

RISK ASSESSMENT

TRAINING GUIDELINE FOR PUBLIC HEALTH THREATS

MEKONG BASIN DISEASE SURVEILLANCE (MBDS)

Supported by

CANADA'S WEAPONS THREAT REDUCTION PROGRAM

2022



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Prepared by:
MBDS Secretariat
Mekong Basin Disease Surveillance, Bangkok,
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Dr. Moe Ko Oo

Secretariat

Mekong Basin Disease Surveillance (MBDS)

ABBREVIATIONS

| | |
|----------|--|
| BCRN | biology, chemical, radio nuclear, physical |
| CARPHA | Caribbean Public Health Agency |
| CDC | Centers for Disease Control and Prevention |
| CO/ WCO | WHO offices in countries, territories and areas |
| COVID-19 | Coronavirus disease (caused by the SARS-CoV-2 virus) |
| DVA | detection, verification and assessment |
| EBS | evidence-based surveillance |
| ECDC | European Centre for Disease Prevention and Control |
| EI | epidemic intelligence |
| EID | emerging infectious diseases |
| EIS | event information site |
| EMS | WHO event management system |
| EpiNorth | North-Eastern Europe |
| EpiSouth | Mediterranean and Balkan countries |
| EWAR | early warning and response |
| FAO | Food and Agriculture Organization |
| FRA | formal risk assessment |
| GLEWS | global early warning system |
| GOARN | Global Outbreak Alert and Response Network |
| H2H | human to human |
| HIV | human immunodeficiency virus |
| HQ | WHO Headquarters |
| IAEA | International Atomic Energy Agency |
| IBS | indicator-based surveillance |
| ICD-10 | international classification of diseases- 10 |
| IHR | International Health Regulation |
| IMS | incident management system |
| INFOSAN | International Food Safety Authorities Network |
| IPC | infection prevention and control |
| IRA | initial risk assessment |
| MBDS | Mekong Basin Disease Surveillance |
| MS | WHO Member States |
| MVP | meningitis vaccine project |
| NaTHNaC | National Travel Health Network and Centre |
| NGO | non-governmental organization |

| | |
|--------|--|
| OIE | World Organization for Animal Health |
| PPHSN | Pacific Public Health Surveillance Network |
| RA | risk assessment |
| RED | Regional Emergency Director |
| RO | WHO Regional Offices |
| SitRep | situation report |
| SOP | standard operating procedure |
| TB | Tuberculosis |
| TTX | tabletop exercise |
| UN | United Nations |
| WHE | WHO/HQ Health Emergencies Programme |
| WHO | World Health Organization |
| WTRP | Weapons Threat Reduction Program |

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FOREWORD

An all-hazards approach has been used in emergency and disaster management and applied to public health events that require an immediate response. This approach has been driven by the International Health Regulations (IHR) 2005 that requires countries to develop a national and/ or sub-national risk assessment capacity. Risk assessment is a systematic and continuous process for gathering, assessing and documenting information to assign a level of risk and to provide the basis for taking action to manage and reduce the negative consequences of a public health public health threats and One Health significance events.

The objective of this series of resource materials are to assist the planning and implementation of risk assessment in order to support defensible decision-making, appropriate and timely control measures, effective operational and risk communication, and improved preparedness and response. This series was developed with basic nine chapters related to risk assessment for public health threats, including about an all-hazards approach, the indicator-based and event-based surveillance, epidemic intelligence process, risk management and communication, monitoring and evaluation, and information sharing mechanism.

Sector-specific and joint risk assessments (JRA) are complementary, which may be conducted either within a sector-specific risk assessment or within JRA, and even both within a sector-specific risk assessment prior to a JRA continuously. This resource materials may not be able to cover all technical aspects, however the nine chapters have been prepared by considering existing and updated related references. This series of resource material covers the gap of knowledge as a supporting reference that can be adopted and modified by the risk assessment team, public health surveillance team, health professional, educators/ trainers, and educational institutions according to the needs and each context/ setting. The authors strongly advise end users to update and improve any information adopted in the materials with guideline user's preferences. This document served as a supporting material and references purposed as part of risk assessment on public health threats from human-animal-environment interface.

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Mekong Basin Disease Surveillance Foundation

Chapter A.

Introduction

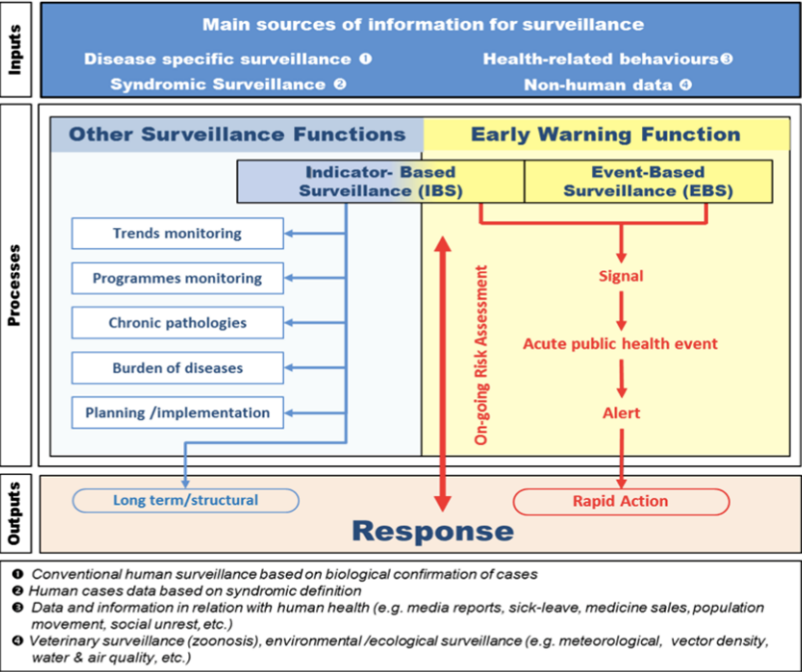
An all-hazards approach has been used in emergency and disaster management and applied to public health threats that require an immediate response. Emergency is defined as a situation impacting lives and well-being of a large number of people or significant percentage of a population and requiring substantial multi-sectoral assistance. As defined by the International Health Regulations (2005), the threats to global public health security result from human actions or causes, from human interaction with environment, and from sudden chemical and radioactive events, including industrial accidents and natural phenomena¹.

The public health threats are events or disasters that may have negative consequences for community, including human, animal, and environmental health, which requires prompt action. Events and emergencies can be acute or slow onset²⁻⁴, such as antimicrobial resistance, falsified medicines, biological and chemical threats and emergencies such as outbreaks or pandemics. Therefore, an all-hazards approach takes into consideration all possible hazards — including biological, chemical, and radio nuclear, hazards and natural disasters (e.g. fires, floods, other extreme weather events, volcanic eruptions, earthquakes and tsunamis)⁵. Health emergency information and risk assessment is one of functions of The Health Emergencies Programme that has been designed and structured to implement these all-hazards approach².

Health issues at the human-animal-environment interface cannot be effectively addressed by one sector alone, thus collaboration across all sectors and disciplines responsible for health is required to address complex public health threats⁶. This approach to collaboration is referred to as One Health. One Health is a collaborative, multidisciplinary, and multisectoral approach that can address urgent, ongoing, or potential public health threats at human-animal-environment interface at subnational, national, global, and regional levels. This approach includes ensuring balance and equity among all the relevant sectors and disciplines to address health issues in a way that is more effective, efficient, or sustainable⁷; while risk assessment aim at supporting the countries in their preparedness and response to a public health threat.

An all-hazards and One Health approaches have been driven by the IHR 2005 that requires all States Parties to the Regulations to develop a set of core capacities in surveillance and response covering any “illness or medical condition, irrespective of origin or source that presents or could present significant harm to humans”. The IHR core capacity requirements for surveillance and response require Member States to develop a national (and, where possible, a sub-national) risk assessment capacity that is recognized as an integral part of the prevention, surveillance and response system⁵. Under the IHR, risk assessment can include assessment of the risk to human-animal-environment interface, of the risk of international spread of disease and of the risk of interference with international traffic and trade⁴. Joint External Evaluation tool of IHR has Indicators on Preparedness to all hazards which includes “Strategic emergency risk assessments conducted and emergency resources identified and mapped”

Figure 1. Overview of all hazard public health surveillance and response functions

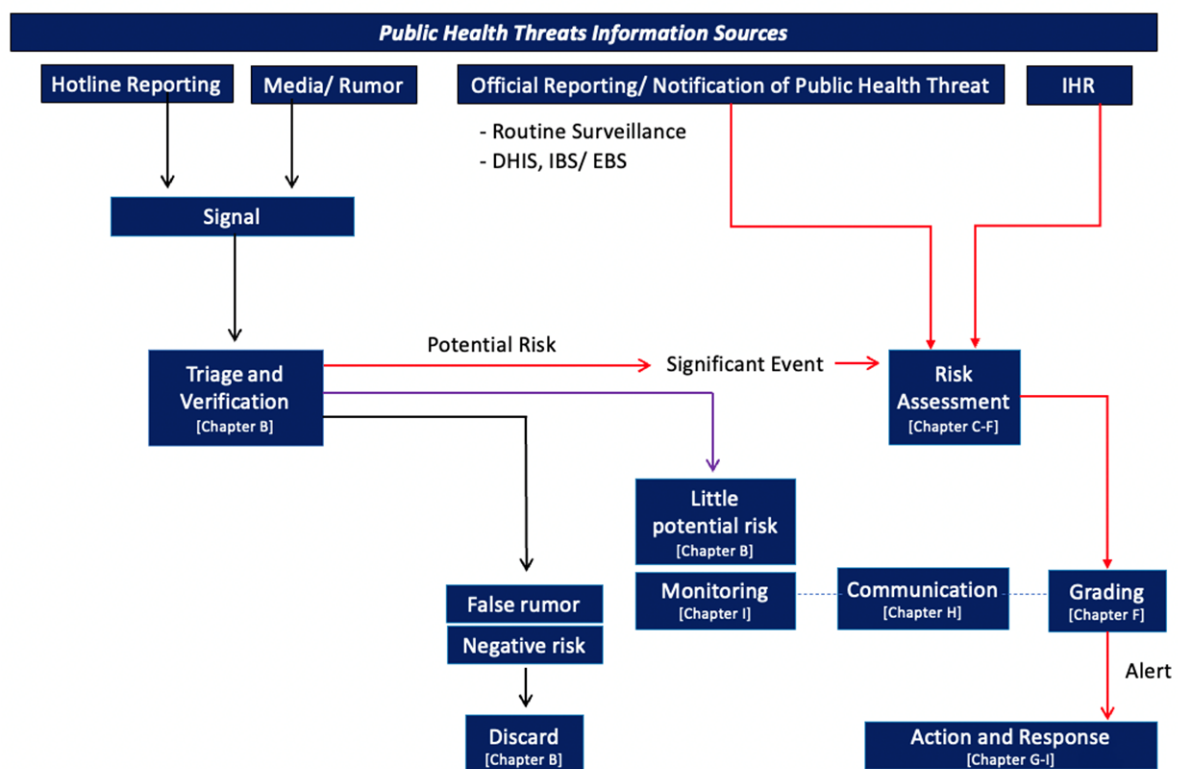


Source: WHO (2014)⁴

Surveillance systems [Figure 1] detect public health threats^{4,5} through:

- Indicator-based surveillance (IBS): Routine systematic collection, monitoring, analysis, and interpretation of structured data (e.g. indicators, produced by a number of well-identified, predominantly health-based formal sources) and pre-defined information about diseases using case definitions (e.g. weekly surveillance of cases of acute flaccid paralysis). Predetermined outbreak thresholds are often set for alert and response. The collection of IBS data is a routine, regular process which is primarily passive
- Event-based surveillance (EBS): Rapid organized collection, assessment, monitoring, and interpretation of ad hoc information about events, which may represent risk to human-animal-environment interface. EBS uses a variety of official and unofficial information sources to detect clusters of cases and the information collection process is mainly active and carried out through a systematic framework specifically established for EBS purposes.

