Joint Risk Assessment Operational Tool (JRA OT)

An Operational Tool of the Tripartite Zoonoses Guide

Taking a Multisectoral, One Health Approach: A Tripartite Guide to Addressing Zoonotic Diseases in Countries

Food and Agriculture Organization of the United Nations

WORLD ORGANISATION FOR ANIMAL HEALTH

World Health Organization

Joint Risk Assessment Operational Tool (JRA OT)

An Operational Tool of the Tripartite Zoonoses Guide

Taking a Multisectoral, One Health Approach: A Tripartite Guide to Addressing Zoonotic Diseases in Countries

Published by

The Food and Agriculture Organization of the United Nations

•

The World Organisation for Animal Health

•

The World Health Organization

•

2020

Food and Agriculture Organization of the United Nations

WORLD ORGANISATION FOR ANIMAL HEALTH

World Health Organization

Joint Risk Assessment Operational Tool (JRA OT)
An Operational Tool of the Tripartite Zoonoses Guide
Taking a Multisectoral, One Health Approach: A Tripartite Guide to Addressing Zoonotic Diseases in Countries

ISBN: 978-92-4-001514-2 (WHO)

ISBN: 978-92-5-133471-3 (FAO)

ISBN: 978-92-95115-72-9 (OIE)

Acknowledgements

The content of this document was developed by the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE), and the World Health Organization (WHO) (also known collectively as the Tripartite), including their regional and country offices, in close collaboration with subject-matter experts from around the world, as listed in Contributors. The Tripartite gratefully acknowledges the enormous time and effort invested by these experts working in their individual and institutional capacities. The Tripartite also thanks the following partners and organizations for providing technical assistance and/or in-kind funding and support for the development of this guide: United States Agency for International Development (USAID), United States Centers for Disease Control and Prevention (CDC), United States Department of Agriculture (USDA), United States Defense Threat Reduction Agency (DTRA), and Korea International Cooperation Agency (KOICA).

Table of Contents

Figures

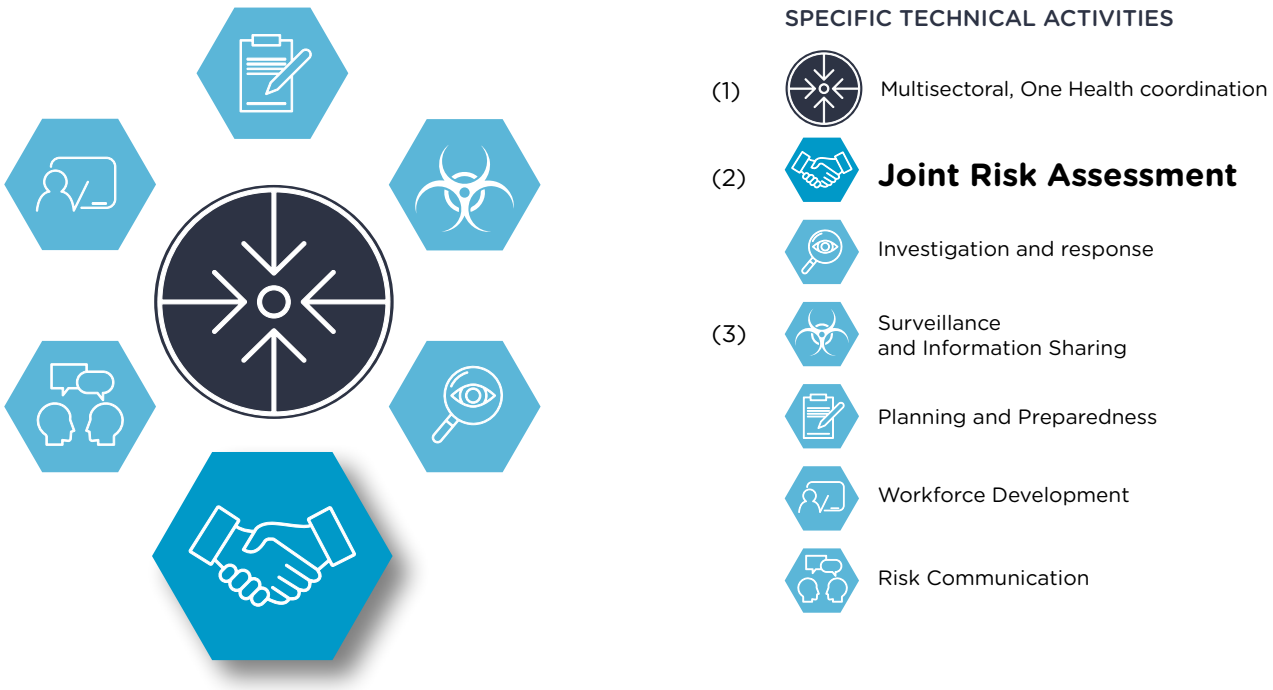
Numbered boxes

JRA in the context of the Tripartite Zoonoses Guide

In 2019, the Tripartite organizations – the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE), and the World Health Organization (WHO) – developed the Tripartite Zoonoses Guide (TZG), which was the summation of a global effort of more than 100 experts worldwide to provide guidance and explain best practices for addressing zoonotic diseases in countries. This includes supporting countries in understanding national contexts and developing capacities for strategic technical areas.

Three Operational Tools (OTs) have been developed to support national staff in these efforts: (1) the Multisectoral Coordination Mechanism OT (MCM OT), (2) the Joint Risk Assessment OT (JRA OT), and (3) the Surveillance and Information Sharing OT (SIS OT). These tools can be used independently or in coordinated efforts to support national capacity for preparedness and response, ultimately linking to existing international policies and frameworks, and supporting efforts for global health security. Specifically, the JRA OT provides additional support on the area of risk assessment to countries implementing the TZG.

Figure 1. JRA in the context of the Tripartite Zoonoses Guide



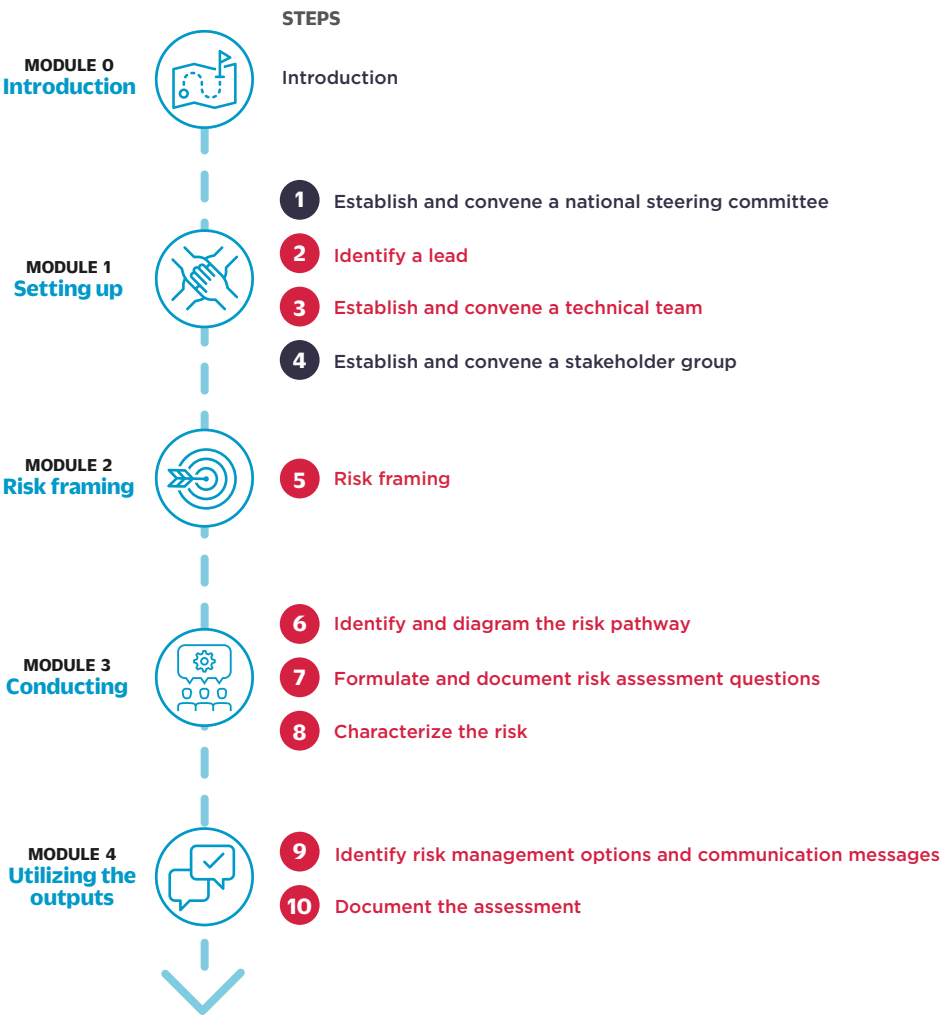
Module 0

Introduction to joint risk assessment

Overview of the Joint Risk Assessment Operational Tool

The 10 steps of the joint risk assessment (JRA) process divide into 4 modules (Fig. 2). This allows different participants to be included in various modules of the JRA.

Figure 2: JRA modules and steps (required: ●, recommended: ●)



Key point

Module 0 pairs with any module to provide background information, so new participants can be included at any point.

Introduction

Key factors in sustainability include:

Zoonotic diseases, classified as either endemic or emerging, pose risks to both animal and public health. Activities to identify, assess, manage and reduce risks from zoonotic diseases benefit from coordination and collaboration between ministries and other agencies within a country that are responsible for various aspects of human health, animal health, and the environment.

Although it is important for the human health, animal health, and other sectors to conduct their own assessments to manage risks within the context of each sector, bringing together national information and expertise from all the relevant sectors to jointly assess health risks from zoonotic disease is necessary to fully understand and manage shared risks at the human–animal–environment interface. When involved sectors contribute data, knowledge, and expertise to the assessment, the amount and quality of information available to estimate risks increases significantly as does the validity of the assessment itself.

The success of a joint risk assessment (JRA) depends on effective communication among the sectors throughout the process, ideally leading to a consensus[1] on the outcome of the assessment and production of a joint or aligned assessment document. The JRA process is normally iterative (repeated periodically), so regular exchanges between sectors fosters intersectoral understanding of the perceptions, needs, mandates, and constraints of all involved sectors.

JRA includes discussion on risk management options and communication needs (risk analysis), and provides recommendations. This allows decision-makers to build and implement science-based risk management measures and communication messages aligned between sectors or implemented jointly.

1 Consensus is not always possible or necessary, depending on sectoral mandates and requirements.

Enhancing the success of a JRA

When certain key elements exist in a country, JRA functions optimally. When they do not, it is necessary to take steps to establish them.

Figure 3. Enhancing the success of a JRA

POLITICAL WILL

Engagement, support, and political will from leadership can provide a mandate to facilitate bringing together the relevant sectors to fully engage in the process and optimize the outcomes and usefulness of the assessment. However, even when such political support is not yet available, the technical teams responsible for zoonoses may come together in their various functions to complete a joint assessment.

RELEVANT SECTOR ENGAGEMENT

Some zoonotic diseases principally affect humans but not animals, or wildlife but not livestock. Irrespective of the impact on a sector, information and expertise from all stakeholder groups is necessary to assess risks fully.

ACCESS TO INFORMATION

Often, early in an event there is insufficient information and a high level of uncertainty about the outcome of a risk assessment. Many countries lack infrastructure and resources for data collection and instead utilize expert knowledge and experience from similar events or pathogens. Irrespective of the information available, a risk assessment identifies specific key information gaps and targeted activities to collect it.

RISK ASSESSMENT EXPERTISE AND CAPACITY

Ideally, the JRA Lead and members of the technical team will have experience in risk assessment. However, in many countries there is insufficient risk assessment or epidemiological expertise in one or more sectors to either complete the sector-specific assessment or contribute to the joint assessment. It is still important to undertake joint assessments in the face of a zoonotic disease event or threat, while simultaneously building capacity.

Key point

All success-enhancing elements listed above are important, but a JRA can be done without them during a zoonotic disease event or threat.

How to use the JRA Operational Tool

This operational tool (OT) is for staff from national ministries responsible for human health, animal health, and the environment, or other government agencies (collectively called "ministries" in this OT) responsible for control and management of zoonotic diseases, in particular epidemiologists, with close involvement of laboratory staff, risk managers, and communication officers. The OT presents the principles of JRA and its role in informing policy development. It provides guidance on how to set up a joint qualitative risk assessment process and describes step by step how to conduct each component of the process. The annexes include model documents and templates to support implementation, including a JRA report template. Prior risk assessment experience is not essential for those using the JRA OT.

Countries can apply and modify the OT components as needed, adapting them to fit national context or existing mechanisms. For example, some countries already have a governmental mechanism for sharing technical information on zoonotic diseases within or among ministries. Such a task force or One Health platform could act as the basis for the steering committee described in the OT.

Countries can apply these tools and processes to national priority zoonoses (for example, avian influenza) or any health concerns at the human–animal–environment interface (for instance, antimicrobial resistance).

Background

Principles of risk assessment

Risk assessment is the systematic process of gathering, assessing, and documenting information to estimate the risk level for a specific time period and location. It is an iterative process based on the best information available during the assessment.

Risk comprises two components: likelihood (probability) and impact (consequences), and each element includes a measure of uncertainty. A risk assessment assesses likelihood, impact, and associated uncertainty for one or more risk assessment questions about a particular aspect of the risks associated with an event or hazard.

- **Likelihood** is the estimated probability or chance that the situation in the risk assessment question will occur.
- **Impact** describes the level or severity of consequences if that situation occurs.

Risk estimates (considering both likelihood and impact) depend on the suspected or known hazard, the presence of or possible exposure to the hazard, and the context for assessing the event.

Risk assessments rely on currently available knowledge, which is usually incomplete or difficult to validate, so they always include an indication of uncertainty about the risk estimate in the outcomes/report. Uncertainty depends on the quality and detail of information available at the time of assessment. In the next iteration of the risk assessment, when new information is available to inform and improve results, the level of uncertainty decreases.

Risk assessments can be quantitative or qualitative

- In quantitative risk assessments,[2] likelihood, impact, and uncertainty are expressed using numbers. Missing data is estimated using mathematical models or through expert consultation. However, there are often not enough data to conduct valid quantitative assessments.
- In qualitative risk assessments, likelihood, impact, and uncertainty are expressed using descriptive sets of categories, with clear meanings defined for each. Qualitative risk assessments are faster, require less complete information, and use expert opinion where scientific data are missing. Qualitative risk assessments evaluate health events or emergencies where data are limited or a quick response is required.

