NPHI has not conducted a risk assessment of JRA for a priority zoonotic disease; Score 1 if NPHI has conducted a risk assessment for at least one priority zoonotic disease; Score 2 if NPHI has conducted a JRA at least one priority zoonotic disease that occurred in the past 12 months. **Documentation required:** JRA report.		2
4.2	4. Preparedness and response	**4.2 – NPHI (and relevant sector) operationalized joint preparedness and response plans in place for rabies, zoonotic influenza, and at least three additional priority zoonotic diseases** **Note:** Score 0 if no priority zoonotic disease preparedness and response plans are in place; Score 1 if joint priority zoonotic disease preparedness and response plans for at least one priority zoonotic disease are in development; Score 2 if operationalized joint priority zoonotic disease preparedness and response plans are in place for at least five priority zoonotic disease (including rabies and zoonotic influenza) and implementation was in collaboration with relevant animal and environmental officials. **Documentation required:** Priority zoonotic disease response plans and evidence of joint implementation.		2

OHF objective[g]	NPHI function	Indicator	Comments	Score
Goal #4: Ensure effective and coordinated public health emergency preparedness and response using a One Health approach				
4.3	4. Preparedness and response	**4.3 – NPHI has functional PHEOC at national level that is staffed with animal and environmental experts and can alert and engage relevant One Health partners in the event of a priority zoonotic disease emergency?** **Note:** Score 0 if NPHI does not have EOC; Score 1 if NPHI has functional EOC that monitors for priority zoonotic diseases, but does not include animal and environmental experts and/or engage with One Health partners; Score 2 if NPHI has fully functional EOC, staffed with animal and environmental experts and routinely engages with relevant One Health partners for priority zoonotic disease emergencies. **Documentation required:** Staffing records; Mechanisms in place for alerting relevant sectors ***See Also I.3 regarding coordinated/joint response.***		2
4.3	4. Preparedness and response and 6. Legislation	**4.4 – 80% or more of the NPHI's investigations of priority zoonotic disease-related health threats in the last year included participants from all relevant sectors.** **Note:** Score 0 if actual percentage is 0–50%; Score 1 if 51–79%; Score 2: if ≥ 80%. **Documentation required:** Priority zoonotic disease investigation reports. ***See Also I1.3 regarding coordinated/joint response.***		2
4.4	4. Preparedness and response	**4.5 – NPHI has emergency stockpiles of supplies (e.g. medicines, vaccines, PPE) needed for priority zoonotic disease outbreaks.** **Note:** score 0 if the NPHI has no stockpiles of supplies in place for any priority zoonotic disease; Score 1 if NPHI has stockpiles in place for at least one priority zoonotic disease; Score 2 if NPHI has stockpiles in place for at least five priority zoonotic diseases including rabies and zoonotic influenza. **Documentation required:** Maintenance and inventory records for the national stockpile		2
			Goal # 4 TOTAL	**10**
Goal #5: Strengthen and support workforce development to prevent and control priority zoonotic diseases				
5.1	8. Workforce	**5.1 – NPHI has a comprehensive operationalized workforce development strategy/plan that addresses rabies, zoonotic influenza and at least three additional priority zoonotic diseases.** **Note:** Score 0 if NPHI does not have a workforce development strategy/plan in place for any priority zoonotic disease; Score 1 if NPHI is in the process of developing a workforce development strategy/plan inclusive of priority zoonotic diseases; Score 2 if NPHI has an operationalized workforce development strategy/plan for rabies, zoonotic influenza, and at least three other priority zoonotic disease that includes epidemiologists, laboratories, clinical staff, and community health workers. **Documentation required:** Workforce plan inclusive of priority zoonotic diseases that target key public health professionals.		2
5.1	8. Workforce	**5.2 – NHPI has an advanced field epidemiology and laboratory training programme (FETP) (or equivalent) that addresses rabies, zoonotic influenza and at least three additional priority zoonotic diseases.** **Note:** Score 0 if the NPHI does not have a workforce training program or a programme that does not address priority zoonotic diseases; Score 1 if an FETP or equivalent is in place that addresses at least one priority zoonotic disease; Score 2 if an FETP or equivalent is in place that addresses prevention, response, and control activities for rabies, zoonotic influenza and at least three additional priority zoonotic diseases. **Documentation required**: Workforce programme curricula inclusive of priority zoonotic diseases.		2