Figure 2. Risk assessment processes in the phases of preparedness and response for public health threats



Source: developed by MBDS

Not all signals detected, notification (threat) or event reported, and alerts generated through IBS and EBS describe real events nor as public health threats importance [Figure 2] that require a dedicated response by public authorities^{4,5}. Therefore, there are some important terms and definitions for understanding the scope of risk assessment:

- **Incidence:** The number of new cases of a disease that develop within a specified population over a specified period of time. Incidence rate—is the ratio of new cases within a population to the total population at risk given a specified period of time.
- **Rumor:** An event either reported through any channel other than the IHR National Focal Point or other competent authority.
- **Notification:** a formal notifying or informing of events or threat concerning public health emergency through an official channel.
- **Signal:** a piece of information selected in the EBS process that may be of One Health importance and therefore needs to be verified for its authenticity and conformity, by actively cross-checking the validity of the information with reliable sources.
- **Significant event:** a signal that has been verified. All events need to be risk assessed by skilled epidemiologists, routinely by conducting an initial risk assessment (IRA) and if required by conducting a formalized risk assessment.
- **Triage:** a process of sorting the information, screening and determining if an event or alert detected is a potential risk, and prioritizing it for action, based on available data and information that are relevant for event detection purposes
- **Alert:** An alert comes from an event which is defined as a signal that has been verified. All events need to be risk assessed by skilled epidemiologists, routinely by conducting an IRA and if required by conducting a formalized risk assessment.

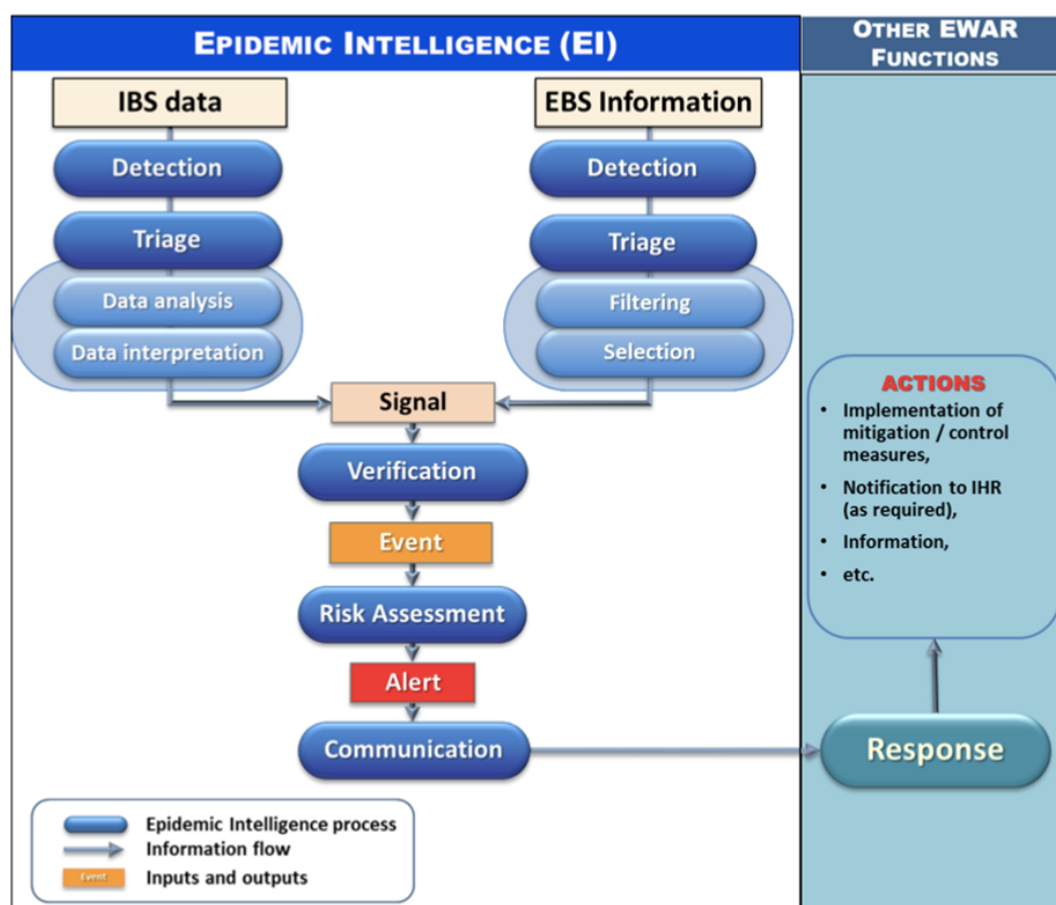


Chapter B:

Epidemic Intelligence Process

Within early warning and response (EWAR), the collection of data with the aim of detecting emerging health threats is part of a single process called epidemic intelligence (EI). Epidemic intelligence is a systematic collection, analysis and communication of any information to detect, verify, assess and investigate events and health risks with an early warning objective [Figure 3]. The EI integrates both sources of information (IBS and EBS) in order to detect public health threats/ verified events, including its risks to human-animal-environment interface⁴.

Figure 3. Epidemic intelligence process



Source: WHO (2014)⁴

Epidemic intelligence can be organized into five main phases⁴:

- Detection of raw data and information
- Triage of relevant data and information
- Verification of signal, rumor, notification (threat)
- Risk assessment of the event
- Communication

Early detection, risk assessment and response are vital to ensuring that the public health threats and One Health significance events do not escalate into large- scale outbreaks or pandemics². The authenticity of the public health threats and One Health significance events needs to be established before embarking risk assessment in the next stage⁴. In addition, some of the human, animal, and environmental significance events require rapid risk assessment and may constitute an emergency necessitating immediate grading and response.

B.1. INFODEMIC MANAGEMENT

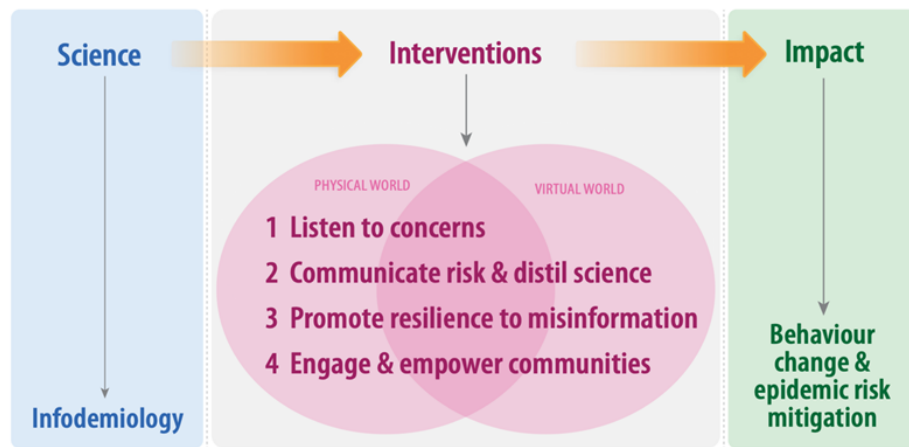
Infodemiology can be described as “the science of the distribution and determinants of information in an electronic medium, specifically the Internet, or in a population, with the aim of informing public health and public policy”^{8,9}. The problem of infodemics and the importance of Infodemiology has increased rapidly. Most of the public health threats are accompanied by infodemic, which is overflow of information and misinformation that surges across digital and physical environments during acute public health event¹⁰.

People frequently encounter public health threats information that draws on different evidence types, which may or may not help make informed decisions. It leads to confusion, risk-taking, and behaviors that can harm health and lead to erosion of trust in the health authorities and public health responses^{11,12}. Due to much uncertainty surrounding public health threats situation, even information coming from legitimate sources can become outdated quickly, making it insufficient to use the credibility heuristics¹³. Misinformation in a pandemic can negatively affect human health: unsupervised use of the products such as chloroquine and hydroxychloroquine and eventually lead of dangerous consequences including death¹⁴. Panic and anxiety caused by infodemics of misinformation hinder public health control efforts¹⁵. The worst end result of infodemics is that effective public health response is adversely affected and undermined¹⁰.

Infodemics have been associated with dissemination of public health information¹⁰; thus properly evaluating and processing such information, including its use of the evidence are crucial¹³. It is critically important that stakeholders across different sectors, professions and parts of society, act with urgency and in solidarity to mitigate this infodemic¹⁶. Controlling information circulation requires efforts in the infodemic management strategies in order to keep the public safe and informed.

Infodemic management can be defined as application of evidence-based interventions that bring understandable, localized, evidence-based information to citizens and drive positive health-seeking behaviour^{10,17}. Infodemic management [Figure 4] aims to ensure that people have the right information at the right time, in the right format, so that they are informed and empowered to adopt behavioral changes during public health threats^{11,18}. The infodemic response cannot be as top-down communication or glossy reports: it is about building partnerships around evidence-based answers and interventions¹⁶.

Figure 4. Infodemic management ecosystem



Source: WHO (2021)¹⁸

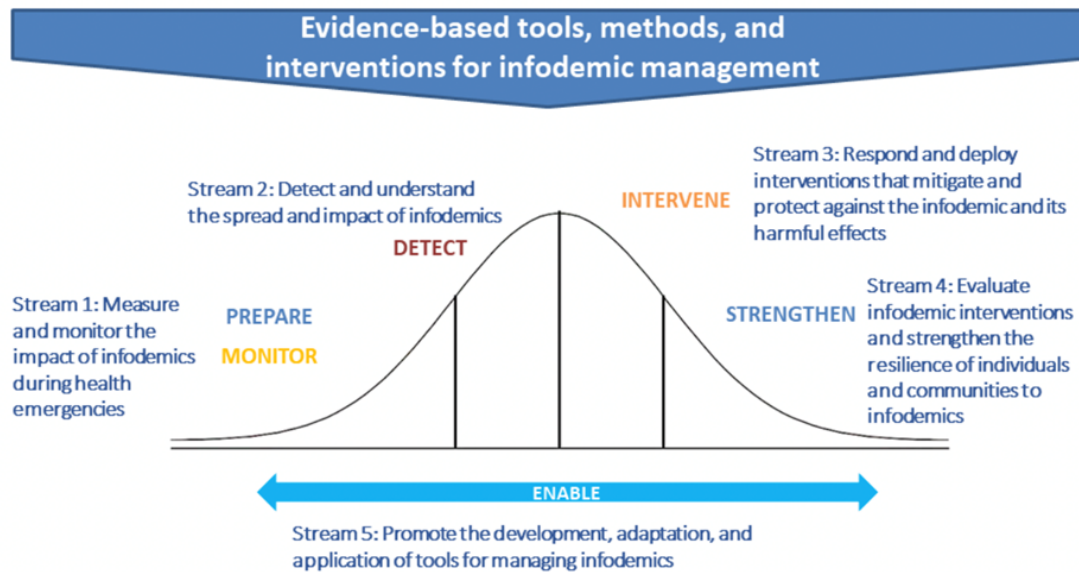
Infodemic management pushes towards shared leadership and decision-making as well as community-led solutions in emergency response¹⁸. Building on diverse research disciplines and expanding the discipline of infodemiology, more evidence-based interventions are needed to design infodemic management interventions and tools, to be implemented by health emergency responders. These interdisciplinary approach involving epidemiologists, data scientists, physicists and mathematicians, risk communication practitioners, behavioral scientists, public health professionals, representatives of affected communities, and ideally support from the leading data providers (e.g., social media entities)¹⁹.

There are six potential stakeholder groups who can be involved, such as: the science and research community, country health authorities, technology companies and social media platforms, NGOs and civil society groups, media and journalism, and UN agencies and multilateral organizations¹⁶.

In considering long-term interventions; critical thinking and literacy (e.g., health, information, digital, and media literacies) play an important role as a basis for interventions to address infodemics. These infodemic has placed strain not just on how to communicate the evolving scientific knowledge but also on how the public health authorities can implement a nimbler pandemic response that addresses the needs and concerns of local communities¹¹. Therefore, public health authorities need to:

- Develop, validate, implement, and adapt tools and interventions for managing infodemics in ways that are appropriate for the countries and contexts.
- Understand the infodemic while balancing privacy and ethical concerns, and managing analytic capacity in limited time frames.
- Empower communities to manage infodemics and build resilient communities through co-designed interventions.
- Build partnerships networks, including with fact-checkers; broader groups of media and journalists; social media, search engines, and digital interaction platforms; community organizations; civil society; and others.
- Take into account the information ecosystem, the ways people interact within the information ecosystem, and how information affects people's health behavior.