2 Summary descriptions of quantification in risk assessment are found in these publications:
2.1. The World Health Organization. WHO guidance: Rapid risk assessment of acute public health events. Geneva: WHO; 2012; page 36 (http://www.who.int/csr/resources/publications/HSE_GAR_ARO_2012_1/en/, accessed 18 June 2020).
2.2. World Organisation for Animal Health. Handbook on import risk analysis for animals and animal products I. Introduction and qualitative risk analysis. Paris: OIE; 2010. (https://rr-africa.oie.int/wp-content/uploads/2018/03/handbook_on_import_risk_analysis_-_oie_-_vol__i.pdf, accessed 23 November 2020).

The role of risk assessment in risk management

Risk assessments provide evidence for decisions on risk management and risk communication. Risk assessments link results directly to management decisions. Thus, risk assessment processes function best within governmental structures that support risk management and risk communication, by engaging decision-makers and policy-makers from all relevant sectors.

Policies for risk management and communication develop primarily in response to the likelihood and impact results of the risk assessment. However, other outputs of the assessment, such as the identified gaps in available information, often highlight and justify specific scientific or social research, additional surveillance, information collection or diagnostic testing. Such additional information can reduce uncertainty and improve the accuracy of estimates in future risk assessment iterations.

Why joint risk assessment?

Sector-specific risk assessments are important ways for the human health, animal health, and environment sectors to manage risks related to their sector within the sectoral context, perspectives, priorities, and mandates, e.g. whether additional hospital beds are needed or whether to tighten control on animal movement. These sector-specific assessments are essential and should take place for all zoonotic disease events and threats.

For health concerns at the human–animal–environment interface, multiple sectors and disciplines must work together. This applies to risk assessments and for preparedness, surveillance, response and many other aspects of national health systems. Bringing together national information and expertise from all relevant sectors for the joint assessment of health risks from zoonotic disease allows all sectors, acting together, to evaluate fully, understand and manage shared risks at the human–animal–environment interface with coordinated responses. A JRA will be more applicable and have greater validity for questions at this interface than a risk assessment conducted by one single sector.

The main challenge to conducting JRAs is that the reasons for doing them often differ between sectors based on different needs and interests, so the risk assessment questions also differ. The tools and processes various sectors use for risk assessment evolve to meet their different needs and thus do not directly align with those of other sectors. When sectors come together for JRA, different approaches and terminology cause confusion or misunderstanding. In some countries, there is no official data sharing between sectors, and in many countries, there is no established mechanism to communicate about zoonoses between different departments within or between government agencies, further complicating the ability to conduct JRAs.

Sector-specific and joint risk assessments are complementary. Findings and gaps from sector-specific risk assessments may highlight a need for information and expertise from multiple sectors and disciplines, and thus a need to collaborate on a JRA. Furthermore, the results of a JRA may influence and improve the next iteration of sector-specific assessments for an event by providing additional perspective on the risks of interest or identifying necessary information and expertise for the interface aspects.

The crucial requirement for strong political will and stakeholder buy-in to support and sustain the risk assessment applies equally for both sector-specific assessments and those performed jointly, with the added challenge of requiring alignment among ministries and a

myriad of stakeholders. However, when all stakeholders agree together on key objectives and outputs are useful across sectors, the JRA process becomes a standard fixture in the national system to address health concerns at the human–animal–environment interface.

When to do a JRA?

Joint risk assessments should be conducted:

- routinely for contingency planning;
- after zoonotic disease prioritization to agree on implementation measures;
- during an emergency event.

Scope of the JRA OT

This OT describes a national process for conducting joint risk assessment. As part of a functioning national health system, the animal health sector, the human health sector, and other sectors (e.g. wildlife, environment) conduct sector-specific risk assessments of health events routinely and individually. When a health event emerges or occurs at the human–animal–environment interface, a JRA focused on risks at the interface is conducted. Information from sector-specific risk assessment(s) becomes part of the JRA process.[3]

This JRA is a qualitative risk assessment. It is possible to conduct it rapidly, without the need for large quantities of validated quantitative data or specialized mathematical skills.

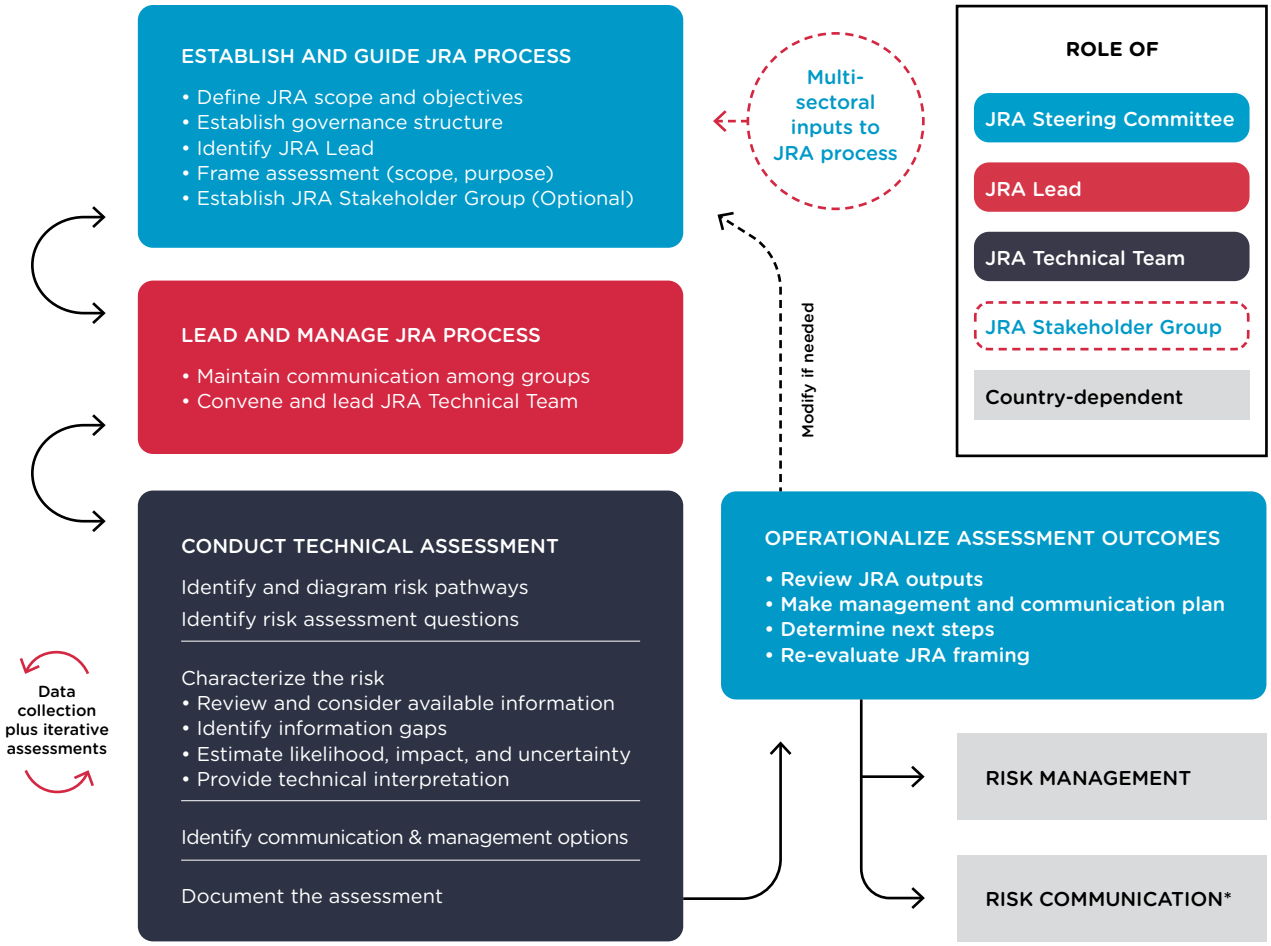
The steps described, particularly the establishment of a JRA Steering Committee and Technical Team, are specific to a single hazard or health event, although membership may overlap for similar events in a country. The technical assessment itself is also event-specific, with objectives and risk assessment questions differing between events. In some cases, information from an assessment may be applicable to more than one event.

Recommended steps in the JRA process

As shown in Fig. 2, the JRA process consists of 10 steps. Different countries may include some steps in their process but not others, and the order of completion may vary, with some steps prepared in anticipation of a particular health event. Some steps may be skipped in emergency situations. Optional recommended steps are noted in FIG. 2 (P. 2), and Fig. 4 illustrates the flow of JRA with feedback points.

3 This operational tool describes JRA only. Other documents are available describing sector-specific risk assessment, surveillance, IHR/OIE reporting, response, and communications.

Figure 4. Tasks and flow of the iterative JRA process



--- Dotted lines indicate optional elements

*RISK COMMUNICATION is applied throughout the JRA process

Module 1

Setting up the JRA

Setting up the JRA

Each country has a rationale and mandate for conducting a JRA and using the obtained results, and may already have structures or mechanisms in place for health risk assessment or multisectoral collaboration. Countries should use existing mechanisms to support the JRA process. For example, an existing One Health platform or coordination mechanism may serve as the JRA Steering Committee. Individual countries undertake the setting up process differently depending on their starting point.

Some national activities may provide background and context for the JRA process. These could include:

- a review of national systems, inter-ministerial linkages and infrastructure, and risk assessment processes already functioning;
- a review of existing national mechanisms for integrated collaboration;
- agreement on generic terms of reference (ToR) for JRA Leads, steering committees, stakeholder groups, and technical teams (SEE ANNEXES A, B, D, E);
- agreement on a generic decision-making mechanism, e.g. to select the JRA Lead, to set up rosters for leaders and members;
- a stakeholder analysis to establish how to identify members of the steering committee, technical team, and stakeholder group;
- effort to ensuring government commitment to the JRA, including overall governmental authority to conduct a JRA, so ministries convene quickly;
- establishment of intersectoral agreement on circumstances for convening a JRA.

Key points

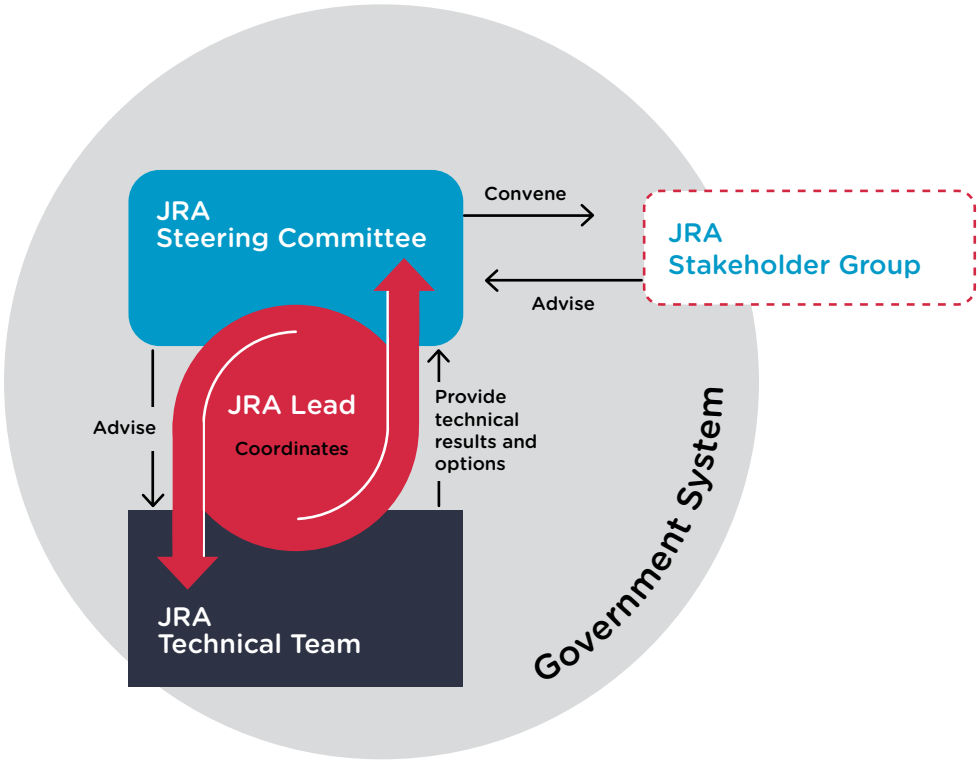
- To ensure usefulness and sustainability, the national agencies responsible for human, animal and environmental health conduct the JRA with engagement from all relevant stakeholders.
- Background activities may occur prior to convening the technical team but do not have to progress in a specific order.

Step 1: **Establish and convene a national JRA Steering Committee**

The steering committee function is recommended in **all situations**. However, steering committees vary in formality, size, and composition under different circumstances and may be modified in the event of an emergency.

The JRA Steering Committee oversees the JRA process. The committee is responsible for the management and communication of decisions based on the outcomes of the JRA, but does not engage in technical aspects of the risk assessment. Additional stakeholders may advise it through an external stakeholder group. Separating these three functions ensures that the JRA Technical Team can focus effectively on the technical questions without being influenced by policy considerations or other diverse perspectives. An existing multisectoral coordination mechanism may function as the JRA Steering Committee.

Figure 5. JRA organizational structure



Box 1 and Annex A present responsibilities, tasks, and roles of the JRA Steering Committee. The steering committee may iteratively modify these tasks based on an evolving disease situation with input from the JRA Technical Team or Stakeholder Group.

Box 1: Responsibilities, tasks, and roles of the JRA Steering Committee.

(See Annex A, Model ToRs)

- Defines the scope of and timeline for the JRA process;
- Identifies the JRA Lead, who subsequently joins the steering committee;
- Proposes the composition of the JRA Technical Team;
- Reviews and interprets the results of the risk assessment;
- Determines and prioritizes risk management strategies and communication messages based on JRA and promotes implementation of actions;
- Re-evaluates and modifies the JRA process as needed;
- Identifies and convenes the stakeholder group;
- Maintains ongoing dialogue with the JRA Technical Team and Stakeholder Group (if available), through the JRA Lead, to assess and modify the process as needed.

Step 1.1. **Establish the JRA Steering Committee**

- Identify members of the JRA Steering Committee:
  - Agencies, likely those requesting the JRA, come together to form the initial JRA Steering Committee (often ministries responsible for human health, animal health, and the environment).
  - The composition of the steering committee may vary for different events, based on lines of authority and responsibility for all aspects of the event.
  - Stakeholder analysis may determine the required composition, when time permits.
  - Consider including communications specialists in case urgent messaging is required while convening the JRA technical process.
- Gain approval from all relevant ministries and agencies to be included, as appropriate to national processes.

Step 1.2. **Convene the JRA Steering Committee**

The ministries discussing the JRA convene the steering committee, unless there is already a formal process in place. The committee meets initially to define the JRA, and again after each risk assessment report is available to interpret the assessment and develop a plan of action. At a minimum, the first two meetings are face to face.