OHF objective[g]	NPHI function	Indicator	Comments	Score
Goal #5: Strengthen and support workforce development to prevent and control priority zoonotic diseases				
5.2	8. Workforce	**5.3 – NPHI has expanded and operationalized the priority zoonotic disease workforce development strategy/plan to include other relevant sectors and/or multisectoral, One Health training opportunities for rabies, zoonotic influenza and at least three additional priority zoonotic diseases.** **Note:** Score 0 if NPHI does not have a workforce development strategy/plan in place inclusive of One Health and other sectors; Score 1 if NPHI is in the process of developing a workforce development strategy/plan inclusive of One Health and other sectors; Score 2 if NPHI has an operationalized workforce development strategy/plan inclusive of One Health and includes training opportunities for epidemiologists, laboratories, clinical staff and community health workers from multiple sectors. **Documentation required:** Workforce plan inclusive of One Health and targets key health professionals from multiple sectors.		2
5.2	8. Workforce	**5.4 – NPHI has an advanced field epidemiology and laboratory training programme (or equivalent), inclusive of a One Health approach and training opportunities with other relevant sectors?** **Note:** Score 0 no multisectoral, One Health training provided in FETP or equivalent program; Score 1 training provided but not all the relevant sectors involved; Score 2 training provided all the relevant sectors involved. **Documentation required:** Workforce programme curricula inclusive of One Health. Graduate records that include trainees from multiple sectors.		2
			Goal # 5 TOTAL	**8**
OVERALL TOTAL				**38**

Glossary of Terms

Academia/academic institutions: Institutions of higher education. May refer to publicly funded, privately funded, and jointly funded institutions, and may refer to those functioning under and accountable to governmental ministries of education or labour, and those that are not.

Action plan: (See plan).

Address: In the current context, to take policy and technical measures to prevent, detect and respond to, as well as to prepare for and assess, zoonotic diseases.

Alignment: A position of agreement or concurrence.

Animal: Domestic animals (both pets and livestock) and wildlife, including para-domestic or urban-dwelling non-domestic animals (e.g. rats, pigeons).

Biosafety: The maintenance of safe conditions in storing, transport, handling and disposing of biological substances to prevent inadvertent exposure of personnel.

Biosecurity: The set of measures taken to limit or counter release of biological substances to the community or environment.

Capability: A function or a range of functions that can be performed (e.g. a laboratory can test for H5, H7 and H1 avian influenza sub-types).

Capacity: The ability to achieve something, generally referring to something that is measurable (e.g. a laboratory can test 100 samples/day for avian influenza).

Collaboration: Individuals or institutions working together as to produce or achieve something.

Competency: A characteristic composed of three parts: skills (ability to do something), knowledge (comprehension of a topic) and abilities (acquired talent to perform) that together enable a person to be effective and to lead to superior performance.

Context: The entire scope of the circumstances, setting or environment in which an event is taking place or a situation exists, and in terms of which the event or situation can be fully understood and assessed.

Contingency plan: An emergency preparedness plan specific to a single zoonotic disease.

Coordination: The organization of the different component parts of an activity to enable them to work together effectively.

Coordinated surveillance system: A mechanism to organize different surveillance elements across collaborating sectors, enabling them to effectively work together toward an agreed upon zoonotic disease surveillance goal(s).

Cultural norms and beliefs: The behaviour patterns that are typical of specific groups, often passed down from generation-to-generation by observational learning within the community.

Discipline: A branch of knowledge (e.g. economics, virology, epidemiology, law, clinical medicine, vector biology).

Element: A component or part of something. Here, refers to components of activities that may be done in any order.

Emergency: A substantial zoonotic disease event that interacts with existing conditions of exposure, vulnerability and capacity and may disrupt the function of a community or society at any scale and which may overwhelm the national capacity to respond to the needs of the affected population, and lead to human, animal, material, economic and/or environmental losses and impacts.

Emergency preparedness: The knowledge, capacities and organizational systems developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, emerging, or current emergencies, including zoonotic disease emergencies.

Emerging zoonotic disease: Zoonotic disease due to known pathogens but that have not yet occurred in a specific geographic area, in a specific species, or that are increasing in prevalence (here, different from new pathogens, see definition below).

Endemic zoonotic disease: Zoonotic disease that exist continually or continuously in a geographic area, so that cases of disease could be expected.