Figure 5. Infodemic management agenda into the phases of epidemic preparedness and response



Source: WHO (2021)²⁰, Calleja, et al (2021)¹¹

The public health agenda for infodemic management²¹ [Figure 5] have five workstreams:

1) Measuring and continuously monitoring the impact of infodemics

- Standardize taxonomies and classifications
- Develop new metrics to measure and quantify infodemics
- Analyze and triangulate data from multiple sources
- Improve evaluation approaches for infodemic interventions

2) Detecting signals and understanding the spread and risk of infodemics

- Understand how information originates, evolves, and spreads on different platforms and channels
- Assess the role of actors, influencers, platforms, and channels
- Understand how misinformation affects behavior in different populations
- Develop regulatory and ethical principles to mitigate the spread and propagation of harmful health information

3) Responding and deploying interventions that mitigate and protect against infodemics

- Design a behavioral/change model applicable to infodemic management
- Design interventions for different levels of action to mitigate the infodemics

4) Evaluating infodemic interventions and strengthening the resilience to infodemics

- Develop interventions that address individual, community, cultural and societal-level factors affecting trust and resilience to misinformation
- Understand and learn from how misinformation has affected behavior among different populations and in different contexts for specific infodemics

- Identify factors associated with successful infodemic management by health authorities, the media, civil society, the private sector, and other stakeholders

5) Promoting the development, adaptation, and application of interventions and toolkits for infodemic management

- Use implementation research evidence in program improvement and policy development
- Promote evidence-based interventions and approaches among countries
- Improve effectiveness and response times to the infodemic during acute health events

The International Health Regulations (2005) list risk communication and community engagement as part of core capacities that need to build and sustain to strengthen national and global systems to detect and respond to public health threats¹¹. To enforce an improved epidemics surveillance, risk assessment team should consider the contemporary presence of infodemics and epidemics dimensions, accounting for their singular and shared features¹⁹. In addition, the availability of data is crucial to develop infodemic prevention and mitigation strategies¹⁰.

INFODEMIC MANAGEMENT IN PRACTICE²²

In the age of COVID-19, information searches and media consumption have increased massively especially during lockdown. Web traffic and social media subscribers to trusted source, such as WHO, have increased. Communication has become more important while delivering health messages through available channels. Means of fighting misinformation include removing harmful information, myths, and rumors, paying attention to trending rumors, working with tech companies, countering false information with facts and data via social media, and enforcing misinformation management. Infodemic management covers not only misinformation and disinformation, but also overwhelming amount of information received from both online and offline.

Infodemic management requires a whole-of-society approach and should be in place in health systems at all time. The following represents the process of infodemic management positioning in health authority processes.

1. Social listening to understand the public's concerns and misinformation

Health authority should listen to population's information needs, concerns and challenges by using social listening tool and data collection methods. Then, analyze those data to provide more responsive health programs.

2. Deliver high-quality health information

To increase awareness and healthy behaviors, health authority should proactively share accurate information to target audiences. Measuring and tracking effectiveness of the message and optimizing the engagement are some of the ways to achieve the delivery of high-quality health information.

3) Apply interventions, methods

Mitigating harm from misinformation can be carried out by designing interventions at multiple level

for target audiences and defining model of change. Methods include social inoculation, health/digital literacy education, tools for crowdsourced factchecking, and participatory mapping of misinformation.

4) Counter misinformation and disinformation

Tracking misinformation, fact checking, developing SOP to collect misinformation at multiple levels, and building network of stakeholders to share information are ways to counter misinformation. In addition, it is necessary to promote credibility and trust in health authorities and service delivery.

5) Monitor information, environment and responses

Measuring the impact of interventions and developing the interventions for improvement are of importance. Methods include using multiple datasets, community participatory monitoring, community informants and inclusion of analysis and recommendations into situation report.

6) Support healthy behaviors and resilience to misinformation at individual, community and societal level

Developing measures to understand how individual behavior is affected by the infodemic, strengthening the community involvement, measuring community empowerment, and incorporating measures into reporting system are methods to support healthy behaviors and resilience to misinformation at all levels.

7) Strengthen outbreak preparedness, and response in acute health events

It is crucial to apply the lessons learnt from interventions in preparing for future outbreak preparedness planning, policy and systems. Working with multidisciplinary teams, collaboration with academia, research community, involving policy makers, alliances with technology sector are ways to strengthen the outbreak preparedness and response.

To conclude, risk communication to the community plays an important role in mitigating the consequences occurred from infodemic. One strategy will not solve the problem and it needs collaboration from all parties involved, especially the community. Community may respond differently to an outbreak. It is important to understand factors influencing community's perceptions of an outbreak: Rumors, misinformation, and conspiracy theories may create panic and people may not comply to the healthy behaviors or proposed interventions. Thus, engaging and empowering community is a must to identify problems and implementing solutions. Active social listening and two-way communication are methods to understand community dynamics, circumstances and behaviors. It will allow health professionals to collect data and develop effective health interventions. Infodemic management is not a one-time process. Social listening, risk communication, promote resilience to misinformation, engage and empower communities should deploy before, during and after the outbreak.

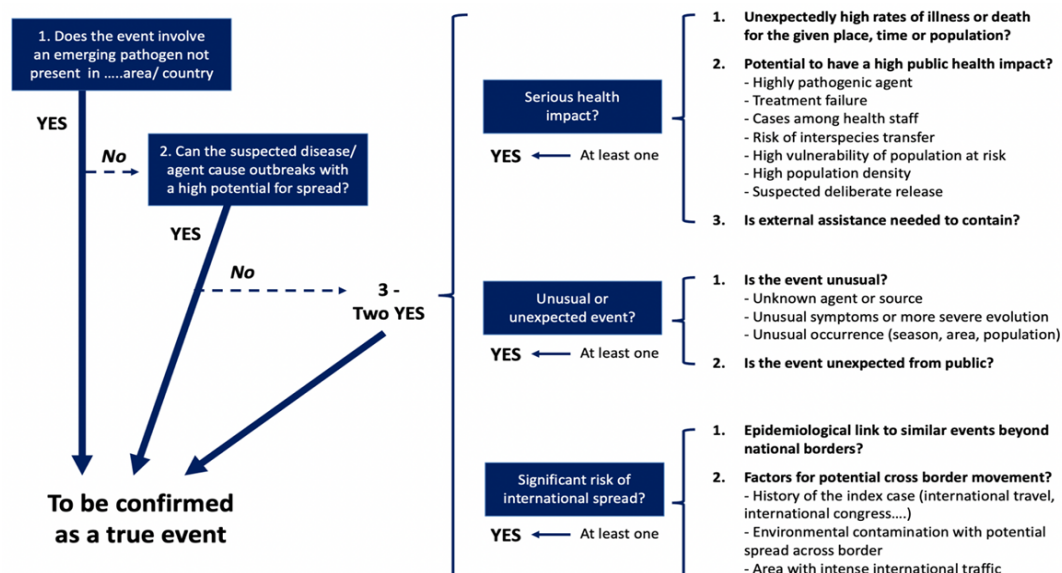
B.2. EVENT DETECTION

An event detection is defined as a systematic review of informal and formal reports and maintenance of log recording significant incidents which are then followed up. Guidance should be developed to assist the triage and assessment of newly detected events⁵. The sources of information that can be used are, as follows:

- Media search (informal news reports, press report, bulletins)
- Internet reporting (international websites, national websites)
- Complaints/ report (hotline)
- IBS data, EBS information, and incidence report to detect clusters of cases with similar clinical signs and symptoms: Surveillance networks, Laboratory reports, Clinicians, Primary care, etc.
- Reports from other Ministries (e.g., Ministry of Health, Ministry of Agriculture, Ministry of Environment and wild life, etc.)

Triage is a process of screening and determining if an event or alert detected is a potential risk to human-animal-environment interface and prioritizing it for action, based on available data and information that are relevant for event detection purposes^{4,5}. Triage process aims to sorting the information collected in the detection step to identify any signals that may be of the public health threats importance. These selection step needs to be conducted by epidemiologically skilled personnel. The next Figure 6 describes the example for a series of questions to assess public health importance based on the decision instrument Annex B of the IHR 2005.

Figure 6. Series of questions to assess significant public health threats



Source: Adopted from ECDC (2011, 2019)^{23,24}

If the event is detected quickly, initial information may be limited and non-specific. The initial triage process focuses on assessing the credibility of the incoming signal(s)/ rumor(s)/ notification(s) and whether the event described is a potential risk to public, animal, and environmental health that warrants investigation. The accuracy of the reporting of the event may be assessed at the same time⁵.

B.3. EVENT VERIFICATION

Event verification is needed when the occurrence, nature, or cause and extent of a potential significance events are not known, or where the sources of the report require substantiation. Event verification is done through the active systematic information-gathering from various sources, for triangulation and technical review². These sources include but are not limited to:

- The official reporting programs
- National level focal from authorities and various organizations
- Other sources: expert networks, published reports, media information.

It is also an opportunity to collect additional complementary information which will be needed for the risk assessment. Verification will vary according to the source and the event⁴, but it could consist of:

- Contacting local health authorities;
- Contacting the original source;
- Cross-checking with other sources;
- Collecting additional information; and
- Checking for official information available on the internet.

Table 1. Example for the list of dedicated website as potential sources

WHO early warning websites

| | |
|--|---|
| IHR Event Information Site (EIS) | Secured platform, accessible only to NFP |
| WHO disease outbreak news | http://www.who.int/csr/don/en/ |
| Global Outbreak Alert and Response Network-(GOARN) | Communications platform for the members of GOARN |
| Regional Office for Africa | http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news.html |
| Regional Office for the Americas | http://new.paho.org/hq/index.php?option=com_content&view=article&id=1239&Itemid=2291&lang=en |
| Regional Office for the Eastern Mediterranean | http://www.emro.who.int/surveillance-forecasting-response/outbreaks/ |
| Regional Office for Europe | http://www.euro.who.int/en/what-we-do/health-topics/emergencies/international-health-regulations/news |
| Regional Office for South-East Asia | http://www.searo.who.int/entity/emerging_diseases/en/index.html |
| Regional Office for the Western Pacific | http://www.wpro.who.int/emerging_diseases/en/index.html |

Other international agencies early warning websites

| | |
|---|---|
| Food and Agriculture Organization United Nations (FAO) | http://www.fao.org |
| World Organisation for Animal Health (OIE) | http://www.oie.int |
| International Food Safety Authorities Network (INFOSAN) | http://www.who.int/foodsafety/fs_management/infosan/en/ |
| The International Atomic Energy Agency (IAEA) | http://www.iaea.org/ |

Examples of disease-specific international websites

| | |
|--|---|
| Global Influenza Surveillance & Response System | http://www.who.int/influenza/gisrs_laboratory/en/ |
| Meningitis Vaccine Project (MVP), Sub-Saharan Africa | http://www.meningvax.org/mission.php |
| Polio Eradication initiative | http://www.polioeradication.org/ |
| WPRO A/H5N1 Avian influenza | http://www.wpro.who.int/emerging_diseases/AvianInfluenza/en/ |
| ECDC West Nile | http://www.ecdc.europa.eu/en/healthtopics/west_nile_fever/west-nile-fever-maps/pages/index.aspx |

Examples of institutional travel health websites

| | |
|---|---|
| WHO International Travel Health website; | http://www.who.int/ith/en/ |
| Centers for Disease Control and Prevention (CDC) | http://wwwnc.cdc.gov/travel/ |
| National Travel Health Network & Centre (NaTHNaC) | http://www.nathnac.org/travel/ |
| Department of Health, Hong Kong SAR, China | http://www.travelhealth.gov.hk/eindex.html |
| Travel Health, Public Health Agency of Canada | http://www.phac-aspc.gc.ca/tmp-pmw/ |
| Ministry of Foreign Affairs, France | http://www.diplomatie.gouv.fr/fr/conseils-aux-voyageurs/ |
| Ministry of Foreign Affairs and Trade, Australia | http://www.smarttraveller.gov.au/ |