The JRA Steering Committee convenes a first meeting as soon as possible after the group has been set up.

At the **first meeting for emergency events**, the JRA Steering Committee:

- agrees on informal ways of working (e.g. chairperson, note takers);
- identifies the JRA Lead – who then becomes a member of the steering committee (SEE MODULE 1: STEP 2.1 for criteria on JRA Lead selection and tasks of the JRA Lead);
- frames and defines the assessment (SEE MODULE 2: STEP 5);
- identifies the expertise and information needed for the assessment (ANNEXES G and H provide examples of required information and information sources);
- discusses and proposes, with the JRA Lead, the JRA Technical Team composition (technical agencies, departments) based on expertise and information needed (SEE MODULE 1: STEP 3);
- decides on the timeline for the JRA technical process;
- designates urgent reporting formats and output documents from assessments prepared by the JRA Technical Team (e.g. full report, summaries) (SEE ANNEX F, JRA REPORT TEMPLATE);
- decides urgent clearance processes and level of confidentiality of outputs from urgent assessments.

In **subsequent meetings for emergency events**, the steering committee:

- considers the outcomes of the JRA and risk management and risk communication options to develop a management plan;
- with the JRA Technical Team, decides on the date of the next meeting.

To ensure the sustainability and effectiveness of the JRA process, **at some point**, the steering committee:

- reviews any adopted urgent processes and revises them as necessary;
  - may decide to utilize different processes in future for urgent and non-urgent situations;
- identifies a mechanism for steering committee leadership (e.g. always the Ministry of Health or Ministry of Agriculture, rotating leadership, or joint leadership);
- agrees on JRA governance and steering committee ToRs (SEE ANNEX A) or reviews drafted ToRs;
- proposes, with the JRA Lead, the stakeholder group composition (SEE MODULE 1: STEP 4).

Step 2: **Identify a JRA Lead**

The JRA Lead function is required in **all situations**. The role and specific activities of the JRA Lead vary in different countries, circumstances, and timeframes.

The JRA Steering Committee designates the JRA Lead to set up and implement the national JRA process, on behalf of the government, for a specific event or threat. This person is the delegated authority from and responsible to the JRA Steering Committee, also participating as a member.

The JRA Steering Committee designates the level of authority and autonomy as well as the scope of activities of the JRA Lead. Box 2 and Annex B present the responsibilities, tasks, and roles of the JRA Lead.

Box 2: Responsibilities, tasks, and roles of the JRA Lead (See Annex B, Model ToRs)

- Identifies members of the JRA Technical Team;
- Discusses and agrees on the composition, timing, and outputs of the JRA Technical Team as advised by the JRA Steering Committee;
- Leads a stakeholder analysis;
- Based on the results of stakeholder analysis, with guidance from the JRA Steering Committee, identifies and invites specific agencies or individuals to participate in the JRA Stakeholder Group;
- Manages and leads all operational aspects of the JRA process for this specific event or threat;
- Coordinates and facilitates ongoing communication activities among the JRA Technical Team, Steering Committee, and Stakeholder Group, to assess and modify the process as needed;
- Takes decisions as authorized by the steering committee;
- Convenes and administratively leads and manages the JRA Technical Team to ensure each team member understands their role and completes their tasks;
- Identifies any challenges brought to the JRA Steering Committee for resolution;
- Identifies and addresses resource issues.

Facilitation is an important role of the JRA Lead, and Annex C lists general facilitation tips to support improved collaboration and coordination during the technical JRA steps 6-8.

Some national activities performed in advance of this step could include:

- Establishment of a process to identify the JRA Lead. Ministries together agree on an appropriate mechanism to identify leadership for the JRA process for any event, hazard, or threat undergoing a JRA. This mechanism differs between countries.
- Development of a roster with department/units (including contact details) of potential JRA Leads for different types of events or threats. Ideally, several individuals, who could act as JRA Leads, should be specifically trained in use of the JRA OT.

Step 2.1. **Identify and confirm the JRA Lead**

The JRA Lead role may go to an individual in one ministry, rotate amongst ministries, be shared (as co-leads) amongst involved ministries, or be a designated person from a key stakeholder agency. In all cases, they are responsible to the steering committee for their functions. The JRA Lead is usually an individual but could be a named function/position or agency.

Critical skills for a JRA Lead are:

- risk assessment expertise/experience;
- leadership capacity;
- ability to negotiate;
- strong facilitation skills;
- understanding of government processes;
- ability to engage with multiple sectors and One Health principles and approaches;
- ability to attain respect from all sectors involved.

To decide which sector will lead, the steering committee may consider:

- which sector has the most information/evidence/expertise;
- which sector is most impacted by the event;
- which sector currently has the most institutional capacity.

Key point

Good facilitation is important in the JRA process and increases its success. A JRA Lead benefits from strong facilitation skills (SEE ANNEX C). Alternatively, outsource this to a facilitator or communication specialist without technical expertise.

Step 3: **Establish and convene a JRA Technical Team**

A JRA Technical Team is required in **all situations**, but the specific ToRs and outputs will vary between different countries and under different circumstances.

The JRA Technical Team is a small group of technical staff who conduct the risk assessment and report to the steering committee. Box 3 and Annex D present the responsibilities, tasks, and roles of the JRA Technical Team.

Box 3: Responsibilities, tasks, and roles of the JRA Technical Team

(See Annex D, Model ToRs)

- Identifies the data needed to conduct the JRA;
- Shares needed data, as well as relevant experience and expertise regarding the event/hazard being assessed;
- Formulates and documents risk questions based on the risk framing and general concerns of the steering committee;
- Identifies and diagrams potential risk pathways;
- Compiles available information to characterize the likelihood and impact of each of the risk questions;
- Identifies and notes any data gaps;
- Provides technical interpretation of risk estimates;
- Identifies risk management and communication options based on the JRA's results;
- Documents the assessment using the agreed report template and shares it with the JRA Steering Committee through the JRA Lead.

Some national activities performed in advance of this step could include:

- Establishment of a JRA Technical Team roster. Generating a roster of technical staff and agencies with necessary expertise and data for potential national zoonotic disease threats in advance facilitates convening a JRA Technical Team quickly. The steering committee could decide, for instance, on necessary qualifications, who keeps and updates the roster. It is useful to include staff involved in sector-specific risk assessments on the roster.
- Establishment of administrative steps to invite staff from other agencies, including external agencies.

Step 3.1. **Identify members of the JRA Technical Team**

The JRA Lead, with input from the JRA Steering Committee, identifies members of the JRA Technical Team and leads this team.

The composition of the technical team depends on the expertise, experience, and information needed for the particular assessment. The steering committee and the JRA Lead may have already discussed this (module 1: step 1.2). The JRA Lead uses this information to identify agencies and departments, including those outside government, which have this information and expertise.

The JRA Technical Team consists of:

- people with key expertise, experience, and information from any sector or discipline required for the technical assessment, including technical experts and those with understanding and experience from local affected areas;
  - role: to contribute relevant technical and local experience necessary for the assessment;
- at least one person with experience in conducting risk assessments (if available);
  - role: to guide the technical risk assessment process and act as the resource person for the JRA methodology and principles;
- staff involved in conducting related sector-specific RAs (if available);
  - role: to contribute key discussion points and outcomes from the sector-specific assessments.

Other considerations in building the JRA Technical Team:

- To maintain the technical focus, reduce the influence of existing or potential policy considerations, and optimize the objectivity of the outcomes:
  - The JRA Technical Team should be limited to those who contribute technical expertise, information, and experience.
  - Communications officers and risk managers are generally not members of the JRA Technical Team to keep the technical risk assessment independent of the decision-making processes for risk management and communication. They may join as observers in the JRA technical assessment to better understand the rationale of the outcomes and contribute later when the JRA Steering Committee discusses implementation options.
  - During the technical assessment, the JRA Technical Team members act as independent subject-matter experts.

  - Non-governmental actors (e.g. private institutions, academia, independent experts) may have an important role in the JRA. When representatives of non-governmental organizations are included, recognition that individual and institutional mandates and priorities may exist, is important to maintain objective, technical discussion and decisions.

- There should be a balance of sectors and disciplines represented on the JRA Technical Team.

Key points

- When a JRA Technical Team is composed of fewer than 10 members, everyone has an opportunity to contribute.
- JRAs benefit from expertise and information from multiple sectors relevant to zoonotic disease. This usually includes animal and human health epidemiologists and laboratories, with environment and wildlife experts.

Step 3.2. **Convene the JRA Technical Team meeting**

Prior to or during the first meeting of the JRA Technical Team, the JRA Lead:

- informs invited participants of:
  - information they are requested to bring to the assessment, based on information and expertise identified by the steering committee;
  - framing and other guidance from the steering committee;
  - the entire range of information requested for the assessment, in case a member has access to additional information not specifically requested from them;
- reviews the event and framing and determines the time required for the first meeting;
- distributes information among members;
  - in advance if possible;
  - where data sharing is challenging, information is brought to the RA and shared during the assessment;
- distributes a copy of the JRA tool to be used, including the JRA report template (ANNEX F);
- shares results of sector-specific risk assessments;
- informs the team of the ToR, including the mechanism for circulation and approval of draft reports.

At the first meeting, the JRA Technical Team:

- reviews framing and guidance from the steering committee;
- reviews any prior assessments relevant to the particular event;
- reviews the template of the JRA report and decides which content is presented to the steering committee;
- conducts the assessment (steps 6-8).

Key points

- Designate someone to take notes during the meeting.
- Use the JRA report template to guide and capture the discussion and decisions taken.

At subsequent meetings, the JRA Technical Team:

- reviews outputs from previous JRAs and any other assessments (e.g. sector-specific assessments) for that event;
- reviews any updated framing and guidance from the steering committee;
- conducts the next iteration of the technical assessment (MODULE 3: STEPS 6-8) with particular emphasis on:
  - feedback from the steering committee;
  - new developments;
  - newly available data.

Step 4: **Establish and convene a JRA Stakeholder Group**

A JRA Stakeholder Group is recommended for **all situations**. However, this step may be skipped during **emergency situations**.

Establishing a stakeholder group is important to engage the private sector, industry, academia, and other relevant stakeholders in the JRA process and subsequent implementation of risk management measures. The group provides a multisectoral and interdisciplinary dimension to the JRA and promotes advocacy and communication. The group's main functions are: (1) to provide diverse perspectives and to advise the steering committee; and, (2) to be instrumental in implementing risk measures. The stakeholder group normally has no technical or decision-making function. Ensuring engagement of the relevant stakeholders is important for wide acceptance and effective implementation of steering committee decisions.

This OT defines a stakeholder as any individual or group that is or should be involved as a partner in preventing or managing zoonotic diseases or other shared health threats at the human–animal–environment interface. Stakeholders include those who impact, are impacted by, or perceive themselves to be affected by zoonotic disease threats, including those who may be affected by measures to address zoonotic diseases. Box 4 and Annex E present responsibilities, tasks and roles of the JRA Stakeholder Group.

Box 4: Responsibilities, tasks, and roles of the JRA Stakeholder Group (See Annex E, Model ToRs)

- Provides perspectives from outside ministries on potential impacts of management measures
- Contributes relevant information where possible (relevant/required data are often held in private-sector or academic institutions)
- Contributes relevant information upon request from the steering committee to facilitate management/communication decisions
- Supports and advocates implementation of management measures, and may contribute to implementation
- Supports and disseminates communication messages

Normally the stakeholder group does NOT have a role in the JRA technical process or in decision-making processes.

Step 4.1. **Conduct a stakeholder analysis**

If not already completed as a national background activity, the JRA Steering Committee, led by the JRA Lead, conducts a stakeholder analysis including:

- review and analysis of the specific event or threat;
- identification of all relevant stakeholders.

More information on conducting this analysis is available in the Tripartite Zoonoses Guide (TZG),[4] Section 4.2.

Step 4.2. **Establish the stakeholder group**

The JRA Lead identifies and invites specific agencies or individuals to participate based on guidance from the steering committee and the results of the stakeholder analysis, ensuring this reflects the interdisciplinary and multisectoral nature of the event.

The JRA Steering Committee designates the overall mandate and role of the stakeholder group.

Step 4.3. **Convene the stakeholder group**

The specific functions of stakeholder groups will vary widely between countries, according to the ToR and needs of the steering committee.

In some cases, the JRA Steering Committee or technical team will ask specific questions or seek particular information. The JRA Lead is responsible for agreeing on an agenda and conveying information between the stakeholder group and the other groups.

Key point

Generally, activities of the JRA Technical Team are purely **technical**, while activities of the JRA Steering Committee include **policy** perspectives. The stakeholder group advises the steering committee.

4 World Health Organization, Food and Agriculture Organization of the United Nations & World Organisation for Animal Health. (2019). Taking a multisectoral, One Health approach: a Tripartite guide to addressing zoonotic diseases in countries. World Health Organization. (https://apps.who.int/iris/handle/10665/325620, accessed 26 June 2020).

Example: Setting up the JRA in Indonesia

Enabling environment: Capacity development for joint risk assessment as part of One Health zoonosis control is a priority activity in the Indonesian National Action Plan for Health Security and is included in the Presidential instruction on enhancement of preparedness and response to zoonotic diseases involving multiple sectors, drawn up in 2019. These national laws and policies provide a legal framework for JRA and greatly facilitate its implementation in Indonesia.

JRA Steering Committee: The Coordinating Ministry for Human Development and Culture oversees zoonotic disease control activities in Indonesia, including various cross-programme and cross-sector initiatives involving government, the private sector and communities. At the JRA pilot workshop in March 2018, the Coordinating Ministry for Human Development and Culture proposed taking on the steering committee role for the JRA, given the Ministry's legal basis for managing zoonoses.

Stakeholder analysis: The most relevant JRA stakeholders in Indonesia include the Ministry of Agriculture, Ministry of Health, Coordinating Ministry for Human Development and Culture, Coordinating Ministry for Political, Legal, and Security Affairs, Ministry of Defense, Ministry of Environment and Forestry, provincial public health and animal health and livestock services, provincial Disease Investigation Centers (DICs), and provincial and district disaster agencies. Countries with decentralized governments, like Indonesia, must build preparedness and response capacity at national and subnational levels.

JRA Lead and technical team: The composition of the JRA Technical Team depends on the hazard assessed and is comprised of members from the most relevant stakeholder ministries and institutions listed above. The steering committee determines the JRA Lead, selected from a pool of facilitators trained during the national and subsequent subnational workshops.