Environment: The complex of physical, chemical and biotic factors (e.g. climate, soil, living things) that act upon an organism or an ecological community and ultimately determine its form and survival; here, refers to the physical location and context in which people and animals live and interact.

Equitable: Fair and impartial, but not implying equality. Here, often refers to distribution of resources.

Event: An occurrence of a zoonotic disease, including an outbreak, epidemic, or pandemic in people or animals. May or may not refer to a single or small number of clinical case(s) or detected zoonotic disease infection(s), depending on the hazard and/or the circumstances.

Exposure: The condition of being subjected to a zoonotic disease pathogen that may cause an infection.

Framework: A basic structure or idea underlying a system, concept, or document, or a specific set of rules, ideas, or beliefs used to approach a problem or decision.

Governance: The set of structures, policies, processes and/or decisions that support the management of a system or group.

Hazard: Anything with the potential to cause adverse health effects (e.g. virus, bacteria, chemical, flood, earthquake, snake); may also be referred to as a threat.

Human–animal–environment interface: A continuum of contacts and interactions among people, animals, their products, and their environment(s); in some cases, facilitating transmission of zoonotic pathogens or shared health threats.

Indicator: Something that can be measured; here, refers to a variable directly or indirectly measured repeatedly over time to reveal change in a system.

In-service: Training carried out during professional services or work; here, refers to training.

Integrated: The state of two or more things being combined into one.

Iterative: Something that is conducted/repeated periodically over time, generally with the aim of achieving more accurate results.

Joint: The state of being or doing something together.

Level (administrative): Refers to the levels within the country, e.g. central/national/ federal, sub-national (district, governorate, state), local/community.

Level (governmental): Refers to the functional level within the administrative level, e.g. prime ministerial, ministerial, technical.

Mapping: Comprehensively collecting and reviewing information on what infrastructure, activities, resources, etc., already exists in the country for addressing zoonotic diseases.

Mechanism: A standing system, part of an infrastructure, or an organized group or network designed to accomplish a specific task; here, in the context of a multisectoral, One Health coordination mechanism, refers to a standing, organized group working under a set of documented procedures. May be named as a platform, committee, task force, working group, etc.

Ministry: Refers to the national governmental entity responsible for a given topic or sector, normally the competent authority. May be referred to differently by different countries (e.g. agency, department, directorate).

Mitigation: (See risk reduction).

Monitoring and evaluation: A process that helps measure, track, improve performance, and assess the results of an ongoing or completed activity, programme or policy by providing indications of the extent of progress and achievement of objectives, and progress in the use of allocated funds, for the purposes of improving performance, ensuring accountability, or demonstrating value. Includes Monitoring: the continuing and systematic collection of information on specified indicators related to the project or process; and Evaluation: the systematic and objective assessment of the relevance, efficiency, effectiveness or impact of a project or process based on the set of information collected on the indicators during monitoring.

Multidisciplinary: Involving participation of multiple disciplines working together such as in a single ministry that employs physicians, nurses, veterinarians or other health professions. Note this does not mean the same as multisectoral (see definition).

Multisectoral: Involving participation of more than one sector working together across on a joint programme or response to an event. Saying multisectoral does not always mean that the human, animal, and environmental health sectors are engaged as is the case when saying a One Health approach (see definition).

Multisectoral, One Health approach: Including multiple disciplines and multiple government entities across the human–animal–environment interface as well as non-governmental entities to jointly address health in a way that is more effective, efficient, or sustainable than might be achieved by one sector acting alone.

One Health approach: An approach to address a health threat at the human–animal–environment interface based on collaboration, communication and coordination across all relevant sectors and disciplines, with the ultimate goal of achieving optimal health outcomes for people, animals, and plants living in a shared environment; a One Health approach is applicable at the sub-national, national, regional and global level.

Outcome: A result or effect of an activity.

Output: The documentation or other physical or measurable evidence of an outcome.

Plan: An operational or action-oriented description of activities to be undertaken, often based on an overarching strategy.

Preparedness: A process used in advance of a potential zoonotic disease event to ensure that capacity and resources will be available to respond.

Pre-service: Training carried out prior to professional services or work (e.g. college, university, apprenticeship), here refers to training.

Readiness: The state of being fully prepared for something; here, ready for a zoonotic disease event or emergency.

Recovery: Action that takes place immediately after a response to a zoonotic disease event, when immediate animal health, public health, and environmental concerns have been addressed and concerns for lives and livelihoods have been mitigated. Recovery refers to the restoration of damaged infrastructure and resources, and all other actions taken to ensure a return to normalcy.