Examples of supranational and regional EWAR Websites

| | |
|---|---|
| European Centre for Disease Prevention and Control (ECDC) | http://www.ecdc.europa.eu/en/press/epidemiological_updates/ |
| Caribbean Public Health Agency (CARPHA) | http://carpha.org/ |
| Pacific Public Health Surveillance Network (PPHSN) | http://www.spc.int/phs/PPHSN/ |
| EpiSouth (Mediterranean and Balkan Countries) | http://www.episouth.org/ |
| EpiNorth (North-Eastern Europe) | http://www.epinorth.org/ |
| Mekong Basin Disease Surveillance Network | http://www.mbdsoffice.com/ |

Source: WHO (2014)⁴

A specially assembled team (experts from the country, regional or global levels, including from technical networks and partners) will deploy to the event location for verification, in-depth investigation and, as required, risk assessment. Information is reviewed continuously to identify signals or events that require further verification or immediate action. This process may take between a few hours to several days depending on the context². Results from event detection, triage outcome, and event verification will determine the next action [Table 2] as follows:

Table 2. Actions based on event detection, triage, and event verification

| Outcome | Assessment | Management decision | Communication |
|---|---|---|--|
| Reported event is a false rumour | Discarded from RRA | | Risk communication about the event may be needed to address the public perception of risk. |
| Confirmed event but considered to be negligible potential risk for public health | Discarded from RRA | | Risk communication about the event may be needed to address the public perception of risk. |
| Confirmed event but considered to be of little potential risk for public health | Discarded from RRA | Monitoring of the situation | Risk communication about the event may be needed to address the public perception of risk. |
| Confirmed event with public health significant but not falling under DVA responsibilities | Discarded from RRA | Forwarding the incident to the relevant group for further actions | |
| Confirmed event with public health significance | RRA done within the group and their network contacts. | Depending on the outcome of the RRA, the group may act as risk managers or refer issues to other groups for risk management action. | Communication about the conclusion and the recommendations of the RRA |

Confirmation of an event does not automatically mean that it presents a public health threat to human-animal-environment interface. IRA routinely conducted risk assessments of all events detected during EBS, with no formalized documentation template. IRA should be carried out within 48 hours of signal detection and repeated as new information becomes available⁴. Some events may have little or no effect on human, animal, and environmental health. As a result, different actions [Table 2] may be taken as a result from the IRA⁵.

Once a signal has been verified, it becomes a verified significant event which then needs to be assessed to determine the level of risk to human-animal-environment interface and to establish the nature of the potential mitigation and control measures that can be implemented⁴. An event categorized as “alert” or “respond” requires the formalized risk assessment using the template for risk assessment on event of potential concerned.

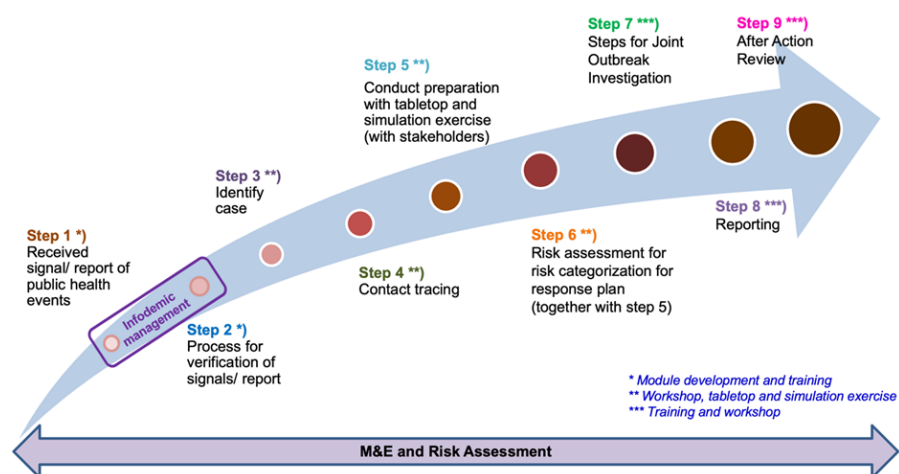
Response begins when public health threats (including human, animal, and environmental health events) is detected and verified, followed by risk assessment or situation analysis to determine if an operational response is required. Risk assessment, situation assessment, or other descriptive analyses of information from an event may be conducted within a sector prior to a joint risk assessment (JRA). These analyses can improve the accuracy of the JRA, especially in relation to impact and uncertainty⁷.

Chapter C:

Risk Assessment

After confirming that a reported event is real and may be considered an immediate public health threat, its public health importance risk must be determined⁵ and risk assessment needs to be conducted. Risk might associated with the human-animal-environment interface, thus risk assessments are used extensively to provide information on any identified impacts to inform decision-making processes²⁵. Risk can be defined as probability of occurrence and the magnitude of the biological and economic consequences of harmful public health threats to individuals or populations in the human-animal-environment interface, during a specified period.

Figure 7. Strategic roadmap for strengthening public health surveillance and response capacity



Source: developed by MBDS

Based on the sequences of activities in the strategic roadmap [Figure 7], risk assessment plan should be prepared and jointly discussed during a planning meeting. Multisectoral stakeholders have to be involved and led by specific public health – related focal persons or relevant sectors within the human-animal-environment interface.

Risk assessment helps identify the risks a country is most likely to face and review in which extent the emergency plans, systems, people and resources are in place. The result of risk assessment is important information to planning and conducting the joint outbreak investigation.

C.1. CONCEPT OF RISK ASSESSMENT

Risk assessment is a systematic process for describing and quantifying the risks associated with hazardous substances, processes, action, or events²⁶. Public health systems work best when they prevent hazardous exposures without waiting for epidemiologic studies to measure the adverse effects²⁷. Risk assessment generally serves as a tool that can be used to organize, structure, and compile scientific information to support risk management decisions through identifying existing hazardous situations or problems, anticipate potential problems, establish priorities, and provide a basis for regulatory controls and/or corrective actions²⁸.

For significant public health threats, risk assessment is a systematic and continuous process for gathering, assessing and documenting information to assign a level of risk (for a specific time period and location) and to provide basis for taking action to manage and reduce the negative consequences of public health threats and One Health significance events and its risks^{4,5}. Risk assessment can be defined as the overall process of identifying and evaluating the likelihood “the probability of an event occurring” of a specific hazard and risk factors causing a particular adverse public health threat/ OH significance event and its associate consequences. Risk assessment will guide definition and prioritization of control measures and what to communicate to the public, especially for evaluating the impact of control measures and identifying whether the risks to health could recur in human-animal-environment interface.

Risk assessment is a core part of public health response and thus widely undertaken by public health professionals. Formal systems which are used to grade the public health threat evidences and recommendations, rely on published research evidence, and studies are graded according to design and susceptibility to bias. As time and evidence are limited, a risk assessment may also need to rely at least in part on specialist expert knowledge²⁴.

Risk comprises two components: likelihood (probability) and impact (consequences), and each element includes a measure of uncertainty²⁹. When completing a risk assessment, it is important to clearly define some keywords:

- An accident is 'an unplanned event or inadvertent occurrence that results in loss'
- A hazard is something (object, substance, or situation) that has the potential for creating undesirable adverse consequences²⁸
- An exposure is the situation of vulnerability to hazards²⁸, including the numbers of people known or likely to have been exposed, the number or groups of people who are likely to be susceptible, the extent/intensity of exposure, and the geographical distribution².
- A context is all factors (i.e. social, ethical, technical, scientific, economic, environmental and political)⁵ that can affect the risk in which the event is taking place²
- A risk is considered to be the probability or likelihood (p) of an adverse effect²⁸ and the severity of a negative occurrence (S) resulting from hazardous situation

$$\text{Risk} = p \times S$$

Related to event of potential public health threats concern, risk is depends on²⁴ the probability or likelihood of transmission in the population (p) and impact or severity of disease (S).

$$p \times S = \text{Risk} \leftarrow \text{context}$$

A risk is Influenced by the context or broad environment in which the threat occurs including political, public, media interest, perception of threat, and the acceptance of risk; which may vary between countries and cultures²⁴ as well as may vary in different setting of human-animal-environment interface. While, risk acceptance is ultimately determined by the institution and its leadership³⁰.

Examples of common public health threats and emergencies requiring assessment/ analysis², such as:

a. Significance events that may require a risk assessment include, but are not limited to:

- Outbreaks of infectious diseases: diseases of unknown origin, new emerging or re-emerging diseases, epidemic prone diseases, zoonoses.
- Events resulting from exposure to the toxic or hazardous materials: falsified and counterfeit drugs or vaccines; unusual reaction to medications or vaccines; food or water contamination; environmental contamination/ exposure; accidental release or deliberate use of biological and chemical agents or radio-nuclear material.
- Other unusual or unexpected events representing a potential risk for human, animal, and environmental health.

b. Emergencies that may require a situation analysis include, are but not limited to

- Emergencies due to the natural hazards: earthquakes, tsunamis, floods, landslides/ avalanches, extreme temperature, progressive drought, and wildfires.
- Emergencies due to human-induced hazards: armed conflict, civil unrest, terrorism, transportation crashes, structural fires, industrial explosions.

C.2. TIMEFRAME OF RISK ASSESSMENT

Risk assessment will be needed for confirmed event or alert with public health threats and OH significance events where there could be an increased risk of significant consequences³¹ in human-animal-environment interface. Once an incident has been verified as being of potential public health threats concern, a risk assessment is undertaken (usually within 24 to 48 hours) to evaluate the risk, not only to human health²⁴, but also for animal and environmental health, as needed. Public health threats that may require a structured risk assessment include those that: are likely to be reportable under IHR (2005), exceed the response capacity of local authorities, and are likely to become a graded emergency for WHO. A structured risk assessment may also be conducted for slow-onset events where the situation is dispersed and complex, and where a risk assessment may bring greater focus on public health threats and OH significance events and responses needs².

Risk assessment evaluates severity of outbreak and minimize the level of its risk by adding control measures, as necessary. To aid the preparedness planning, risk assessment can be used to identify at-risk areas or populations, rank preparedness activities, and engage key policy and operational partners⁵. The goals of risk assessment³² is to answer the following basic questions:

- What can happen and under what circumstances?
- What are the possible consequences?
- How likely are the possible consequences to occur?
- Is the risk controlled effectively, or is further action required?

Risk assessment can be complex and challenging as they must be produced within a short time period when information is often limited and circumstances can evolve rapidly²⁴. Risk assessment undertaken in the initial stages of an event or incident of potential public health concern²⁴, whereas more formal risk assessments (FRA) are produced at later stage of public health threats or OH significance events, usually when more time and information is available.

The risk assessment is an iterative process based on the best information available during the assessment²⁹. There may be many reasons a risk assessment is needed³², including:

- Before new processes or activities are introduced,
- Before changes are introduced to existing processes or activities, including for new information concerning potential outbreak
- When outbreaks are identified.

Sector-specific and joint risk assessments are complementary. Risk assessment from an event may be conducted either within a sector-specific risk assessment or within JRA, and even both within a sector-specific risk assessment prior to a joint risk assessment continuously. Joint risk assessments should be conducted²⁹ with:

- Routinely for contingency planning,
- After disease prioritization to agree on implementation measures,
- During an emergency event.