Module 2

Risk framing for the JRA

Step 5: **Risk framing**

Risk framing, coordinated by the JRA Lead, is completed and shared before the technical team starts its assessment. In risk framing, the JRA Steering Committee defines the hazard as well as the scope, purpose and key objectives of the risk assessment, according to the template in Annex J. The steering committee completes one template for each hazard. Through this framing, the steering committee guides the technical JRA process to focus on their key concerns related to the event or threat to ensure that results are practical and useful to support event or threat management decision-making, implementation, and risk communications. The JRA Technical Team subsequently formulates risk assessment questions based on the risk frame (SEE MODULE 3: STEP 7).

An additional outcome of the framing discussion is better mutual understanding of the perspectives and needs from other members of the steering committee.

Key points

- The JRA Steering Committee may need to modify the risk framing iteratively based on discussions with the JRA Technical Team or Stakeholder Group.
- Each sector conducts a sector-specific risk assessment for the event, and brings their information and results to the joint assessment. However, conducting a JRA is possible even if sector-specific assessments are not complete.

Step 5.1. **Define the specific hazard**

Although, the **hazard** is likely to be well known prior to convening the risk assessment, confirming the specific hazard ensures focused discussion. Keeping the hazard as narrow as possible makes the assessment more directed and its outcomes more useful.

Example hazards:

- avian influenza A(H7N9) virus
- avian influenza viruses
- potentially zoonotic influenza viruses.

Step 5.2. **Define the scope**

The scope of the JRA will in most cases be an assessment of health risks at the human–animal–environment interface posed by the agreed hazard within the country, in a specific geographical area or administrative level of concern (e.g. national or subnational level). The steering committee suggests how much of the sector-specific discussion (including risk assessment questions and risk pathways) is included in the JRA and how much is completed in advance through sector-specific assessments and outcomes brought to the JRA. Sector-specific aspects may be included in the JRA scope as needed in order to evaluate risk at the interface.

Example scope:

- Domestic health risks at the human–animal–environment interface posed by avian influenza virus H7N9 currently circulating in neighbouring country X.

Step 5.3. **Agree on purpose and key objectives**

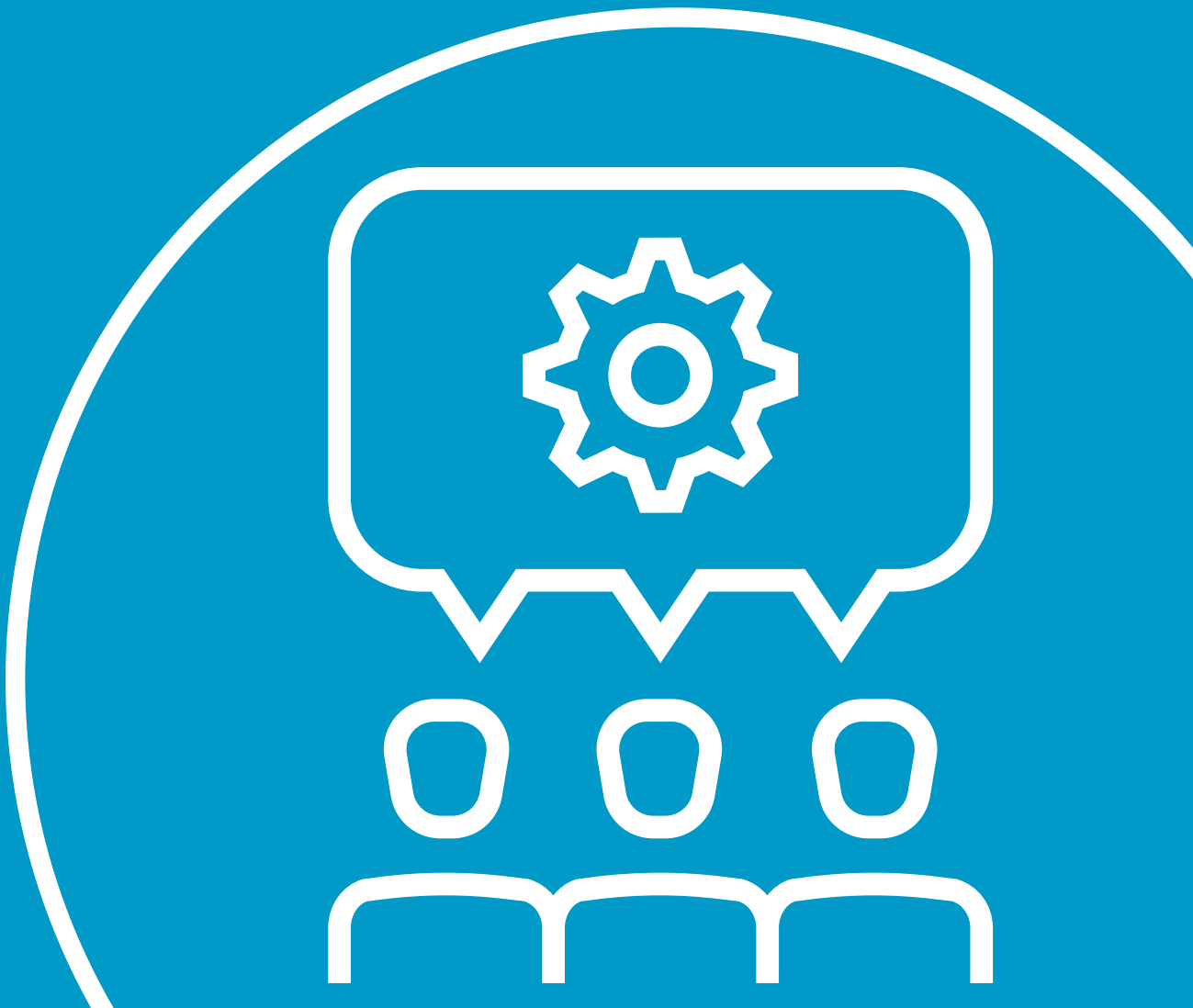
In general, the purpose of any risk assessment is to support the mitigation of risks associated with the hazard, while the key objective is to provide a basis for management or communications decisions. However, countries may also wish to emphasize more specific purposes and objectives relative to the assessed zoonotic disease event or threat. These are discussed, agreed upon, and communicated to the JRA Technical Team.

Example: Risk framing for rabies

In Country X, the hazard of concern selected by the JRA Steering Committee is rabies. The committee's top concern is a recent series of deaths in farmers, which resulted in farmers' unions demanding that the government improve disease control. The steering committee is concerned about risks at the animal–human interface between farmers and feral dogs, but is also concerned about the risk of feral dogs transmitting rabies to livestock, which could be further transmitted to farmers. The issue is of nationwide concern, and festival season is approaching which will increase livestock slaughter and thus interaction between animals and humans. The steering committee wants the JRA to provide general risk mitigation options and consider improved safety for farmers, the primary concern of the farmers' unions. This must therefore be included in management and communication decisions. All ministries involved in animal, human, and wildlife health should have technical representatives on the technical team, as should the national university, which operates a rabies surveillance research study in the country.

Module 3

Conducting the JRA



At the start, the JRA Lead briefs the technical team on the risk framing, i.e. the hazard, scope, purpose, and key objectives agreed upon by the steering committee.

Tip

Start using the JRA report template (ANNEX F) now to document all discussions.

Step 6: **Identify and diagram the risk pathway**

Considering the hazards, scope, purpose, and key objectives provided by the steering committee in their risk framing, the JRA Technical Team identifies all the potential risk pathways, irrespective of their likelihood, and captures the information in a risk pathway diagram (AS DEPICTED IN FIG. 4).

Risk pathways describe the logical movement sequence of the hazard from its source to its infection of the host of interest. The entire risk pathway for most zoonoses spans from the time the pathogen enters the country, through its spread in animals and into humans (or other hosts), and potentially back into animals.

The risk pathway diagram frames the risk assessment within the scope defined in module 2: step 5 of this OT. Risk pathway diagrams facilitate communication about risks and risk management with the JRA Steering Committee and other stakeholders. Understanding the relative importance of different pathways in the diagram allows the technical team to present the most practical, efficient, and cost-effective risk management options.

The process of identifying and discussing risk pathways helps to identify the specific source(s) of greatest interest, which is (are) incorporated in the risk assessment questions. The process may even reveal new risk assessment questions.

Step 6.1. **Identify points and processes in the risk pathways from each hazard source**

To promote the fullest understanding of the national system, the JRA Technical Team identifies all possible pathways of hazard movement as comprehensively as possible. Tracing all possible starting points (sources), within the scope defined by the steering committee, along the logical sequence of events, through to exposure of a human host (or back into an animal host from a human host), the technical team elaborates all processes along the pathways. This includes animal transport, potential exposures/infections in other species and wildlife, and border crossings. Including all points in a logical sequence allows understanding of the conditional dependence[5] of events and processes, which is useful when assessing the likelihood for each risk assessment question (SEE MODULE 3: STEP 8.3).

Sources of the pathogen may be known or unknown. If sources are unknown, all possible sources are proposed. Examples of interface-relevant sources for avian influenza include household poultry, wild birds, live animal markets, commercial poultry units, poultry products, and equipment. All plausible potential sources within the scope of the JRA are identified and included. Any risk pathways assumed but not known in detail are included to the extent possible, identifying and noting the information gaps. Value chain analysis identifies important points and processes in the animal health-related risk pathways. Other plausible risk pathways, such as exposure of household poultry via wild birds or household pets, are also considered.

Risk pathway diagrams from sector-specific risk assessments provide further information and may reveal additional potential sources of hazard exposure. Risk pathways crossing the interface are highlighted (AS DEPICTED IN FIG. 4). These are possible risk assessment questions to address in module 3: step 8.

Step 6.2. **Draw a final pathway diagram by hand or electronically**

Once the risk pathways have been identified and agreed upon, the JRA Lead documents the complete risk pathway in hand-drawn or electronic diagrams. These are consulted during future JRA iterations and attached to the JRA report when requested.

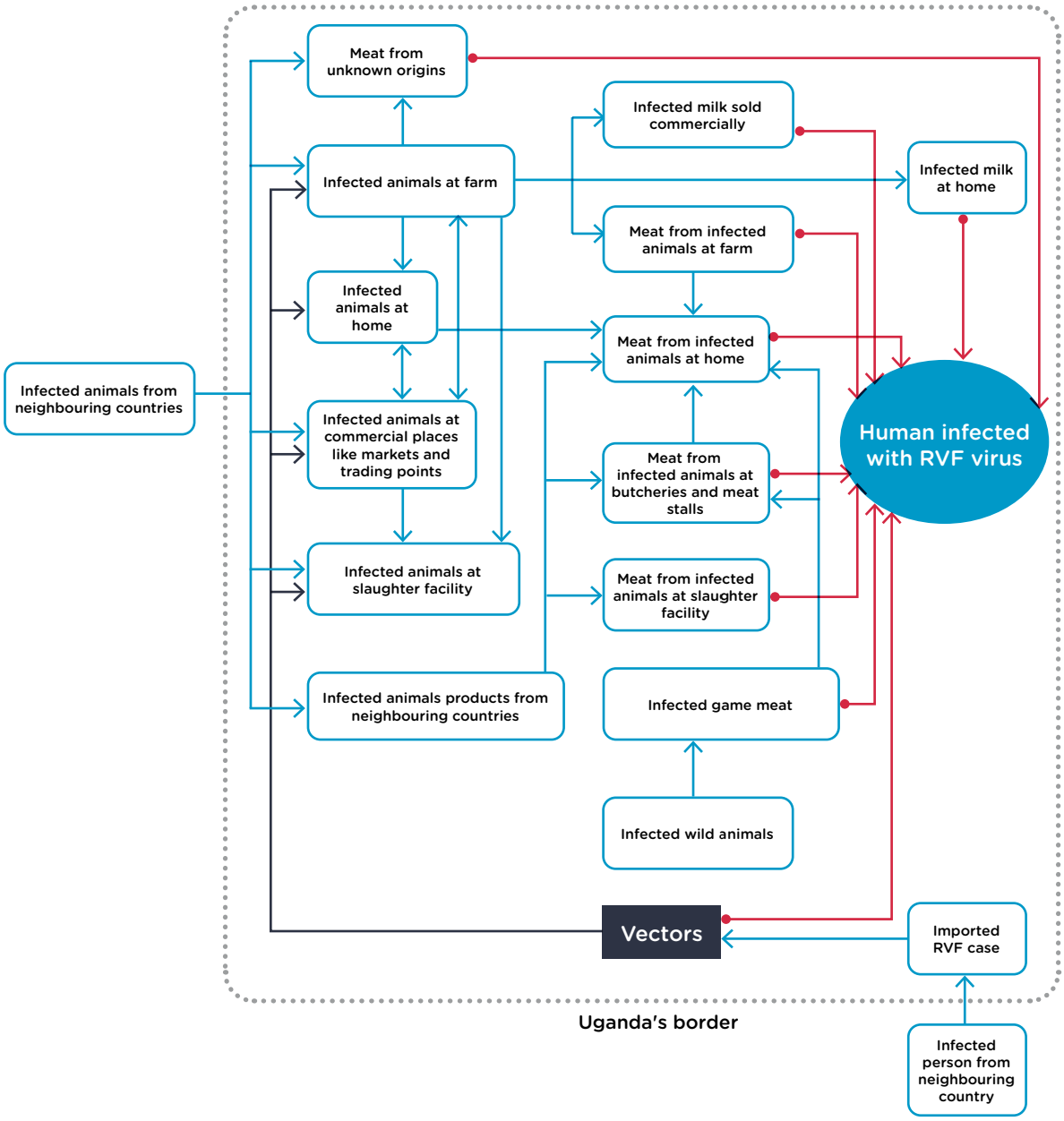
Key point

Through the entire JRA process, the JRA Lead facilitates ongoing dialogue among the JRA Steering Committee, the JRA Technical Team, and the JRA Stakeholder Group (when available), to continually assess and modify the scope, risk assessment questions, and risk pathways.

5 Conditional dependence occurs when each step depends on the previous step, so that if a step does not occur, the following ones cannot occur. For example, a poultry worker can only be exposed to H7N9 virus at work if the virus is present in the chicken flock, which is conditional on it having been introduced to the chicken flock. If the virus is never introduced to the flock, the worker cannot logically be exposed at work (but may be exposed elsewhere, via another pathway).

Example: Risk pathways for Rift Valley fever virus

Figure 6. shows a risk pathway diagram for Rift Valley fever virus in the Ugandan national context



This risk pathway diagram describes all potential pathways for Rift Valley fever virus infecting humans at the human–animal–environment interface after introduction into Uganda.

- **Blue highlights** animal to animal transmissions
- **Black highlights** reflect risk pathways across vectors to animal interfaces
- **Red highlights** risk pathways related to human exposure interfaces

For a given hazard, risk pathway diagrams may differ between countries or even subnational level territories due to differences in animal production systems, food value-chains, and local practices, for instance.