Region: A group of countries that have some similarities, normally geographically linked.

Relevant sectors/disciplines/stakeholders/ ministries: At a minimum, those sectors, disciplines, stakeholders, or ministries that are key to the specific health threat to be addressed using a multisectoral, One Health approach. Other sectors and agencies that are stakeholders to the health threat (e.g. private stakeholders, academia), may be included as needed.

Reservoir: Any animal, person, plant, soil, substance – or combination of any of these – in which a zoonotic disease agent normally lives and multiplies, and for which it primarily depends on for its survival. It is from the reservoir that the infectious substance is transmitted to a human, animal or other susceptible host.

Resources: Materials, staff, time or money required to conduct activities.

Response: Those activities undertaken to react to a zoonotic disease event anywhere on the spectrum from increased monitoring to full emergency response.

Risk: A function of the likelihood that a zoonotic disease event may occur and the magnitude of the impact if it were to occur.

Risk assessment: In this context, risk assessment is defined as the systematic process of gathering, assessing and documenting information to estimate the level of risk and associated uncertainty related to a zoonotic disease event, during a specified period of time and in a specified location.

Risk communication: The real-time exchange of information, advice and opinions among experts, community leaders or officials and the people who are at risk or who have a direct influence on risk mitigation due to their practices or behaviour. Risk communication ensures that people and communities are aware of current threats and can be used to promote behaviours to reduce ongoing risks.

Risk factor: Any physical or contextual variable that contributes to the likelihood or impact of either a priority zoonotic disease, zoonotic disease event or emergency at the individual or population level.

Risk management: The identification and implementation of policies and activities to avoid or minimize the likelihood and/or impact of ongoing or potential zoonotic disease events. In practice, risk management typically refers to responding to current disease events (e.g. quarantine, culling, movement control).

Risk reduction/risk mitigation: The identification and implementation of policies and activities designed either to prevent zoonotic disease agents from creating health risks or to lessen their frequency, distribution, intensity or severity. In practice, typically refers to avoidance or decreasing current ongoing or future risk and/or impact.

Rural–urban differentials: The variation in social determinant factors based on where people live and reside in either rural or urban locations.

Sector: A distinct part or branch of a nation's sociological, economic, or political society or a sphere of activity such as human health, animal health, or environment.

Social determinants of health: The conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems.

Stakeholder: Any individual or group that is or should be involved in preventing or managing a health threat at the human–animal–environment interface, or impacts, is impacted by, or perceives themselves to be affected by a such a health threat, including those that may be impacted by any associated risk management measures.

Stakeholder analysis: A consultative process whereby all relevant stakeholders to a health threat at the human–animal–environment interface are identified and the relationships and networks among them mapped.

Strategy: A high-level, overarching or conceptual plan or set of policies designed to achieve a specific outcome, often operationalized through a specific action plan or operational plan.

Sub-national: Those administrative levels below the central or national level.

Surveillance: The continuous, systematic collection, analysis and interpretation of data needed for planning, implementation and evaluation related to zoonotic diseases.

Surveillance (event-based surveillance): The organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding events or risks that may represent acute risks to health, and which in the context of this guide will refer to surveillance for zoonotic diseases.

Surveillance (indicator-based surveillance): The systematic and routine collection, monitoring, analysis and interpretation of structured zoonotic disease data, generally collected from a number of well-identified formal sources, which in the context of this guide will be mostly human and animal health-based sources.

Threat: A zoonotic disease hazard, agent, event, concern, or issue that poses risks to human or animal health.

Trigger: Something that initiates a process or action.

Vector: Invertebrate (e.g. insect) or non-human vertebrate species that transmit zoonotic disease agents from one host to another.

Vulnerability: The degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the negative impacts of events such as a zoonotic disease event.

Wildlife: Animals considered to be wild or feral or otherwise not adapted to domestic situations; may be mammals, birds, fishes, reptiles, amphibians, etc.

Workforce development: The continual process of developing education and training programmes to enable individuals to acquire knowledge, skills and abilities that provide individuals with the capacity to meet national and international workforce needs.

Zoonotic disease agent: A pathogen or hazard causing a zoonotic disease.

Zoonotic diseases (zoonoses): Infectious diseases that can be spread between animals and humans; can be spread by food, water, fomites or vectors.

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