C.3. OBJECTIVE OF RISK ASSESSMENT

Overall for public health threats or OH significance events, the risk assessment process seeks to estimate the likelihood of occurrence of adverse effects and consequences resulting from exposures²⁸ to provide the information on identified impacts to inform the decision-making processes^{25,33}. Risk assessment also help determine appropriate risk control measures to reduce the risk to an acceptable risk^{30,34}. Risk assessment aims to:

- a. Assess the risk of a public health threat or OH significance event
- b. To document the summarized information of a risk assessment of acute potential public health threat concern at one particular point in time (may be repeated as event develops)
- c. To inform and support decision making of senior management regarding the events of potential public health threats concern
- d. To identify and initiate response mechanisms to
 - Reduce the impact of the event on human-animal-environment interface
 - Reduce negative social and economic consequences
- e. To share rapid risk assessment with key stakeholders and partners

The main objectives of the risk assessment are to characterize the risk to public health threats and to recommend the most effective public health and OH actions – especially to prevent amplification of public health threats and OH significance events into an outbreak². The following are several objectives of risk assessment:

- a. To assess the risk posed by a public health threat to negatively impact human, animal, and environmental health
- b. To categorize the risk (e.g., as low, moderate, high, very high) using the Hazard, Exposure and Context approach
- c. To agree on specific actions to be taken - based on the outcome of the risk assessment
- d. To identify communications/ information to be shared, and to which stakeholders

C.4. IMPORTANCE AND BENEFIT

Risk assessment are very important as they form an integral part of outbreak control. On-going risk assessment allow stakeholders to make informed decisions on preventing or mitigating the impact of emergency² or outbreaks. Investigation of outbreaks is necessary to understand, ultimately control, prevent the spread and studying the trends of public health threats and OH significance events. Countries not only can build or strengthen national capacity for preparedness and response, but also can ultimately linking to existing international policies and frameworks, and supporting efforts for global health security.

Epidemiologists can use collected epidemiology information to identify sources of threats and infections³⁵ and make recommendations for stopping their spread. In addition, investigation of outbreaks is also particularly important when the public health threat in question is particularly severe or has high rates of transmission. For a newly recognized disease as one of public health threats, there is the opportunity to study the clinical spectrum of the illness. Investigators also attempt to characterize the populations at greatest risk and to identify specific risk factors.

The risk assessment will help health authorities⁴ to:

- a. Determine additional information and analysis required to fully assess the event;
- b. Activate surveillance and other special investigations for assessing the extent of event;
- c. Estimate likelihood of spread/ increase in case number and the need to scale up response;
- d. Implement appropriate and timely mitigation/ control measures (including preparedness in unaffected areas);
- e. Estimate the potential for political or media attention and define messages of alerts for communication with the media and the public;
- f. Estimate the potential consequences for travel and trade;

- g. Determine whether event needs to be notified through IHR (2005), to other supranational organizations and/or to neighbors; and
- h. Define effective operational and risk communication strategy.

There are also several benefits from risk assessment as follows:

- a. To create awareness of specific hazard and risk factors causing a particular adverse event;
- b. To assess who may be at risk of acute public health threats and OH significance events;
- c. To determine whether a control program is required for a particular outbreak;
- d. To determine if existing control measures are adequate or if more should be done;
- e. To prevent further illness and massive transmission, especially at the planning stage;
- f. To prioritize outbreak and control measures and further resources needed;
- g. To meet legal requirements where applicable;
- h. To document the summarized information of a risk assessment of acute events of potential public health threat concern at one particular point in time (may be repeated as event develops).

Risk assessment from an event may be conducted either within a sector-specific risk assessment or a joint risk assessment (JRA), and even both within a sector-specific risk assessment prior to a joint risk assessment continuously. 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. However, for health concerns at human–animal–environment interface, multiple sectors and disciplines must work together. Bringing together national information and expertise from all relevant sectors for JRA²⁹ of public health threats allows all sectors, acting together, to evaluate fully, understand and manage shared risks at human–animal–environment interface with coordinated responses. 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.

C.5. PRINCIPLES AND ATTRIBUTES

An early detection is required for early action, to prevent public health threats or OH significance events from becoming emergencies; while risk assessment improves decision making for effective response⁴. Risk assessment is evidence-based and robust which should be based on the structured identification of key information from all readily and credible available sources (including the context factor), using systematic appraisal of best scientific evidence and/or specialist expert knowledge available at the time in order to provide a clear estimate on the scale of the public health threats while documenting the level of uncertainty²⁴. The major attributes of risk assessment that are particularly relevant to the risk management programs²⁸ include the following:

- a. Identification and ranking of all existing and anticipated potential hazards;
- b. Explicit consideration of all current and possible future exposure scenarios;
- c. Qualification and/or quantification of risks associated with full range of hazard situations, system responses, and exposure scenarios;
- d. Identification of all significant contributors to the critical pathways, exposure scenarios, and/or total risks;
- e. Determination of cost-effective risk reduction policies, via the evaluation of risk-based remedial action alternatives and/or the adoption of efficient risk management and risk prevention programs;
- f. Identification and analysis of all significant sources of uncertainties.

Risk assessment should be objective and unbiased³⁶, and the event also must be monitored until it is over or no longer represents a significant risk to the human, animal, and environmental health. Sufficient staff, core funding, and close coordination and collaboration are essential to effective event detection, verification, risk assessment and monitoring. The outcome of risk assessment should be used to direct a proportionate response that reflects the risk⁴ and the information should be shared using the IHR (2005) legal framework²⁸. Therefore, a good risk assessment²⁴ should be:

- a. Consistent and transparent to ensure fairness and rationality;
- b. Easily understood by all the interested parties;
- c. Flexible enough to deal with complex situations, including cultural aspects;
- d. Reproducible;
- e. Based on best scientific evidence available at the time, well-documented and supported with references to the scientific literature and other sources, including expert opinion;
- f. Regularly reviewed (may be done at preset intervals) and updated when additional new information becomes available;
- g. Complemented by a log for decisions and actions based on available information;
- h. Contain a record of uncertainties (gaps in knowledge) and assumptions made, in order to evaluate the effect of these on the final risk estimate and priorities for future research (dated and with version control).

In addition; political will, relevant sector engagement, access to information, and risk assessment and capacity are key elements of joint risk assessment (JRA) which need to be established. 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.

Chapter D:

Model and Structure of Risk Assessment



Risk assessment is a primary management tool in providing the objective information needed for decision making, including a characterization of the relevant uncertainty that could influence the decision⁵. Risk assessment framework [Figure 8] is a process with five steps or procedures based on the Plan-Do-Check-Act cycle³⁰:

- a. Gather information,
- b. Evaluate the risks,
- c. Develop a risk control strategy,
- d. Select and implement risk control measures and,
- e. Review risks and risk control measures.

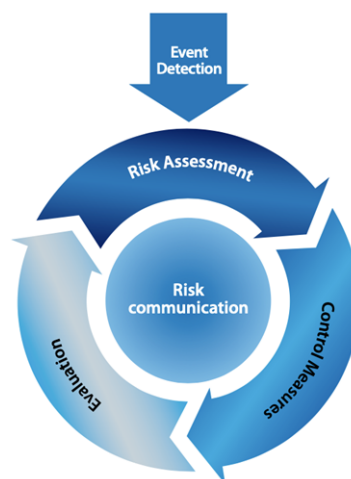
Figure 8. The risk assessment framework



Source: WHO (2020)^{30,34}

The steps and order in which risk assessment are carried out are not always in a stepwise manner, but should carefully considering all relevant information before making decisions for selection and an effective implementation of risk control measures³⁰. Risk assessment is a process that informs the risk management process³¹.

Figure 9. The risk management cycle



Source: WHO (2012)⁵

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 event²⁹. The risk management cycle⁵ [Figure 9] includes:

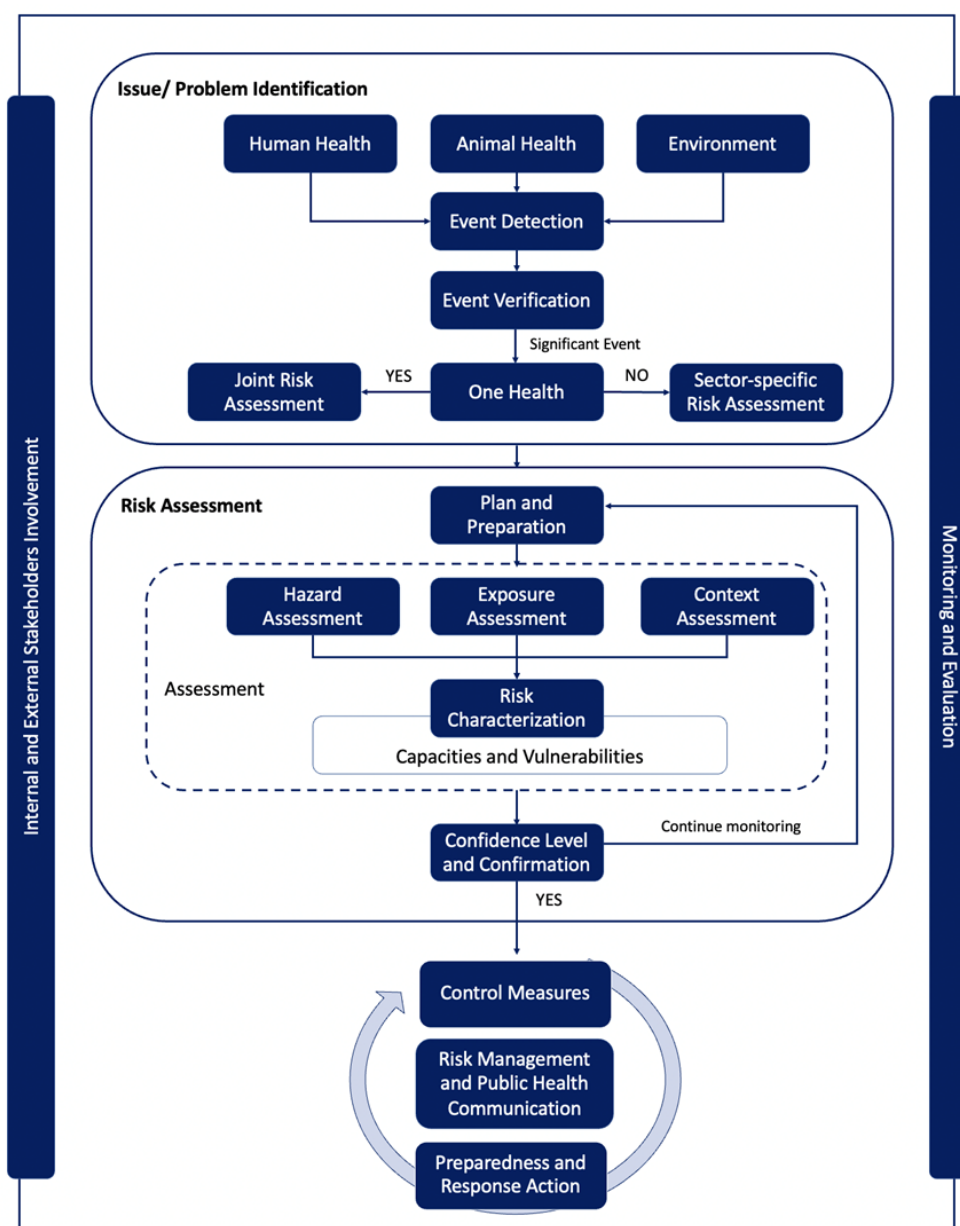
- a. Risk assessment — hazard, exposure and context assessment and risk characterization in which the level of risk is assigned to the event
- b. Identification of potential control measures — ranked by priority, taking into account likelihood of success, feasibility of implementation and unintended consequences for the affected population and society more broadly
- c. Continuous monitoring and evaluation as the event unfolds
- d. Effective ongoing communication to ensure that risk managers, other stakeholders and affected communities understand and support control measures that are implemented
- e. An evaluation of lessons learned at the end of the response.

D.1. MODEL FOR RISK ASSESSMENT

The framework model [Figure 10] encompasses the essential stages for risk assessment of public health threats. This model applied an all-hazards approach that has been driven by the IHR (2005) [Chapter A], to strengthen the epidemic intelligence process [Chapter B] and risk assessment [Chapter C] capacity, as well as to optimize the use of IBS and EBS information for detecting, verifying, and assessing the public health threats and OH significance events. As one of the critical stages, plan and preparation stage [Chapter E] should be conducted before undertaking the hazard, exposure, and context assessment [Chapter F].

Risk assessment from an event may be conducted either within a sector-specific risk assessment or a joint risk assessment (JRA), and even both within a sector-specific risk assessment prior to a joint risk assessment continuously. These analyses can improve the accuracy of JRA, especially in relation to impact and uncertainty⁷ of public health threats and OH significance events to human-animal-environment interface. Once the risk assessment team has carried out the assessment, a level of risk should be assigned through the risk characterization following by confirmation based on the level of confidence [Chapter F]. The extent of the likelihood of control measure will prevent further spread and the consequences of control measure implementation [Chapter G] will be considered to formulate the preparedness and response action.