Step 7: **Formulate and document risk assessment questions**

Taking into account the outcomes of risk framing and the risk pathway diagram, the JRA Technical Team formulates precise risk assessment questions to ensure that the risk assessment is practical and relevant for the priority health management decisions under consideration by the steering committee. Annex I provides examples to show how the risk framing, risk assessment questions, and risk management options work together. Guided by the risk framing (module 2: step 5), the JRA focuses on risk pathways that cross the human–animal–environment interface.

Sometimes, additional risk assessment questions emerge later or a given risk assessment question may be revised based on the technical discussion. Ideally, the JRA Technical Team, through the JRA Lead, discusses and agrees upon risk assessment questions with the steering committee before proceeding to step 8.

Tip

Draw on a white board or flip chart to visualize pathways under discussion.

The group can start drawing pathways from any point. Starting with the interface concern, based on the risk framing, and moving outwards is often helpful.

Step 7.1. **Formulate appropriate risk assessment questions**

Appropriate risk assessment questions (ILLUSTRATED IN FIG. 7):

- are written using the general format of "What is the likelihood and impact of...?";
- are specific, usually noting in each risk assessment question:
  - Hazard (e.g. "avian influenza H7N9 virus");
  - Event/thing to be assessed (e.g. "at least one human becomes clinically ill", "disease is detected in another country", "virus begins circulating locally");
  - Location (e.g. "within province A", "in live animal markets", "in already affected areas", "in unaffected areas neighbouring affected areas");
  - Population (e.g. "in live animal market workers", "in health care workers", "in children", "in workers in intensively managed poultry farms");
  - Source (e.g. "due to virus coming from wild birds", "due to virus in raw/processed poultry meat");

- are relevant if they:
  - fit into the agreed scope and are based on JRA objectives;
  - are agreed upon by all members of the JRA Steering Committee;
- are time-bound, i.e. a this time frame is provided (e.g. “within the next 12 months”, “during this outbreak”);
- describe the unwanted outcome (e.g. spread of disease, increase in the number of cases/deaths).

Figure 7. Formulating specific, relevant and time-bound risk assessment questions

What is the likelihood and impact of…	
WHAT	**hazard** and **event** (as agreed during risk framing)
WHERE	**population** and **location**
WHEN	**time frame**
HOW	**source** (may be refined/decided/finalized later, after discussing the risk pathways)

Example:
What is the likelihood and impact of at least one consumer in the country being exposed to influenza A(H7N9) virus in a live bird market in the next 6 months?

Table 1 drafts the risk assessment questions. Add specific information into a table row, and then formulate the full question. The question always starts with “What is the likelihood and impact of…” and then continues using the information from the row.

Table 1: Developing risk assessment questions

	Number/ extent of situation	Target population	Geographic location	Outcome	Hazard	Source of exposure	Time frame
What is the likelihood and impact of...	at least one	human poultry worker	in a live animal market	exposed	H5N1 avian influenza virus	(NA, any source)	during the next influenza high activity season
	an increasing number	children	in the country	deaths	H5N1 avian influenza virus	(NA, any source)	during this H5N1 outbreak
	at least one	consumer/ shopper	in province A	presents with clinical disease	a new subtype of animal influenza virus	in live poultry market X	in the next 12 months
	(NA, any)	live poultry markets (NB: this is not strictly an interface question)	to bordering provinces	spread	H7N9 avian influenza virus	(NA, any source)	during the coming Chinese New Year season
	at least one	human	in province X	exposed	Ebola virus	wild animals	specific bat migration period/fruiting period of trees
	at least one	tourist	national park X	infected	Crimean Congo haemorrhagic fever virus	Ixodid ticks	high abundance period (country dependent) or high season for tourism
	increasing number	slaughterhouse workers	in country Y	infected	Rift Valley fever virus	susceptible livestock meat	major festivities

Using the above criteria, a risk assessment question is: "What is the likelihood and impact of at least one human poultry worker in an intensively managed chicken farm in province A being exposed to an infectious H5N1 avian influenza virus within the next 12 months?" Additional criteria may be added, for example, "... as a result of the presence of this virus in the local wild bird population?"

Key points

- Risk assessment questions include one hazard, ("virus A", not "virus X and virus Y").
- It is possible that many appropriate risk assessment questions emerge. To make the JRA manageable, choose five or fewer questions (priorities) for assessment. With sufficient time, the JRA might address additional questions.

Step 7.2. **Check the risk assessment questions**

During the JRA Technical Team meeting, questions may arise that are important to answer or discuss but are not risk assessment questions, in that they do not warrant an associated risk estimate. These are often epidemiological or situation assessment questions. Although the standard risk assessment process is not applied to such questions, they may be very important to consider as part of the overall situation assessment and for filling data gaps, and they should still be discussed if they provide background or further understanding for the group.

Tips

A question might NOT BE a risk assessment question if:

- it does not start with "What is the likelihood and impact of...";
- the answer exists and could already be determined by collecting more or better data;
- it refers to something happening now rather than something that could happen in future;
- it does not directly link to a decision on how to manage a risk.

Examples of questions that are not risk assessment questions:

- What is the likelihood that there is H7N9 virus circulating in live bird market X this year?
- What is the extent of spread of H5N1 virus in poultry in country X this month?
- What is the likelihood that the H5N1 virus will cross the border from country X during this outbreak?
- What is the risk associated with importation of poultry from country Y during this outbreak?

Sometimes these can be turned into risk assessment questions, e.g. What is the likelihood and impact of an illegal shipment of birds infected with H5N1 virus crossing the border from country X during this outbreak?

Step 7.3: **Document the risk assessment questions**

Record the formulated risk assessment questions in the JRA report template.

Example: Risk questions for Rift Valley fever virus

"What is the likelihood and impact of having at least one worker in a slaughter facility in province X become infected with RVF virus through contact with fluids from an infected animal between April and November this year?"

Step 8: **Characterize the risk**

Based on the risk assessment questions and the risk pathways, and considering the hazard, scope, purpose, and key objectives provided by the steering committee in the risk framing, the JRA Technical Team conducts the technical assessment. The JRA report template documents the risk characterization.

If more risk assessment questions are proposed or identified than can be assessed, prioritize and select questions based on:

- key concerns described in the risk framing;
- questions most strongly linked to practical management decisions;
- key questions for public messaging.

Step 8.1. **Review and consider available information**

Prior to the JRA technical assessment meeting, the JRA Lead requests the JRA Technical Team to compile the relevant information (e.g. literature reviews, technical reports, surveillance data, as outlined in Annex G) (SEE MODULE 1: STEP 3.2.). This information may be shared in advance or brought to the assessment. Information gaps that impact the assessment are noted.

For each risk assessment question, the JRA Technical Team examines the associated risk pathway, discusses shared information, and notes where there is sufficient information and where major data gaps exist. Information may include:

- information brought to the risk assessment, shared in advance, or any additional supporting information the team may have;
- results of sector-specific risk assessments already conducted for the event, disease, or hazard;
- expert opinion of the JRA Technical Team members.

Local expert knowledge is particularly useful when other information is lacking. For example, universities may be able to support literature reviews or information gathering. It is helpful to set up a shared folder or document repository to collect available information, in advance of conducting the JRA.

Even with insufficient data quality or quantity, the technical team must still undertake the JRA to establish a preliminary level for each risk assessment question, 1) knowing the uncertainty will be very high, and 2) assuming there will be a next iteration after better specific data exists.

With minimal data, the team:

- relies more heavily on expert opinion through the technical team;
- makes reasonable assumptions (as below);
- uses information about a similar event under similar circumstances in the same country;
- sources information from other areas or similar pathogens (e.g. publications, experiences).

And then:
- identifies these factors as data gaps;
- reflects these gaps in the uncertainty level assigned.

Key point

When expertise on a specific hazard is limited (e.g. the disease has never occurred in the country), additional expertise (e.g. academic partners, research institutes, regional or international experts) is sought for the next JRA iteration.

When necessary for the JRA to proceed, the technical team may make certain assumptions (SEE ANNEX F, JRA REPORT TEMPLATE, SECTION 7), for instance, about key infrastructure or practices or the epidemiology of the disease event. Assumptions are overarching things that are likely to be true. They often allow a risk assessment to be conducted in known but unproven contexts.

For example, the technical team assumes:
- cases/deaths in people are linked epidemiologically with exposures to infected animals although there is no field evidence available;
- live animal market hygiene and practices in province A are similar to that of province B;
- surveillance of people is likely to identify cases anywhere in the country;
- poultry slaughter practices during a common festival are the same among islands.

The report identifies and records assumptions and prioritizes information necessary to prove or disprove assumptions, for collection before the next iteration of the JRA for this event. Where assumptions are made, they are considered as "true" for estimating likelihood and impact.

Every country and every event is different. Teams consider the current context, including the risk assessment questions, when identifying the information needed and how to find it. Annexes G and H describe information that may be required and potential sources.

Step 8.1 may be completed in parallel with the estimation of likelihood and impact for each risk assessment question, step 8.3 below.

Key point

Some types of risk assessment specifically include a hazard assessment, an entry assessment, and an exposure assessment. Formulating appropriate risk assessment questions within the risk framing ensures all three components are included. Alternatively, separate assessment of hazard, entry, and exposure can take place when characterizing the risk.

Step 8.2. **Identify information gaps** (Annex F, JRA report template, section 10)

In this step, the technical team identifies and clearly documents in the JRA report all key information that is missing or of insufficient quality. This may be done in parallel with step 8.1 where missing information is identified.

Key point

After making estimates in step 8.3, prioritize the data gaps noted in step 8.2. Specific information needed to inform likelihood and impact estimates and decrease uncertainty in the next JRA iteration receive priority.

The report discusses and proposes potential next steps and timelines for obtaining the information, designating the team member responsible and potential information sources. If the information is crucial to risk management, making it available could trigger a future assessment iteration.

Step 8.3. **Estimate likelihood and impact and assign respective uncertainties for each risk assessment question**

(Annex F, JRA report template, section 8)

In this step, the JRA Technical Team addresses each risk assessment question individually, considering associated risk pathways and associated risk factors for each.

Key points

With minimal or poor quality information:

- DO attempt to estimate likelihood and impact accurately, and then assign high uncertainty.
- Do NOT assign likelihood and impact estimates as "moderate" in attempt to balance lack of evidence.

8.3.1. **Estimate likelihood**

For each risk assessment question, the likelihood (chance of the situation described in the risk assessment question happening) is estimated based on (1) the information available, and (2) the expert opinion of the JRA Technical Team.

The technical team considers how the context in which the event is taking place, including local capacity, could influence the likelihood or impact of the event. This context assessment may include factors that are infrastructural/programmatic, social, ethical, technical, scientific, economic or environmental/ecological, such as pathogen evolution, capacity for case detection, severity of the disease in people, and capacity of the health system to respond effectively. The JRA process completes the context assessment while estimating the likelihood and impact for each risk assessment question.

Estimates of likelihood at particular steps in risk pathways may already be available from sector-specific risk assessments. These are extremely helpful in estimating interface risks.

If the JRA Technical Team is unable to assign a likelihood estimate for a specific risk assessment question based on available data, the team notes the decision, recording the data gaps for that question and explaining the decision in the report. The technical team still conducts all other assessment steps for all risk assessment questions.

Likelihood estimates are assigned a qualitative category, as in Table 2, based on assessment of the likelihood that the situation described in the risk assessment question will occur.

Table 2: Criteria to estimate likelihood

Likelihood estimate	Criteria
High	The situation described in the risk assessment question is likely to occur
Moderate	The situation described in the risk assessment question may occur
Low	The situation described in the risk assessment question is unlikely to occur
Negligible	The situation described in the risk assessment question is almost certain not to occur but could occur under exceptional circumstances

Key point

Record the rationale for each estimate: include all key information on which an estimate is based, so others can follow the technical team decision to fully understand how the estimate was made.

8.3.2. Assign uncertainty for likelihood

For each risk assessment question, level of uncertainty (how likely it is that the risk estimate for likelihood or impact is true) is assigned based on: (1) quality and quantity of data available, and (2) opinion of the JRA Technical Team. Step 8.1 describes data considerations. Even when there is minimal or poor quality information, likelihood and impact are still estimated before assigning a high level of uncertainty.

The level of uncertainty is assigned according to the criteria in Table 3.

Table 3: Criteria for estimating level of uncertainty

Uncertainty	Criteria
Very high	Lack of data or reliable information; results based on crude speculation only
High	Limited data or reliable information available; results based on educated guess
Moderate	Some gaps in availability or reliability of data and information, or conflicting data; results based on limited consensus
Low	Reliable data and information available but may be limited in quantity, or be variable; results based on expert consensus
Very low	Reliable data and information are available in sufficient quantity; results strongly anchored in empiric data or concrete information

8.3.3. **Estimate impact**

Each risk assessment question estimates the impact according to how bad it would be if the exact situation described in the question were to occur.

The JRA typically assesses impact at the population, local, national, or international level rather than the individual level. The impact at the individual person level generally relates to disease severity and is a factor in the context assessment.

The JRA may consider only direct impacts to health and health systems or may include a broader set of direct and indirect impacts, e.g. economic, social, environmental. The JRA Steering Committee defines the scope of the impacts to be assessed.

Impact estimates are assigned one of four qualitative categories, as shown in Table 4, based on the assessment of impact if the situation described in the risk assessment question were to occur. The JRA Technical Team should focus on concerns identified by the government in the risk framing when assigning the category. For example, if the impact on tourism was a major concern for the government, that aspect should be the focus of the impact assessment. When there is more than one area of concern, that of highest impact should be selected for inclusion in the risk matrix (module 3: step 8.4) for the risk assessment question.