Figure 10. Model for risk assessment of public health threats



Source: adapted from Covello and Merkhofer (1993)²⁶, Rosa et al (1998)³⁷, WHO (2010)³⁸, Spickett et al (2010)²⁵, ECDC (2011)²⁴, enHEALTH (2012)³¹, WHO (2012)⁵, Asante (2017)²⁸, WHO (2017)², WHO-FAO-OIE (2019, 2020)^{7,29}

The model incorporates three essential components of risk analysis, such as: risk assessment, risk management, and risk communication [Chapter H] to support the process of control measures, response system, and information sharing. Note that multisectoral stakeholder involvement and engagement is considered as a critical element at all stages of the risk assessment of public health threats and One Health significance events. A multisectoral, One Health coordination mechanism (MCM) refers to any formalized, standing, group that acts to develop and/ or strengthen collaboration, communication, and coordination across the sectors responsible for health concerns at the human-animal-environment interface. An MCM have both leadership and technical coordination functions and the scope of MCM is depends on country needs and priorities. An MCM has routine, ongoing functions and is responsible for coordination, leadership, and governance of efforts among relevant sectors to achieve jointly determined and agreed common goals⁷. Conducting joint risk assessments is one of the coordinating technical activities of the MCM.

In addition, monitoring and evaluation [Chapter I] should also be built at all stages, to update and review the indicators (i.e., input, process, output, outcome/ impact) keep on-track and are achieved according to the objective of risk assessment. Any specific coordinating technical activities to be undertaken are identified based on consideration of national plans, targets, and gaps identified through the assessment of national infrastructure and capacities.

D.2. STRUCTURE OF RISK ASSESSMENT

In general, the structure of risk assessment is divided into two parts, summary and supporting information. The results of risk assessment process will be described in the following structure:

The documentation of risk assessment must include

- Dates and number of assessments
- Overall risk characterization
- Risk statement with brief summary of justification
- Assessment of specific risk questions
- Major recommended actions by the risk assessment team
- Communications regarding risk assessment

To get the information above, need to conduct the planning and preparation for risk assessment which will be described in the next chapter.

Page 2 – Supporting information

Aims to provide the most relevant background of the event required to inform risk assessment:

- Brief assessment of
 - Hazard
 - Exposure
 - Context
- Immediate actions
- Risk assessment team members
- Reference documents supporting risk assessment

Table 3. Structure of risk assessment 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 → The date, time, and place of assessment. DATES OF PREVIOUS RISK ASSESSMENTS → 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 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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 → Any general assumptions on which joint risk assessment 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 → Complete the following sections for each risk assessment question. WHAT IS THE LIKELIHOOD AND IMPACT OF...? → Provide the entire risk assessment question assessed. → Rationale for uncertainty level associated with likelihood estimate → Rationale for uncertainty level associated with impact estimate RISK MATRIX FOR RISK ASSESSMENT QUESTION <table><tr><td rowspan="4">Likelihood</td><td>High</td><td></td><td></td><td></td><td></td></tr><tr><td>Moderate</td><td></td><td></td><td></td><td></td></tr><tr><td>Low</td><td></td><td></td><td></td><td></td></tr><tr><td>Negligible</td><td></td><td></td><td></td><td></td></tr><tr><td colspan="2"></td><td>Negligible</td><td>Minor</td><td>Moderate</td><td>Severe</td></tr><tr><td colspan="2"></td><td colspan="4">Impact</td></tr></table> | Likelihood | High | | | | | Moderate | | | | | Low | | | | | Negligible | | | | | | | Negligible | Minor | Moderate | Severe | | | Impact | | | |
| Likelihood | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Moderate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Negligible | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Negligible | Minor | Moderate | Severe | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Impact | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|-----|--|
| | TECHNICAL INTERPRETATION OF RISK ASSESSMENT QUESTION <i>→ 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.</i> |
| 9. | OVERALL TECHNICAL INTERPRETATION (Optional) <i>→ Provide an overall summary of the conclusions if needed to supplement the technical interpretations for each risk assessment question.</i> |
| 10. | INFORMATION NEEDED <i>→ Include specific priority information needed to inform the likelihood and impact estimates and to decrease uncertainty in the next joint risk assessment iteration. May include identification of potential sources of this information.</i> |
| 11. | RISK MANAGEMENT OPTIONS FOR CONSIDERATION <i>→ Summarize the proposed risk management options, especially any priorities.</i> |
| 12. | RISK COMMUNICATION OPTIONS FOR CONSIDERATION <i>→ Summarize the proposed risk communication options, especially any priorities.</i> |
| 13. | ANY OTHER ISSUES FOR THE RECORD <i>→ For example, significant sources of conflict or lack of agreement among experts.</i> |
| 14. | RECOMMENDED NEXT STEPS <i>→ Summarize the steps to collect priority data of joint risk assessment, report template, including potentially conducting sector-specific risk assessments.</i> |
| 15. | PROPOSED INTERVAL UNTIL THE NEXT JOINT RISK ASSESSMENT <i>→ 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).</i> |
| 16. | ATTACHMENTS <i>→ Can include supporting documents as needed: data/information used; risk pathway diagrams; outcomes of sector-specific risk assessments, etc.</i> |

Note: Public health threats may have negative consequences for human, animal, and environmental health, which requires prompt action. Therefore, risk questions in the assessment template can be added with information of risk for impact, not only on human health, but also risk for impact on animal and environmental health.



Chapter E:

Planning and Preparation for Risk Assessment

According to the national organization, this risk assessment can be performed at different levels⁴. Depending on the quality and completeness of the information available to assess the risk, a risk assessment team may be assembled. Deciding on the disciplines that should make up the risk assessment team is a critical step that is often overlooked⁵. Implementation of RA by the team depends on type and magnitude of public health threats, the current capacity, and coordination process, whether at national, regional, and/or global level. Each country has also a rationale and mandate for conducting joint risk assessment and using the obtained results, and may already have structures or mechanisms in place for the multisectoral risk assessment and collaboration. Countries should use existing mechanisms to support sector-specific and joint risk assessments process. To ensure usefulness and sustainability, national agencies who responsible for human, animal and environmental health should conduct risk assessment with engagement from all relevant stakeholders²⁹. Generally, the risk assessment plan³² will determine:

E.1. TEAM AND STAKEHOLDER INVOLVED

Risk assessment team should be appropriate to the circumstances³⁶. The risk assessment plan will determine who are members of team for stakeholders involved. Stakeholder is defined as an agency, organization, group or community that has direct or indirect interest in a particular activity, or its assessment³. Assessments should be done by a competent person and/ or team who have a good working knowledge of the situation being studied. Include either on the team or as sources of information, who work with the process under review as these individuals or team are the most familiar with the operation³². The expertise and local knowledge of the team greatly influence the risk assessment⁵. The overall role and function of risk assessment team are:

- a. Undertaking risk assessment in a transparent, systematic, reproducible and objective way
- b. Rapid and used to highlight current gaps in knowledge
- c. Used to promote risk-informed decision making
- d. Advising on prevention and control measures
- e. Provide a record of uncertainties (gaps in knowledge) and assumptions made, in order to evaluate the effect of these on the final risk estimate and priorities for future research (dated and with version control).
- f. Prioritizing areas for data gathering and surveillance
- g. Ensure all decisions become easier to explain and justify
- h. Providing operational and risk communication all the way through risk assessment
- i. Assessing the need for a formal (in-depth) risk assessment

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 ²⁹. The team always includes RA team member and input from an infectious disease specialist or other hazard-specific expert². Additional expertise (e.g. in toxicology, animal health, food safety or radiation protection) can be brought in at any time but may be needed at the beginning of the risk assessment⁵ if:

- The hazard is unknown;
- The event is unlikely to be caused by an infectious agent;
- Public health threat is associated with disease or deaths in animals, and/or is otherwise identified as a suspected zoonosis;
- Public health threat is related to a food or product recall, known chemical accident, or radio nuclear incident with or without reports of human disease.

The roles and responsibilities of all team members must be clearly defined before starting the assessment, although additional people may be consulted as needed³⁰. The following are the steps that can be considered to set up the team and stakeholder involved²⁹, especially for joint risk assessment:

A. ESTABLISH AND CONVENE A STEERING COMMITTEE

The Steering Committee oversees the risk assessment process and responsible for the management and communication of decisions based on the outcomes of risk assessment. Additional stakeholders may advise it through an external stakeholder group. An existing multisectoral coordination mechanism may also function as the JRA Steering Committee. The responsibilities, tasks, and roles of Steering Committee, includes:

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

B. IDENTIFY A JRA LEAD FOR RISK ASSESSMENT IMPLEMENTATION

The Steering Committee designates the JRA Lead to set up and implement risk assessment process, on behalf of the government, for a specific event or public health threats. This person is the delegated authority from and responsible to Steering Committee, also participating as a member. 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. The responsibilities, tasks, and roles of JRA Lead, includes:

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

C. IDENTIFY A JRA LEAD FOR RISK ASSESSMENT IMPLEMENTATION

The Technical Team is a small group of technical staff who conduct the risk assessment and report to the steering committee. The composition of the technical team depends on the expertise, experience, and information needed for the particular assessment. There should be a balance of sectors and disciplines represented on the Technical Team. The responsibilities, tasks, and roles of Technical Team, includes:

- Identifies the data needed to conduct the risk assessment;
- Shares needed data, as well as relevant experience and expertise regarding 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 risk assessment results;
- Documents the assessment using the agreed report template and shares it with the Steering Committee through the JRA Lead.

D. ESTABLISH AND CONVENE A STAKEHOLDER GROUP

The Technical Team is a small group of technical staff who conduct the risk assessment and report to the steering committee. The composition of the technical team depends on the expertise, experience, and information needed for the particular assessment. There should be a balance of sectors and disciplines represented on the Technical Team. The responsibilities, tasks, and roles of Technical Team, includes:

- 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

In addition, operational and risk communication are integral parts of risk management. At a minimum, links and coordination channel should be established between the risk assessment team and communication specialists. If possible, a communication specialist should be included in the risk assessment team⁵, accordingly.

E.2. SCOPE OF RAPID RISK ASSESSMENT

The 'planning and scoping', as well as the 'problem-formulation' stages of risk assessment are indeed necessary to ensure that the general form and content of risk assessment are determined²⁸. Risk assessment plan will determine what the scope of assessment will be (e.g., be specific about assessing the types of outbreaks). While, 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). Aspect of sector-specific risk assessment may also be included in the JRA scope as needed in order to evaluate risk at the interface²⁹. The following questions can be considered to define the scope of risk assessment:

- Risk of introduction or spread?
- National or subnational risk?
- Health sector or food/security?
- Risk to vulnerable?
- What particular time frame are we interested in?

In addition, based on characteristics of the public health threat, the risk assessment team should decide how frequently the risk assessment should be updated. The team should also agree on the priority questions and decide the time needed to complete each assessment⁵. The time available between assessments may also be considered to direct the number and scope of risk questions considered. In general, to do a risk assessment:

- Identify outbreaks.
- Determine the likelihood of risk, such as an illness occurring, and its severity.
- Consider normal situations, outbreak situation, emergencies, extreme weather, etc.
- Review all available health and safety measure
- Understand the minimum legislated requirements for jurisdiction.
- Identify actions necessary to eliminate the outbreak, or control the risk using hierarchy of risk control methods.
- Evaluate to confirm if the outbreak has been eliminated or if the risk is appropriately controlled.
- Monitor to make sure the control continues to be effective

- Keep any documents or records that may be necessary. Documentation may include detailing the process used to assess the risk, outlining any evaluations, or detailing how conclusions were made.
- The location, duration and frequency of risk assessment
- Any possible interactions with other activities in the area and if the outbreak could affect others (e.g., health workers.).
- The education and training of health workers.
- How a person would react in a particular situation It is important to remember that the assessment must take into account not only the current state of the workplace but also any potential situations as well.

The course of risk assessment may be shifted when a laboratory test can confirm a different disease whose clinical signs are similar at the outset of an outbreak (Japanese encephalitis vs Nipah virus in Malaysia in 1998-99).

E.3. FORMULATING RISK QUESTIONS

Risk assessment process begins with problem formulation and includes some additional essential steps, such as hazard assessment, exposure assessment, context assessment, and risk characterization³⁸. The risk assessment plan will determine the key questions that to be answered. This helps to define the scope and objective of the assessment and ensures that all the relevant information is collected. Clearly defined questions help identify priority activities to be conducted as part of the risk assessment. Depending on the size and complexity of a public health threat, many risk assessment may be needed to address new and different risk questions as event progresses⁵. These questions need to come from the risk assessment team, in order to characterize risks in ways that are going to be of most use to make decisions.

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 differ²⁹. Risk question is similar to a research question and may be framed as a series of scenarios⁵:

- a. What is the public health threat risk of the event in the current situation?
- b. What is the public health threat risk of spread or disease transmission?
- c. What is the public health threat risk of event affecting more than one area (province/ state, country)?
- d. Who is likely to be affected? (i.e. at particular population, particular location, etc.)
- e. When, why and how a population might be adversely affected by exposure to a hazard?
- f. What is the likelihood of exposure to the hazard if no action is taken?
- g. What are the consequences (type and magnitude) if this public health threats and One Health significance events occurred?
- h. What and how would control measures to be implemented?
- i. Does the system has enough capacity?

Table 4. Formulating specific, relevant and time-bound joint 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? | |

Note: Drafts the joint 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.

Sometimes, additional risk assessment questions emerge later or a given risk assessment question may be revised based on the technical discussion. During the JRA Technical Team meeting, questions may arise that are important to answer or discuss but are not risk assessment questions. These are often epidemiological or situation assessment questions. Although the standard risk assessment process is not applied to such questions, these questions may be very important to consider as part of the overall situation assessment and for filling data gaps²⁹.

The risk assessment team should not try to answer all the possible risk questions at once. Instead, critical questions should be identified and ranked by priority for immediate response. Less time-critical questions can be addressed later or by other teams⁵. The risk assessment team has to ensure that the risk question is interpreted similarly by the person involved and hence that risk assessment team is addressing the most appropriate question for human-animal-environment interface. The outcome of this interaction between the group may be that the question that was initially posed is redefined.

E.4. FORMULATING RISK QUESTIONS

The risk assessment plan will determine the resources needed (e.g., train a team of individuals to carry out the risk assessment, the types of information sources, etc.). Risk assessment team must ensure that sufficient resources (e.g. time, money, personnel and expertise) are available relative to the purpose and scope, and establish a realistic timetable for completion of the work³⁶. There are uncertainties related to the risk assessment and it is important to make the best possible use of available information³¹.

Acquisition of information appropriate to an event/ scenario of interest is a fundamental challenge in risk assessment³⁸. Type of information sources^{4,5,28} in risk assessment is categorized into:

- **Official Source:** any governmental subnational/ national/ international institution (public or assimilated) accredited to provide information: e.g. National Institute of Public Health, the Ministries of Health, Agriculture, Foreign Affairs and other national sources, the reference laboratories, the international and supranational organizations such as WHO, OIE, FAO, ECDC, US-CDC, other supranational organizations and institutional networks.
- **Formal Sources:** official sources and authorized sources: i.e. non-official and not dependent from a government agency but in direct contact with the event (e.g. NGOs, hospital and medical sources, clinicians, local laboratories, etc.)
- **Informal Sources:** these sources are neither official nor formal. Informal sources include the press and other media (radio, television, etc.), Blogs, twitter®, social network channels (Facebook®), etc.

Expert opinion(s) may also be considered as another source of information for the risk assessment³⁹. The ongoing collection and analysis of information is undertaken using several approaches²:

- a. Maintaining direct, ongoing communications with developing partners (e.g. WHO offices), Ministries of Health, UN partners, NGOs, and other professional networks.
- b. Receiving formal notification of IHR events through the National IHR Focal Points.
- c. Sharing information about public health threats and One Health significance events through partnership networks, including Global Outbreak Alert and Response Network (GOARN), the FAO-OIE-WHO Global Early Warning System (GLEWS), etc.
- d. Searching public and open sources of information for key words across different electronic media, using computer-aided algorithms.

All data needed for the assessment and the characterization of the risk might not be present in initial signal, especially when originating from non-official source. The search for complementary information contributes to risk assessment processes. The following are types of additional information needed to assess the nature and magnitude of events⁴:

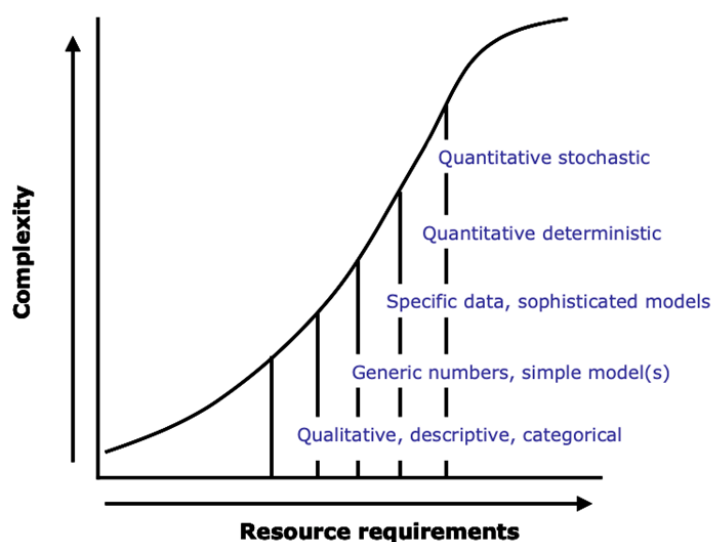
- a. Nature of the event / agent / disease
- b. Source of event identification
- c. Location of the event
- d. Potential origin (infectious, chemical, radiological, nuclear)
- e. Date of event or date of onset
- f. Number of cases/deaths, severity of case
- g. Number of people potentially exposed to the hazard
- h. Groups affected (e.g. age, occupation, gender)
- i. Common clinical/laboratory characteristic among affected
- j. Likelihood of an intentional release
- k. Likelihood of group intoxication/contamination
- l. Potential for importation of cases to the country (for international events)

Note: other potential information required for the assessment and information sources will be added in annexes

E.5. RISK ASSESSMENT APPROACH

In human-animal-environment interface, there are many types of risk assessments that apply different methodologies². The level of risk can be described either qualitatively (i.e. by putting risks into categories such as 'high', 'medium' or 'low') or quantitatively (with a numerical estimate or computer modelling)³¹ [Figure 11]. The degree of quantification that is possible in the risk assessment depends on factors such as the data available, how quickly the assessment is required and the complexity of the issues⁵.

Figure 11. Continuum of risk assessment types



Source: WHO/FAO (2006)³⁶

a. In quantitative risk assessments^{5,29} :

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.

b. In qualitative risk assessments^{5,29} :

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.

In some disciplines, highly quantitative assessments are feasible. However, qualitative approach may be the only option, particularly early in an event when data are often limited or unavailable⁵. Criteria for evaluating risk assessment methods³¹, include:

- a. The logical soundness of the method (e.g. its justification based on theoretical arguments or scientific knowledge, and the validity of the underlying methodological assumptions)
- b. Completeness (e.g. whether it can address all aspects of the problem and the degree to which it excludes issues because they are hard to accommodate)
- c. Precision and accuracy (e.g. reflected in the confidence level associated with the results or biases resulting from undue weight being given to specific interests or considerations and the sensitivity of results to untested or untestable assumptions)
- d. Acceptability (e.g. compatibility with existing processes; whether it is viewed as rational and fair; the level of understanding for all parties affected by it; and the confidence and familiarity of those who will use it)
- e. Practicality (e.g. the level of expertise, time and input data required)
- f. Effectiveness (e.g. usefulness of results; range of applicability across different risks and problem areas; generalizability of conclusion to other problem areas; and effectiveness and efficiency of linkage with other types of methods).

In practice, many assessments use a mix of methods, using quantitative methods when numerical data are available and qualitative methods when they are not. Directly or indirectly, qualitative descriptors also become part of a quantitative risk assessment process²⁸. It should be emphasized that a quantitative risk assessment that uses poor data or inappropriate quantitative techniques can be far less scientific and defensible than a well-structured, more qualitative assessment⁵. There are typical or common measures, parameters, and/or tools that form the basis for risk qualification or quantification²⁸, such as:

- a. Probability distributions (based on probabilistic analyses)
- b. Expected values (based on statistical analyses)
- c. Economic losses or damages
- d. Public health threat consequences
- e. Risk profile diagrams (e.g., iso-risk contours plotted on area map, to produce an iso-risk contour map)
- f. Incidence rate (defined by the ratio of [number of new cases over a period of time] : [population at risk])

E.6. SYSTEMATIC COLLECTION OF EVENT INFORMATION

EMERGING DISEASES/AGENTS:

- For new or unusual conditions, the risk profile will summarize current stage of knowledge of the condition, including all contextual information
- The most important functions of the risk profile are to reduce and better define the uncertainty relevant to the decision problem.
- Ensure that detailed information on the incident has been gathered, preferably from those responsible for investigating the incident at local or national level. The incident information should be summarized by the risk assessment team following a standardized format.

FOR ALREADY KNOWN AGENT OR DISEASE:

- Use already available agent/disease profile and up-date them with the latest information available at the time of occurrence of the incident, complete the disease profile with the risk profile.

E.7. DATA ANALYSIS MEASURES

The risk assessment plan will determine what type of data analysis measures will be used (e.g., manual, specific form). The data collection⁴ and analysis process can either be:

- a. Passive: transmission of data to the teams in charge of their analysis is the responsibility of those providing the data and/or may occur automatically through a variety of defined structures. Both collection, analysis, and transmission should comply with formalized procedures relating to specific case definitions, format of data, and periodicity or
- b. Active: data are actively collected by the team in charge of their analysis. Data are collected according to defined criteria, in a normalized format (e.g. in standardized forms) and from a changing number of potential sources.

Type of risk analysis measures should consider the design of risk assessment. In addition, there are major study designs that can be utilized in risk assessment practice for public health threats²⁸:

- a. Cohort Studies—that follow exposed and non-exposed people over time to determine if disease rates differ in the two groups;

Cohort studies are the most frequently used type in risk assessments — in part because often have large sample sizes and extensive exposure information within the available databases or related resources²⁸. Only if risks can be evaluated can be compared, and priorities be identified. Only if their distribution is known, can response/ actions be targeted at where they are most required. Only if trends in these risks can be identified can future projections be made with any degree of confidence³³. However, utilization of cohort studies in rapid risk assessment may be limited due to time demanding situations in nature of public health threats and emergencies.

E.8. SUPPORTING REFERENCES

For the risk assessment of most infectious disease threats, observational data is often the only available and obtainable source of information²⁴. To effectively utilize it as a public health management tool, risk assessment should be recognized as a multidisciplinary process that draws on data, information, principles, and expertise from many scientific disciplines; especially when large-scale risk assessments are undertaken^{28,36}. The risk assessment plan will determine what the relevant laws, regulations, codes, or standards may apply in your jurisdiction, as well as organizational policies and procedures from multisectoral stakeholders.

Sector-specific and joint risk assessments are complementary. Some national activities may also provide background and context for the JRA process. These could include²⁹:

- 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;
- 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.

E.9. ADVANCE PREPARATION

Risk assessment is an ongoing process as the level of risk may change over time⁴. Risk assessment should be carried out as quickly as possible² – ideally within 24-48 hours: to evaluate the risk to human-animal-environmental health, to determine whether a response is indicated, to determine the urgency and magnitude of response, to set up the suitable design and selection of critical control measures, and to inform about the wider implications and to propose further management option in addressing or response on the public health threats²⁴. Nonetheless, the timing may vary by hazard, the accessibility of the affected areas, and the rate of onset or evolution of the public health threats and One Health significance events². Advance preparation and planning saves time and is vital to ensure that potential threats are identified, assessed, and managed effectively²⁴. Therefore, there is advance preparation for risk assessment as follows:

- a. Develop evidence-based protocols and guidance for responding to public health threat, incidents, and outbreaks of common infectious threats (disease/agent risk profile)
- b. Establish clearly defined protocols for identifying sources of key information for risk assessment
- c. Gather published literature, grey literature, outputs of national and international public health experts.
- d. Identify relevant focal points at different administrative level (national, provincial and district level).
- e. Identify (availability) and maintain (sustainability) lists of named individual experts. This may include links with relevant multisectoral groups or individuals and should include details of qualifications, experience in the field, publications, sources of funding.
- f. Ensure relevant staff members are able to undertake a rapid literature search.
- g. It is advisable that the Incident Management Team of the EOC be part of the risk assessment team.