Table 4: Criteria to estimate impact if situation described in the risk assessment question occurs

Impact estimate	Criteria	Direct examples	Indirect examples (economic, social, environmental)
Severe	The situation described in the risk assessment question will have substantial NEGATIVE consequences on the health (or health system) of the population	• Potential pandemic in the human population (or large at-risk groups) or animal population (domestic and wildlife) with high mortality; significant livestock production losses at national and international levels • Severe disruption of normal activities and services	• Threat to national and international trade: losses of market shares, importation bans in other countries, drop in product prices (meat, eggs) • Large number of measures needed at national and international levels with significant cost for authorities and stakeholders • Threat to food security and/ or food supplies and indirectly human livelihoods at national level • Similar level of disruptions in other sectors
Moderate	The situation described in the risk assessment question will have significant NEGATIVE consequences on the health (or health system) of the population	• Case reports in several regions with significant mortalities in the human population (or medium at-risk groups) or animal population (domestic and wildlife)	• May be a threat to food security or food supplies and indirectly human livelihoods at regional level • Threat mainly to national trade but maybe also to international trade in specific products produced in the affected regions (e.g. foie gras and avian influenza) • Several measures needed at regional and national levels involving major costs • Similar level of disruption in other sectors
Minor	The situation described in the risk assessment question will have marginal NEGATIVE consequences on the health (or health system) of the population	• Rare human case reports (mainly in small at-risk groups) with rare mortality, and low number of animal case reports (domestic or wildlife), with low mortality • Small areas affected (regional level or below)	• No threat to food security or the economy • Measures needed at regional level with low to moderate costs • Similar level of disruptions in other sectors
Negligible	The situation described in the risk assessment question will have insignificant NEGATIVE consequences on the health (or health system) of the population	• No human case reports and no, or low number of, localized animal case reports (domestic or wildlife)	• No threat to food security or the economy • Few measures needed at sub-regional or lower level; minor costs of measures implemented at sub-regional level • Similar level of disruptions in other sectors

Key point

If the technical team has difficulty deciding on an estimate due to differences in expert opinion, they should make every effort to assign a single estimate based on the evidence available.

8.3.4 **Assign uncertainty for impact**

As completed for likelihood, estimate the level of uncertainty for impact. Please refer to Table 3 in step 8.3.2.

Key point

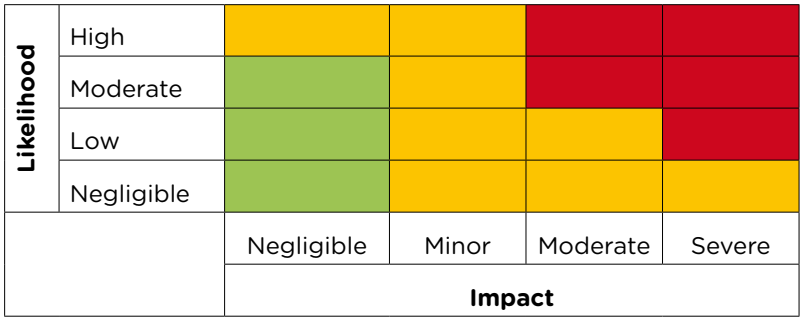
It is crucial to convey the correct level of uncertainty to decision-makers and clearly document the thought process in the JRA report. Decision-makers have specific information to create messages on what is unknown, why, and the steps required to gather the information needed.

Step 8.4. **Plot estimates**
(Annex F, JRA report template, Section 8)

The likelihood and impact estimates are plotted in a risk matrix (shown in Fig. 8) for each risk assessment question to facilitate linking the risk to potential options for risk management. A dot or star added to the matrix indicates the risk estimated for each risk assessment question. The individual estimates for each question are not combined, but interpreted separately.

The uncertainty level associated with each risk assessment question is included when reporting or discussing likelihood and impact estimates.

Figure 8. A risk matrix



For example, risk assessment results (likelihood and impact of introduction of a livestock disease) could link to risk management (use of surveillance), as follows:

- **red**: critical to implement mitigation measures (increased surveillance);
- **yellow**: review and adjust mitigation measures (surveillance enhanced: targeted or linked with existing surveillance activities);
- **green**: maintain current mitigation measures (surveillance maintained).

Step 8.5. **Technical interpretation**

Based on likelihood and impact estimates, considering the uncertainty level for each of the risk assessment questions, and given the situation and national context discussed, the JRA Technical Team provides qualitative technical interpretation of the overall risk assessment for the steering committee.

The technical interpretation on each risk assessment question is the basis for decisions on risk management options by the JRA Steering Committee. This may be the only part of the report (ANNEX F) that decision-makers read.

A technical interpretation is conducted after characterizing each risk assessment question, to keep the different interpretations separate and clear. After all of the risk assessment questions are characterized individually, the JRA Technical Team may provide an additional overall technical interpretation. When provided, it should include a brief technical summary of:

- risk assessment questions;
- key assumptions;
- likelihood and impact estimates and associated uncertainties;
- justifications for the estimates;
- critical management/communication options.

Example: Characterize risk for H5N1 HPAI virus

The following is an abbreviated technical interpretation submitted by a JRA technical team to the JRA Steering Committee:

"The JRA technical team assessed the likelihood and impact of at least one human in the Lake Tonka Region being exposed to H5N1 HPAI virus from infected backyard ducks in the next three months, and concluded that the likelihood and impact are both moderate. This conclusion assumed that there is the possibility of importation of infected poultry from affected neighbouring countries because there is no inspection occurring at border points.

The moderate likelihood estimate is based on data available concerning birds migrating to the country from affected countries, as well as numerous published studies on research conducted in other countries, which found live bird markets, similar to those present, to be high risk for disease transmission. The moderate impact estimate for H5N1 HPAI virus incursion is based on estimating economic losses due to loss of poultry stock and consumer confidence, unavailability of human vaccines, high human case fatality rate, and the country's reliance on poultry as a food source, conversely weighed against lack of human-human transmission demonstrated in other countries. Experts felt the latter point lowered the impact compared to other potential disease events. The uncertainty for both estimates is low due to the availability of reliable information. Although only a limited quantity of information comes from within the country, there is extensive research on the disease in several neighbouring countries.

The JRA Technical Team recommended that the JRA Steering Committee should approve several mitigation and communication measures. For example: the reinforcement of laws and regulations concerning control measures on poultry importation, including veterinary quarantine grounds at all major border points and certificate inspection; the display of posters in a prominent position at border points; and the direct communication of new regulations to authorities and private individuals/companies in the export countries.

This assessment was based on data and information obtained from expert opinions, literature, and official standard setting or technical organizations, including the OIE, WHO, and FAO. A significant information gap concerning in-country surveillance for HPAI exists. It was recommended that active surveillance be conducted within the next year, and a subsequent JRA be conducted with the updated information."

Module 4

Utilizing the JRA outputs

Step 9: **Identify risk management options and communication messages**

The purpose of risk assessment is to direct risk management and communication options within the scope, purpose, and objectives framed by the steering committee. The JRA technical discussion captures and prioritizes options and discusses and documents technically justified pros and cons, including the costs and benefits of each option. These options and messages are based entirely on the technical outcomes of the assessment and are scientifically justified. For example, those risk management measures with the highest impact on reducing overall risk and the lowest negative impact on production, animal welfare, also called critical control points, could be considered when prioritizing options.

The factors and variables contributing to the risk, as discussed during risk characterization and included in the rationale (module 3: step 8) should be the basis for developing risk management and risk communication options.

The JRA Technical Team proposes general options for evidence-based risk management and potential key messages related to the human–animal–environment interface aspects of the event or threat assessed. Options for both multisectoral management and communications and sector-specific, but aligned, management and communications may be proposed (SEE *TZG*, CHAPTER 5.5.).

An example of a management option is to conduct a simulation exercise to evaluate the response to the hazard. An example of a communication option is a campaign with the key message that thoroughly cooked meat is safe to eat.

Step 10: **Document the assessment**

The technical team keeps comprehensive notes (SEE ANNEX F, JRA REPORT TEMPLATE) while conducting the JRA (MODULE 3: STEPS 6-8). A note-taker completes the template as the discussion unfolds. A JRA report, provided to the steering committee after the assessment, details all information.

The documentation is critical. The JRA Technical Team must be able to review in detail the thought process behind each step of their risk assessment to catalogue specifically the information and expert opinions used and the basis for each likelihood and impact estimate made for each iteration. This allows for:

- later justification of decisions for the JRA Steering Committee or others;
- estimates of evolving risks in subsequent iterations based on the same criteria, especially if there are changes in JRA team members.

The JRA report template, or another reporting format as agreed by the JRA Steering Committee, ensures the preparation of a comprehensive standard JRA report useful for comparison across JRA iterations. The steering committee also decides on the need for a summary report and any attachments or other supporting documents they require (SEE MODULE 1: STEP 1.2).

The JRA Lead submits the JRA report and any requested summary to the steering committee (SEE MODULE 1: STEP 1.2), which may depend on the urgency of the assessment. The report may include any written concerns or recommended changes to the process from the JRA Technical Team, e.g. expertise missing from the team. Proposed changes to the risk assessment questions or new questions are included and justified. The JRA Lead highlights these concerns directly with the steering committee as needed.

Operationalize risk assessment outcomes and next steps

The JRA Steering Committee operationalizes the JRA outcomes in all situations. Its task is to:

- review risk management options, justifications and prioritization from the JRA output;
- decide on key risk management options for implementation;
- review proposed key content of risk communication messages and justifications from the JRA output;
- agree on key content of risk communication messages;
- determine next steps, timelines, roles and responsibilities for risk management and risk communication;
- agree on priority actions and take next steps;
- decide on timing for next risk assessment iteration;
- review plans (e.g. contingency, surveillance) across sectors and integrate JRA results where feasible.

The JRA Steering Committee reconvenes shortly after finalizing the JRA assessment, to review the assessment outcomes and decide on next steps. The committee reviews the JRA report and any other output from the JRA Technical Team. They discuss the risks and the JRA Technical Team's technical interpretation in the context of the purpose and objectives stated in the JRA framing, the management and communications options proposed, and the implications for policy development. They also create or revise the event or hazard management plan, including communication. If needed, they may request clarification, revision or additional analysis from the JRA Technical Team.

The steering committee is unlikely to be directly responsible for implementing the actions included in the management and communication plans. Most management and communication actions will be implemented as part of routine responsibilities by the line ministries of each relevant sector for surveillance, communications and response. Some actions and messages will be sector-specific while some will be joint, but all are aligned and do not contradict the others.

The JRA Steering Committee in consultation with the technical team decides when the team reconvenes for the next iteration, based on the urgency of the situation. The steering committee identifies triggers that lead to convening an earlier urgent assessment. Subsequent JRAs may be conducted quickly if needed (e.g. in a half day meeting or over the phone) and likely will not require a multi-day meeting. Risk pathway diagrams and risk assessment questions can often be reused and only need revision if the epidemiological situation or the risk framing changes. A next iteration of a JRA may provide the opportunity to add additional expertise to the JRA Technical Team, which should ideally be confirmed with the steering committee. Previous JRA reports should be referenced in subsequent JRA iterations.

Example: Rift Valley fever virus

The technical team proposed risk management and risk communication options to the steering committee while conducting a JRA to address health risks at the human–animal–environment interfaces posed by the Rift Valley fever (RVF) virus.

The risk question was "What is the likelihood and impact of having at least one worker in a slaughter facility in province X being infected with the RVF virus through contact with fluids from an infected animal between April and November this year?"

Risk management options for consideration by the steering committee

Short-term management options

Vector control:
- Farmers should use insect repellent and spray their animals.

Infection of animals:
- Stakeholders and farmers should consider vaccination to prevent outbreaks.

Early detection of RVF outbreaks in animals:
- Institute integrated surveillance of RVF in animals at sub-county level and install quarantines if RVF outbreak in animals is confirmed.

Control of RVF outbreaks in animals:
- Enforce animal check points and quarantine.

Detection before slaughter:
- Inspection and examination of all animals before loading on trucks or authorization for sale.
- Enhance the level of animal identification, traceability and feedback.

Preventing infection during and after slaughter:
- Encourage use of appropriate personal protective equipment (PPE) in slaughterhouses.
- Safety and hygiene at slaughter facility should be enforced by management and health inspectors.

Long-term management options

Vector control:
- Stakeholders should identify and encourage use of existing biological control measures for vectors that are environmentally friendly.

Early detection of RVF outbreaks in animals:
- Develop rapid point-of-care rapid diagnostic tests for prompt detection of RVF.

Control of RVF outbreaks in humans at slaughter facilities:
- Update and implement the National Code of Meat Inspection and Public Health Act among other pieces of legislation.

Detection before slaughter:
- Set up centralized slaughter areas in sub-provinces.

Risk communication options for consideration by the Steering Committee

- **Farmers and animal traders should be trained and sensitized on detecting RVF infections at farm level through reporting high rates of spontaneous abortions.**
- **Develop ways to communicate the impacts of RVF on economy, livelihoods, among others.**
- **Raise awareness among slaughterhouse workers on the risk of RVF infection and appropriate use of PPE.**

Supporting documents

Risk assessment guidelines

1. The World Health Organization. Early detection, assessment and response to acute public health events. Geneva: WHO; 2014 (www.who.int/ihr/publications/WHO_HSE_GCR_LYO_2014.4/en/, accessed 26 June 2020).
2. The World Health Organization. Rapid risk assessment of acute public health events. Geneva: WHO; 2012 (www.who.int/csr/resources/publications/HSE_GAR_ARO_2012_1/en/, accessed 26 June 2020).
3. European Centre for Disease Prevention and Control. Operational guidance on rapid risk assessment methodology. Stockholm: ECDC; 2011 (www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/1108_TED_Risk_Assessment_Methodology_Guidance.pdf, accessed 26 June 2020).
4. OIE: OIE risk assessment guidelines www.oie.int/index.php?id=169&L=0&htmfile=chapitre_import_risk_analysis.htm, accessed 26 June 2020).
5. Australian Institute for Disaster Resilience. National emergency risk assessment guidelines. Melbourne: AIDR: 2015 (knowledge.aidr.org.au/media/2030/handbook-10-national-emergency-risk-assessment-guidelines.pdf, accessed 26 June 2020).

Annexes

Annex A. **Model terms of reference for the Joint Risk Assessment Steering Committee**

Joint Risk Assessment Steering Committee - TERMS OF REFERENCE

1. **Scope of work**

The joint risk assessment (JRA) steering committee oversees the JRA process. It does not engage in the technical aspects of risk assessment, but is responsible for management and communications decisions based on the outcomes of the JRA.

2. **Roles and responsibilities**

The JRA Steering Committee has the following roles and responsibilities:

- defines the scope and timeline of the JRA process;
- identifies the JRA Lead who then becomes a member of the steering committee;
- proposes the JRA Technical Team composition;
- reviews and interprets the results of the risk assessment;
- adopts and prioritizes risk management strategies and communications messages based on the JRA, and promotes implementation of actions;
- re-evaluates and modifies the JRA process as needed;
- identifies and convenes the stakeholder group (optional);
- maintains ongoing dialogue with the JRA Technical Team and Stakeholder Group (if convened), moderated by the JRA Lead, to assess and modify the process as needed.

3. Composition and structure

3.1. Composition

The JRA Steering Committee consists of designated focal points or their representatives from relevant government agencies. For example:

- Department of Livestock, Ministry of Agriculture;
- Department of Disease Control, Ministry of Health;
- Ministry of Interior;
- JRA Lead;
- Department of Public Relations (as a communications advisor).

JRA Steering Committee members may invite experts or representatives of partner agencies as observers to a JRA Steering Committee meeting. However, only members participate in decisions.

3.2. Structure

The optimal JRA structure should be specified. For example:

- focal points or their representatives from relevant government agencies such as JRA Steering Committee members;
- Chair and Vice-chair, elected from among the JRA Steering Committee members, on a one-year rotation;
- experts, resource persons, or representatives of partner agencies, as non-decision-maker observers.

4. Frequency of meetings and reports

- The JRA Steering Committee convenes a first meeting as soon as possible after the group is established.
- The JRA Steering Committee convenes subsequent meetings no later than one week after receiving the assessment report from the JRA Technical Team. The JRA Steering Committee meets as needed or at least once per year.
- The Chair convenes a JRA Steering Committee meeting.
- With the consent of the Chair and Vice-chair and upon consultation with other members, any member of the JRA Steering Committee can request a meeting.
- The Chair prepares the meeting reports.
- Any members unable to attend the meeting convey their comments on the meeting report to the Chair and other members no later than two weeks after receiving it. At that time, the report is considered confirmed and adopted.
- Members receive at least one week's notice of the next meeting, unless there is an urgent matter for the JRA Steering Committee to address, then shorter notice is allowed.

- At the conclusion of each meeting, the JRA Steering Committee determines the time, date and venue of the next meeting.
- The reports and documents of a JRA Steering Committee meeting are confidential and only distributed to meeting participants. Reports or excerpts from them may be circulated to other parties only after the written consent of the Chair.

5. **Amendment**

The JRA Steering Committee may amend these terms of reference, as deemed necessary.

Annex B. **Model terms of reference for the Joint Risk Assessment Lead**

Joint Risk Assessment Lead - TERMS OF REFERENCE

1. **Scope of work**

The joint risk assessment (JRA) lead sets up and implements the national JRA process only for the specific event or threat described in the risk framing (REFER TO MODULE 2: STEP 5). The JRA Steering Committee determines the specific duties of the JRA Lead.

2. **Roles and responsibilities**

The JRA Lead has the following roles and responsibilities:

- identifies members of the JRA Technical Team;
- discusses and agrees on the composition, timing, and outputs of the JRA Technical Team, as advised by the JRA Steering Committee;
- leads a stakeholder analysis;
- identifies and invites specific agencies or individuals to participate in the JRA Stakeholder Group, based on results of the stakeholder analysis and JRA Steering Committee guidance;
- manages and leads all operational aspects of the JRA process for this specific event or threat;
- coordinates and facilitates ongoing communication and activities among the JRA Technical Team, the Steering Committee, and the Stakeholder Group, to assess and modify the process as needed;
- takes decisions as authorized by the steering committee;
- convenes and leads and manages the JRA Technical Team in an administrative capacity to understand and complete their role and tasks;
- identifies challenges brought to JRA Steering Committee for resolution;
- identifies and addresses resource issues.

3. **Appointment**

The JRA Steering Committee appoints the JRA Lead, who should be a government official or individual with a specific function or position within a government agency.

Annex C. **Facilitation tips for the Joint Risk Assessment Lead**

Facilitation enables groups and organizations to work more effectively together. Basic facilitation tips support the setup of the four joint risk assessment (JRA) modules by creating the right environment for collaborative work.

1. General facilitation tips to support collaboration and workflow

1. **Start with the end in mind** – know the audience and what they try to achieve in the JRA workshop.
2. **Celebrate participation** – create an environment where all participate; empower reserved people.
3. **Actively listen** – prioritize key messages and repeat key words; use silence to give people time to think and process.
4. **Reinforce positives and reframe negatives** – "excellent point" or "thank you for your honesty".
5. **Maintain the pace** – communicate start and end times clearly; respect the schedule.

Module-specific facilitation tips for the JRA Lead

MODULE 1: Setting up the JRA	• If the JRA Lead lacks facilitation skills, a communication specialist (without event-specific expertise) may join the steering committee. • When a JRA Technical Team is composed of fewer than 10 members, everyone has the opportunity to contribute. • Recognition of existing individual and institutional mandates and priorities is important to maintain objective discussion and decisions.
MODULE 2: Risk framing for the JRA	• The JRA Lead ensures that concerns of each sector are represented in the risk framing.
MODULE 3: Conducting the JRA	• The JRA Lead maintains ongoing dialogue between the steering committee, technical team, and stakeholder group, to continually assess and modify the scope, risk assessment questions and risk pathways.
MODULE 4: Utilizing the JRA outputs	• The JRA Lead maintains ongoing dialogue between the steering committee, technical team, and stakeholder group, providing clarification as needed regarding JRA outputs. • Ideally, the JRA Lead continues to be involved in risk mitigation strategies and supports linkages to the next iteration.

Annex D. **Model terms of reference for the Joint Risk Assessment Technical Team**

Joint Risk Assessment Technical Team - TERMS OF REFERENCE

1. **Roles and responsibilities**

The Joint Risk Assessment (JRA) Technical Team has the following roles and responsibilities:

- identifies the data needed to conduct the JRA;
- shares essential data, relevant experience and expertise regarding the event/hazard being assessed;
- formulates and documents risk questions based on the risk framing and general concerns provided by the steering committee;
- identifies and diagrams potential risk pathways;
- assembles available information to characterize the likelihood and impact of each of the risk questions;
- identifies and notes data gaps;
- provides technical interpretation of risk estimates;
- identifies and recommends risk management and communication options based on the JRA results;
- documents the assessment using the agreed report template for the JRA Steering Committee, shared through the JRA Lead.

2. **Composition**

The JRA Technical Team is a small group of experts on the health event or hazard of concern with the skills required to conduct the risk assessment. The JRA Lead identifies members of the JRA Technical Team with input from the JRA Steering Committee, and follows established administrative steps to invite or appoint staff from government and non-governmental agencies. The technical team consists of members who:

- have key expertise, experience, and information relevant to the hazard or event being assessed;
- have experience in conducting risk assessments, where possible;
- provide a balance of sectors and disciplines on the JRA Technical Team.

3. Frequency of meetings and reports

- The JRA Lead convenes the JRA Technical Team initial meeting as soon as possible after the group is established.
- With the consent of the JRA Lead and after consultation with the other members, any member of the technical team can request a meeting.
- Any members unable to attend the meeting convey their comments on the meeting report to the Chair and the other members, no later than two weeks after receiving it. At that time, the report is considered confirmed and adopted.
- Members receive at least one week's notice of the next meeting unless there is an urgent matter for the JRA Technical Team to address, then shorter notice is allowed.
- At the conclusion of each meeting, the JRA Technical Team determines the time, date and venue of the next meeting.
- The reports and documents of a JRA Technical Team meeting are confidential and only distributed to meeting participants and the steering committee. Reports or excerpts from them circulate to other parties only with the written consent of the JRA Lead.

Annex E. **Model terms of reference for the Joint Risk Assessment Stakeholder Group**

Joint Risk Assessment Stakeholder Group - TERMS OF REFERENCE

1. **Background**

A joint risk assessment (JRA) stakeholder group may be convened to engage the private sector, industry, academia, and other relevant stakeholders in the JRA process and subsequent implementation of management measures. This group provides a multisectoral and interdisciplinary dimension to the JRA, and promotes advocacy and communication. Despite these important roles, the JRA Stakeholder Group is an optional step in the JRA process.

2. **Scope of work**

The scope of the JRA Stakeholder Group's work provides boundaries within which the group operates. The group's main function is to provide varied perspectives and advise the JRA Steering Committee on request. The stakeholder group has no technical or decision-making functions.

3. **Roles and responsibilities**

The JRA Stakeholder Group has the following roles and responsibilities:

- provides perspectives from outside government on the potential impacts of management measures;
- contributes relevant information (e.g. relevant/required data which is held in private-sector or academic institutions);
- contributes relevant information upon request by the steering committee for making management/communication decisions;
- supports and advocates the implementation of management measures, and may contribute to implementation;
- supports and disseminates communication messages.

4. **Appointment and composition**

The JRA Lead invites candidates to join the JRA Stakeholder Group, with guidance from the JRA Steering Committee. The group consists of individuals or agencies from within and outside of government. Selection of members for JRA Stakeholder Groups may follow from the stakeholder analysis, considering the specific contributions and reflecting the interdisciplinary and multisectoral nature of the event.

Annex F. **Joint risk assessment report template**

1. **Title of the assessment**

- A short sentence overview of the event being assessed, e.g. “Joint risk assessment of (event, hazard) in (location), (month/year)”.

2. **Date, time, and place assessment took place, dates of previous risk assessments**

- The date, time, and place of assessment

- The date of the last risk assessment for this event

3. **Participants and affiliations**

- List names and affiliations of participants.
- Identify the joint risk assessment (JRA) lead.

4. **Event summary**

- It is a brief summary of the event or hazard being assessed.
- Include a brief description of who, what, where, when, measures taken to date, and other relevant/key information.

5. **Risk framing**

- Describe hazard, scope, and purpose and objectives, as defined by JRA Steering Committee.

6. **Assessment summary**

- This is an "Executive Summary" of assessment outcomes and technical interpretation, including the risk assessment questions and associated estimates of likelihood, impact, and uncertainty, along with those factors contributing most to these estimates and the data gaps, and key management/communication options.

7. **Key assumptions underlying JRA** (see module 3: step 8.1, section "Making assumptions")

- Any general assumptions on which JRA is based, especially in cases where very little information about the event is available
- For example, "This assessment is based on the assumption that there is an epidemiological link between the disease in the animal population and the human population", if this is unknown

8. **Detailed risk assessment results based on risk assessment questions** (see module 3: steps 7–8)

- Complete the following sections for each risk assessment question.

8A. What is the likelihood and impact of...?

- Provide the entire first risk assessment question assessed.

Likelihood estimate A:

Provide the estimated likelihood for this risk assessment question.

a) Rationale for likelihood estimate A

- Provide, as bulleted points, the key information on which this likelihood estimate is based;

- Provide any assumptions used to estimate this likelihood (e.g. “Assumed that this virus has the same prevalence in poultry as during the last outbreak”, “Assumed that the virus causes similar disease in poultry as during the last outbreak”).

b) Uncertainty level for likelihood estimate A

Provide uncertainty level assigned for the likelihood estimate.

c) Rationale for uncertainty level associated with likelihood estimate A

Provide the key information gaps on which this uncertainty level is based (e.g. “Virus subtype not available”; “No prevalence data on the infection in poultry”).

Impact estimate A:

Provide the estimated impact for this risk assessment question.

a) Rationale for impact estimate A

- Provide the key information on which this impact estimate is based.

- Provide any assumptions used to estimate this impact (e.g. “Assumed that animal movement control is effective”).

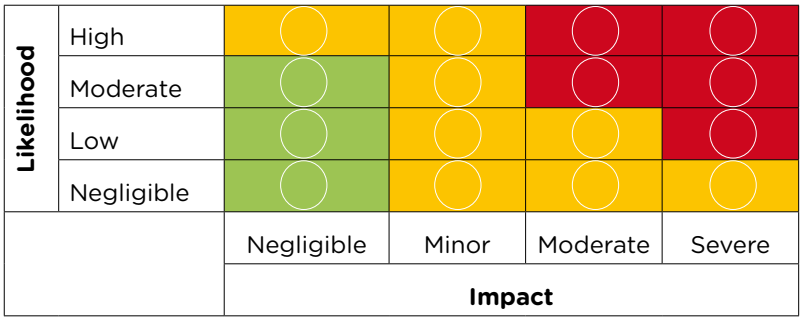
b) Uncertainty level for impact estimate A

- Provide the uncertainty level assigned for this impact estimate.

c) Rationale for uncertainty level associated with impact estimate A

- Provide bulleted points for the key information gaps on which this uncertainty level is based (e.g. “Virus subtype not available”; “No prevalence data on the infection in poultry”).

Risk matrix for risk assessment question A



Mark the box that correlates with the likelihood and impact estimates for this risk assessment question.

d) Technical interpretation of risk assessment question A

Summary of conclusions based on the estimates and uncertainly level, including which key information and information gaps were relevant. Some options for the level of risk management and risk communication messages needed may be included (see module 3: step 8, Example).

8B. What is the likelihood and impact of...

Provide the entire first risk assessment question assessed.

Likelihood estimate B:

Provide the estimated likelihood for this risk assessment question.

a) Rationale for likelihood estimate B

- Provide bulleted points for the key information on which this likelihood estimate is based.

- Provide any assumptions used to estimate this likelihood (e.g. “Assumed that this virus has the same prevalence in poultry as during the last outbreak”, “Assumed that the virus causes similar disease in poultry as during the last outbreak”).

b) Uncertainty level for likelihood estimate B

Provide uncertainty level assigned for the likelihood estimate.

c) Rationale for uncertainty level associated with likelihood estimate B

Provide the key information gaps on which this uncertainty level is based (e.g. “Virus subtype not available”; “No prevalence data on the infection in poultry”).

Impact estimate B:

Provide the estimated impact for this risk assessment question.

a) Rationale for impact estimate B

- Provide the key information on which this impact estimate is based.

- Provide any assumptions used to estimate this impact (e.g. “Assumed that animal movement control is effective”).

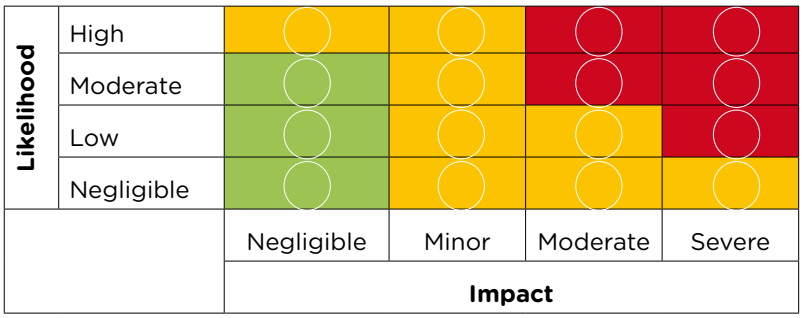
b) Uncertainty level for impact estimate B

- Provide uncertainty level assigned for this impact estimate.

c) Rationale for uncertainty level associated with impact estimate B

- Provide bulleted points for the key information gaps on which this uncertainty level is based (e.g. “Virus subtype not available”; “No prevalence data on the infection in poultry”).

Risk matrix for risk assessment question B



Mark the box that correlates with the likelihood and impact estimates for this risk assessment question.

d) Technical interpretation of risk assessment question B

Provide a summary of the conclusions based on the estimates and uncertainly level, including which key information and information gaps were relevant. Some options for the level of risk management and risk communication messages needed may be included (see module 3: step 8, Example).

8C, 8D, etc. What is the likelihood and impact of...

Provide the entire first risk assessment question assessed.

9. **Overall technical interpretation** (optional)

Provide an overall summary of the conclusions if needed to supplement the technical interpretations for each risk assessment question.

10. **Information needed** (see module 3: step 8.2, section "Identify information gaps")

- Include specific priority information needed to inform the likelihood and impact estimates and to decrease uncertainty in the next JRA iteration.
- May include identification of potential sources of this information.

11. **Risk management options for consideration by the steering committee** (see module 4: step 9)

Summarize the proposed risk management options, especially any priorities.

12. **Risk communication options for consideration by the steering committee** (see module 4: step 9)

Summarize the proposed risk communication options, especially any priorities.

13. **Any other issues for the record**

For example, significant sources of conflict or lack of agreement among experts.

14. **Recommended next steps**

Summarize the steps to collect priority data as identified in section 10 above of this JRA report template, including potentially conducting sector-specific risk assessments.

15. **Proposed interval until the next joint risk assessment for this event**

Indicate the proposed interval until the next iteration or the trigger for the next iteration based on urgency or other factors (e.g. data collection).

16. **Attachments:**

Can include supporting documents as needed:

- data/information used;
- risk pathway diagrams;
- outcomes of sector-specific risk assessments.

Annex G. **Potential information required for the assessment**

Epidemiology and clinical presentation

1. **Primarily human health information**

- Number of human cases/events and affected sub-populations of interest, date of initiating event and time course of progression;
- Age, gender, exposure;
- Timing, incubation period, period of transmissibility;
- Clinical signs, case fatality rate and severity, at risk populations;
- Treatment history, outcome;
- Travel history;
- Presence of other cases, suspect or confirmed, among close contacts or health care workers;
- Onward spread and clusters with potentially human to human transmission;
- Similar cases in the country/region (recent and historical).

2. **Primarily animal health information**

- Disease activity in animals in the country/region (species, affected sub-populations of interest, number of cases and timing/location, date of initiating event and time course of progression, incidence/prevalence);
- Original reservoir/source ongoing;
- Animal production profiles and systems relevant to human exposure;
- Species-specific value chain information, including movements within a country and across borders and information from cross-border value chain price monitoring.

3. **General and interface information**

- Sources of potential human exposure (human, animal, environment);
- Seasonality or other known effects e.g. seasonal and cultural behaviour and practices (festivals, hunting seasons, seasonal restocking);

- Economic activities expanding the human–livestock–wildlife interface (e.g. hunting, ecotourism, transhumance, agricultural encroachment)
- Contaminated environments;
- Vectors and amplifying hosts, if relevant;
- Recent introduction or relocation of wildlife species for conservation, if relevant;
- Food safety issues, if relevant.

4. **Pathogen/Hazard**

- Human agent/animal agent: laboratory identifying/confirming, availability and location of isolate, subtype/clade/strain/serotype, antimicrobial sensitivity, genetic mutations/markers of interest;
- Changes to the virus (antigenicity, genetically, or reassortment events);
- Normal circulation of subtype/clade/strain/serotype in the region/globally;
- Transmissibility to and among humans (R_0,[6] if known);
- Routes of transmission in animals;
- Dose response, if relevant;
- Likely population immunity (animals and humans);
- Availability of vaccination in animals;
- Shedding, despite vaccination.

5. **Context**

- Ecology/climate;
- Animal production and marketing systems, percentage of households keeping host species, live animal market use in affected areas;
- Type of investigation carried out to date;
- Efficiency/efficacy of national surveillance systems in humans;
- Hospital capacity and surge capacity;
- Efficiency/efficacy of national surveillance systems in animals;
- Measures in place (and implementation, consequence), investigation/control activities, and level/distribution of implementation;
- Cultural issues, health care seeking behaviour, holidays;
- Political situation, security issues;
- Economic and social consequences;
- Cross-border movement of people.

6 R_0: basic reproduction rate - a measure for the transmission potential of pathogens/diseases.

Annex H. **Potential information sources**

1. **From ministries**

- Event reports (e.g. from national animal health networks, village animal health workers and farmers, live market workers and traders);
- Laboratory reports;
- Clinician reports/hospital records;
- Outbreak investigation reports;
- Country statistics (e.g. workforce statistics and animal and human population numbers and demographics);
- Statistics or reports on cross-border movements of animals and/or humans;
- Statistics on animal and human population densities;
- Existing laws and regulations at national and subnational levels relevant to specific hazards.

2. **From the Tripartite**

- WHO regional and country offices (e.g. surveillance systems in place, hospital capacity, measures in place and implementation, infrastructural constraints, health seeking behaviour, cultural aspects, vaccination programmes);
- OIE factsheets;
- OIE WAHID reports;
- OIE disease cards;
- FAO-ECTAD regional and country offices;
- FAO mission reports;
- OFFLU scientific data/reviews;
- FAO or OIE Reference Laboratory data on virus behaviour (including challenge studies) and vaccines;
- FAO H7N9, H5Nx, Ebola and SARS-CoV-2 global risk assessments;
- FAO manuals on specific diseases;
- WHO risk assessments on specific hazards;
- FAOSTAT database for livestock production, trade (import/export).

3. **General/publicly available**

- Expert experience (including technical and contextual);
- Past clinical data on similar hazard;
- Media articles, ProMed reports;
- ICD-10 information;
- Risk assessments from other agencies and organizations, such as the Centers for Disease Control and Prevention (CDC), French Agency for Food, Environmental and Occupational Health & Safety (ANSES), European Food Safety Authority (EFSA), American Public Health Association (APHA), United States Department of Agriculture Food Safety and Inspection Service (USDA-FSIS), on similar hazards;
- Control of Communicable Disease Manual (Heymann DL);
- Peer-reviewed literature;
- Technical data available on the Internet, e.g. climate/weather.

Annex I. **Linking the risk framing, the risk assessment questions, and risk management**

Risk assessment questions are formulated to address the specific concerns of the joint risk assessment (JRA) steering committee (as captured in the risk framing) and are directly linked to management and communications options. Some generic examples of the relationships are given in the table below. These are further described using the specific hazard, geographic location and time frame of concern.

Concerns captured in the risk framing	**Example risk assessment question:** Likelihood and Impact of...	**Technical considerations**	**Possible management communication options**
1. Safety of live animal markets (LAM)	...a person being exposed to the pathogen in an LAM...	Presence of pathogen in LAMs	Decrease pathogen in value chain
		Transmissibility to humans	Communication to improve understanding of risks and what people can do to protect themselves from exposure
		Pathogen prevention and control activities	Improve pathogen control in markets (e.g. rest days, no overnight stays)
2. Public fear and perception, negative impacts on travel and tourism	. . . a person becoming seriously ill or dying from infection due to contact with water in a recreational lake...	Capacity of the human health system and wildlife sector to detect disease	Target surveillance for early detection
			Communication to improve understanding of risks and what people can do to protect themselves from exposure
			Measures to manage wildlife contamination of recreational water
		Capacity of the environment sector to detect pathogen contamination	Establish systems for monitoring recreational water contamination
3. Transmission of pathogen in households	... a person becoming infected by buying/ keeping animals at home...	Presence of pathogen in household animals	Surveillance and control of pathogen in animals in households
		Presence of pathogen in animals sold by vendors	Surveillance and control of pathogen in animals being privately transported and sold to households

Concerns captured in the risk framing	Example risk assessment question: Likelihood and Impact of...	Technical considerations	Possible management communication options
4. Disease coming across a border	... a person becoming infected as a result of contact with illegally imported animals...	Number, source, destination, and intended use of infected animals coming across a border	Tighter movement controls at border
			Communication to improve disease awareness in border communities
			Increased surveillance in border communities or known value chains
5. Transmission from wild animals	... a person becoming infected from contact with wild animals...	Presence of pathogen in wild animal populations	Communication to improve awareness about disease risks from hunting and other contact with potentially sick or dead wild animals
		Frequency and likelihood of transmission associated with contacts between wild animals and people	Measures to decrease contact between people and potentially contaminated environments
		Frequency and likelihood of transmission associated with contacts between people and environments contaminated by wild animals	
Note: In some circumstances, such as when diagnosis is complex/difficult, the risk assessment question may focus on a proxy for the disease, e.g. dog bites instead of rabies cases. The following specific examples illustrate this.			
6. Rate of dog bites in the human population	.. a person requiring treatment for a dog bite...	Numbers of stray dogs	Communication to improve disease awareness about dog bites
		Frequency of stray dog contact with people	Stray dog spay and neuter campaigns
		Types and numbers of dogs associated with dog bites	
7. Rabies in people	...a person being exposed to rabies from dogs...	Health system capacity to detect high-risk exposures and provide post-exposure prophylaxis	Measures to improve detection and reporting of dog bites and administration of post-exposure prophylaxis
			Dog vaccination campaigns
		Rates of rabies infection in dogs	
8. Rabies in people	...a person being exposed to rabies from wildlife...	Rates of rabies infection in bats and other wildlife	Measures to decrease rabies in wildlife (e.g. bait drops)
			Communication on how to decrease disease risks associated with contact with wildlife

Annex J. **Risk framing template**

Tripartite joint risk assessment risk framing template. (Complete one template per hazard)

This template supports the joint risk assessment (JRA) steering committee to frame the joint risk assessment so that the assessment and the associated risk management and communication options are focused on the specific current concerns of the government. Based on this risk framing, the JRA Technical Team identifies risk assessment questions to address in the JRA and provides appropriate and relevant risk management and communication options.

Provide as much specific information as possible.

1. **Hazard**

(1) Hazard, priority zoonotic disease, or zoonotic disease event of concern to be assessed

(2) What is the top government concern related to this hazard?

2. **Scope**

In most cases, the scope of the JRA will be 'health risks at the human–animal–environment interface posed by the above hazard within the country' (specifying also the geographical area or administrative level of concern e.g. national or subnational level).

(3) Is this the scope of the proposed assessment?

Yes No

(4) If no, what is the scope?

(5) What are the geographical area(s) and administrative level(s) of concern?

(6) Are there other critical aspects to be included in the scope (refer to JRA OT, Module 3: Step 5.2)?

Yes No

(7) If yes, other aspects to be considered in the scope

3. **Purpose**

In general, the purpose (reason for doing the assessment) of any risk assessment is to support mitigation of the risks associated with the hazard.

(8) Is this the purpose of the proposed assessment?

Yes No

(9) If no, what are the additional or more specific purposes?

4. **Key objective**

In general, the key objective (goals or desired result) is to provide a basis for management or communications decisions.

(10) Is this the key objective of the proposed assessment?

Yes No

(11) If no, what are the additional or more specific objectives?

5. **JRA Technical Team**

(12) What government (or non-governmental) agencies or institutions have the required expertise and information relevant to the entire scope of the aspects described above?

(13) Are there any other stakeholders[7] that need to be informed or involved?

7 In the *Tripartite Zoonoses Guide*, stakeholders are defined as 'any individual or group that is or should be involved as a partner in preventing or managing zoonotic diseases or other shared health threats at the human–animal–environment interface. Stakeholders include those who impact, are impacted by, or perceive themselves to be affected by zoonotic disease threats, including those who may be affected by measures to address zoonotic diseases'.

Glossary

All terms and definitions below are used in the context of the JRA OT only and may be used differently elsewhere, including in other publications of the FAO, OIE, and/or WHO. Countries may choose to use their own terminology in the implementation of the JRA OT.

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.

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

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

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

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

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

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

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 or environmental losses and impacts.

Emerging zoonotic disease: Zoonotic disease due to known pathogens but that have not yet occurred in a specific geographical 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 exists continually or continuously in a geographical area, so that cases of disease are 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.

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 cases or detected zoonotic disease infections, depending on the hazard and the circumstances.

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

Governance: The set of structures, policies, processes, 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 be referred to as a threat.

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

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.

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

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.

Multisectoral: Involving participation of more than one sector working together 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 with a One Health approach (see definition).

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

OH 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 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.

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 both people and animals; a One Health approach is applicable at the subnational, national, regional, and global levels.

Outcome: A result or effect of an activity.

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

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.

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 is 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.

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.

Stakeholder: Any individual or group that is or should be involved as a partner in preventing or managing zoonotic diseases or other shared health threats at the human–animal–environment interface. Stakeholders include those who impact, are impacted by, or perceive themselves to be affected by zoonotic disease threats, including those who may be affected by measures to address zoonotic diseases.

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

Subnational: 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.

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

Tripartite: Term used to describe the three agencies responsible for human and for animal health internationally, the WHO, OIE, and FAO, in their work together.

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

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

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.

Contributors

Individual Contributors

Authors:

Ordered by technical contribution

Sophie von Dobschuetz (FAO); Elizabeth Mumford (WHO); Kachen Wongsathapornchai (FAO); Guillaume Belot (FAO / WHO); Xavier Roche (FAO); Ryan Aguanno (FAO); Dirk Pfeiffer (CityU HK / RVC); Kaylee Myhre Errecaborde (WHO); Dana Cole (USDA APHIS / OIE designated expert)

Supporting Contributors:

Ordered alphabetically:

OIE:

Tianna Brand; Lucia Escati; Julie Sinclair (OIE / US CDC); Jing Wang

FAO:

Garba Ahmed; Dragan Angelovski; Charles Bebay; Daniel Beltran-Alcrudo; Aurelie Brioudes; Filip Claes; Wantanee Kalpravidh; Fredrick Kivaria; Juan Lubroth; Niwael Mtui-Malamsha; Serge Nzietchueng; Yooni Oh; Julio Pinto; Claudia Pittiglio; Ludovic Plee; Eran Raizman; Luuk Schoonman, Ismaila Seck; Mikheil Sokhadze, Baba Soumare; Keith Sumption; Damian Tago-Pacheco; Farida Zenal

WHO:

Stéphane De La Rocque de Severac; Lisa Crump; Erica Dueger; Anthony Eshofonie; Vasily Esenamanov; Gudrun Freidl; Tinatin Gigauri; Gyanendra Gongal; Thi Hong Hien Do; Benido Impouma; Heba Mahrous; Allan Mpairwe; Ambrose Otau Talisuna; Dina Pfeifer; Nesre Redi; Ana Riviere-Cinnamond; Caroline Ryan; Farah Sabih; Dubravka Selenic; Endang Widuri Wulandari; Mya Yee Mon; Tamila Zardiashvili

Other organizations/institutions: Celine Gossner (ECDC); Norikazu Isoda (Hokkaido University); Dilys Morgan (NIS-PHE); Tony Mounts (USCDC); Maria Concepcion Roces (SAFETYNET)

Contributing countries

Afghanistan, Cameroon, Cote d'Ivoire, Ethiopia, Georgia, Ghana, Indonesia, Kenya, Pakistan, Panama, Rwanda, Senegal, Tunisia, Uganda, United Republic of Tanzania, Viet Nam.