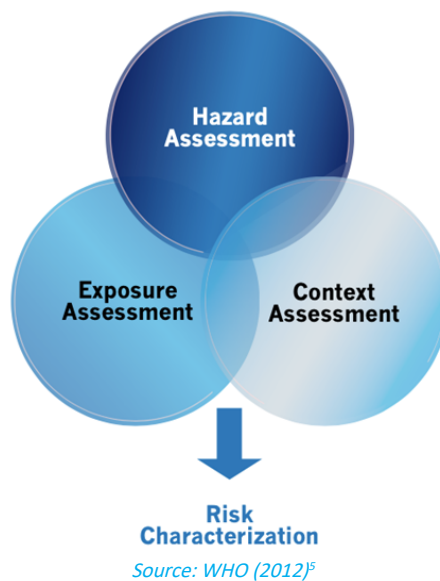


Chapter F:

Undertaking Risk Assessment

As one of the critical stages, plan and preparation stage [Chapter E] should be conducted before undertaking the hazard, exposure, and context assessment [Chapter F]. The level of risk assigned to public health threats and OH significance events are based on the suspected (or known) hazard, the possible exposure to the hazard, and the context in which the event is occurring. Risk assessment includes three essential components — hazard, exposure, and context assessments⁴ [Figure 12]. The outcome of these three assessments is used to characterize the overall level of risk⁵, both in human-animal-environment interface.

Figure 12. The risk assessment process



A participatory process should be used in initiating, performing and finalizing a risk assessment³⁶. Completing a risk assessment is not always a sequential process with hazard, exposure and context usually assessed at the same time. Although each is assessed separately, there is overlap in the information required to assess each domain^{4,5}. The existing disease/ agent risk and public health threats profiles should be considered as source of information. Additional information should be gathered not only from published and grey literature, but also from consultation with experts. The process of identifying and discussing risk pathways also 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, both for the sector-specific and joint risk assessments. Risk pathways describe the logical movement sequence of the hazard from its source to its infection of the host of interest, including the entire risk pathway from the time the pathogen enters the country and spread into the hosts²⁹.

F.1. HAZARD ASSESSMENT

Hazard assessment is the identification of the characteristics or number of potential human-animal-environmental health hazard causing the event and the associated adverse health effects. Hazards can include biological, chemical, radiological and nuclear events^{4,5}. The process of hazard assessment is as follows:

- Straightforward when laboratory confirmation of the causative agent is available, or when the event is easily characterized on clinical and epidemiological features.
- Identifying and listing the possible hazard(s) that could be causing the event based on the initial description of the event (e.g. the clinical and epidemiological features);
- Reviewing key information about the potential hazard(s) (i.e. characterizing the hazard);
- Ranking potential hazard(s) when more than one is considered a possible cause of event;
- Identifying and listing the known burden of diseases in the affected community; and type and distribution of existing hazards.

Several sources of information⁵ that can be considered, such as: published literature and data on research in human-animal-environmental interfaces, official data and reports (e.g. from WHO, FAO and OIE, other UN agencies, non-governmental organizations, national government websites), medical records and chart audits (ICD-10), hospital-based sentinel surveillance systems, laboratory surveillance systems, other reference laboratory database, etc. Other potential information required for the assessment and information sources will be added in annexes.

Table 5. Hazard assessment

| |
|--|
| Hazard identification: biology, chemical, radio nuclear, physical (BCRN) |
| <ul style="list-style-type: none"> Agent confirmed and fully known Unknown infectious agent Known infectious agent but incomplete information |
| Hazard characterization: microbes |
| <ul style="list-style-type: none"> Mode of transmission/ infectiousness/ transmissibility (i.e. epidemic dynamics or: R0 “basic reproduction number”, point sources, etc.) Pathogenicity/ severity of illness Difficulty related to diagnosis (i.e. test performance, asymptomatic/ symptomatic or unspecific symptoms) Presence or high introduction threat |
| An example for Emerging Infectious Diseases (EID): |
| <ul style="list-style-type: none"> Genetic markers of severity or H2H (human to human) transmission, number and size of clusters Clinical features and natural history of the disease in humans or animals Timing of the event and the speed with which the event evolves |
| - <i>In short, links between agent detection, its presence, severity and transmissibility</i> |
| - <i>Disasters: type of disaster and type of impact according to frequency/ magnitude</i> |

The less specific the information reported about public health threat and OH significance event, the broader the list of possible hazards becomes. However, as more information becomes available, the number of potential hazards is reduced and they can be ranked in order of the likelihood of being the cause⁵.

F.2. EXPOSURE ASSESSMENT

Exposure assessment is the evaluation of the exposure of individuals and populations to likely hazards. The key output of the assessment is an estimate of the number of people or group known or likely to have been exposed; and number of exposed people or groups who are likely to be susceptible (not immune)^{4,5}. It should also include a demographic analysis of at-risk populations, describing the properties and characteristics of populations that might potentiate or mitigate concern regarding potential exposures, as well as a description of the magnitude, duration, and frequency of exposure³⁷. The process of exposure assessment is as follows:

- Evaluating mode of transmission (e.g. human-to-human: droplet spread, sexual transmission; animal-to-human; occupational risk);
- Evaluating information related to the vector (e.g. distribution, density, infectivity) and/or animal hosts (density, prevalence, existing control programmes);
- Evaluating incubation period (known or suspected);
- Evaluating estimation of the potential for transmission (e.g. R0 basic reproduction number);
- Evaluating vaccine/ immune status of the exposed population; and
- Evaluating dose of exposure (e.g. amount of ingested/absorbed/inhaled heavy metals, salmonella bacteria, radionuclides); dose-response, and duration of exposure.

Several sources of information⁵ that can be considered, such as: published research and data (e.g. surveys, outbreak investigations), official data and reports (e.g. from WHO, FAO and OIE, other UN agencies, non-governmental organizations, national government websites), IBS and EBS systems in endemic and epidemic-prone areas (human-animal-environmental interface), medical records and chart audits (ICD-10), hospital-based sentinel surveillance systems, laboratory surveillance systems (e.g. detection methods and susceptibility data), international event-based surveillance systems, participatory epidemiology systems, etc. Other potential information required for the assessment and information sources will be added in annexes.

Table 6. Exposure assessment

| |
|--|
| The evaluation of the exposure of individuals to likely hazards: <i>host factors (humans, vectors, animal reservoir), disasters</i> |
| <ul style="list-style-type: none"> • Population susceptibility • Environmental suitability (climate, temperature, urbanization) • Frequency or/and magnitude of disaster hazard |
| The key output is an estimate of |
| <ul style="list-style-type: none"> • Number of people exposed and susceptible if appropriate • High risk groups for exposure |

- Risk factors or determinants of infection or disease
- Health status of population: nutrition, aging, HIV, TB, etc.

An example for Emerging Infectious Diseases (EID):

- Genetic markers of severity or H2H (human to human) transmission, number and size of clusters
- Clinical features and natural history of the disease in humans or animals
- Timing of the event and the speed with which the event evolves

- *In short, population and risk factors data*

For vector-borne diseases and other zoonoses might include the species, distribution and density of vectors of disease, and the species, distribution and population density of animal hosts. The exposure assessment will provide an estimate of the likelihood that a particular area is vulnerable to the transmission of a zoonotic disease⁵.

F.3. CONTEXT ASSESSMENT

Context assessment is an evaluation of the environment or setting in which the event is taking place². This may include the physical environment such as climate, vegetation, land use (e.g. farming, industry) and water systems and sources, as well as the health of the population (e.g. nutritional status, disease burden and previous outbreaks), infrastructure (e.g. transport links, health-care and public health infrastructure), cultural practices and beliefs^{4,5}. The process of context assessment is as follows:

- a. Context assessment should consider all factors that can affect the risk of the event. These factors may be social, ethical, technical, scientific, economic, environmental and political.
- b. They will include the surveillance system's capacity to detect cases, health-seeking behavior of individual groups, the prevalence of malnutrition, environmental conditions favoring the multiplication of vectors and the presence of animal hosts. For example:

- **SURVEILLANCE SYSTEM**

Type of information: number of functioning reporting sites in affected area; sensitivity of surveillance (representativeness) # surveillance units; how suspected cases are identified; and identification of suspect cases (lab capacity, awareness of clinicians)

Output: the likelihood that cases will be identified

- **RESILIENCE AND HEALTH-CARE INFRASTRUCTURE**

Type of information: the number, location and quality of health-care facilities in the affected area; health-seeking behavior in the affected population; staff dedicated and well trained; and well-equipped or/ and well-paid staff with compensation schemes

Output: the likelihood that cases will seek and receive medical care that results in good clinical outcomes

- **NUTRITION SURVEYS AND HIGH-RISK GROUPS**

Type of information: number of functioning reporting sites **Type of information:** nutrition status; level of malnutrition in affected area or among specific groups (e.g. immunocompromised groups, younger or older age groups)

Output: the likelihood of severe disease

- b. Case-control Studies—used to determine whether exposures in the past differ in diseased and non-diseased people; and
- c. Cross-sectional Studies—for which exposures and disease status are determined simultaneously in a group of individuals (i.e., a ‘picture-pair’ at precise moment in time).

- **INFORMATION ON ANIMALS AND VECTORS**

Type of information: environmental conditions that might be favorable to population explosions of potential disease vectors, and information on number and distribution of potential animal hosts

Output: the likelihood of outbreaks in humans or animals

- **GOVERNMENT POLICY FOR OUTBREAK CONTROL/RISK MITIGATION**

Type of information: funding available for outbreak control; SOP for outbreak control is available; treatment; efficient interventions; coordination, preparedness and/ or readiness

Output: the likelihood of early detection and response for outbreak control

Several sources of information⁵ that can be considered, such as: surveys and studies, national health indicator data, vital statistics, demographic data including household income data (e.g. census), routine programmatic data (e.g. prevention and control), annual reports and program evaluation reports, public and private health-care facility data, maps of population density, economic analyses in endemic areas, cultural practices, international transport, meteorological data, other published and rapid assessment data, etc. Other potential information required for the assessment and information sources will be added in annexes.

Table 7. Context assessment

| An evaluation of the environment in which the event is taking place which may include (high resilience, lower impact):* |
|--|
| <ul style="list-style-type: none"> • Socio-cultural: cultural practices, beliefs, acceptance, social resilience, public and professional perception • Technical capacity • Economy: infrastructure, resilience, financial capacity • Environment: climate, vegetation, land use (farming, industry), and water systems and sources • Policy: regulations and laws framework |
| Defence systems (technical capacity) |
| <ul style="list-style-type: none"> • Health system resilience: infection prevention and control (IPC), coordination, availability of supplies • Surveillance: Early Warning, Alert and Response System (EWARS) and laboratory capacity • Response capacity and business continuity • Preparedness plan and implementation |

The following types of questions is a critical component of context assessment⁵:

- a. What are the factors associated with the environment, health status, behaviors, social or cultural practices, health infrastructure and legal and policy frameworks that increase a population's vulnerability?
- b. Do any factors associated with the environment, health status, and social or cultural practices reduce the population's risk of exposure?
- c. What is the likelihood that all suspect cases can be identified?
- d. What is the availability and acceptability of effective preventive measures and of treatment or supportive therapies?
- c. For instance⁴:
 - For measles, the risk of expansion of an outbreak after the detection of the event will depend upon factors including the immunization coverage of the population; the capacity to quickly organize a mass vaccination campaign if the coverage is too low; the local conditions of hygiene; the access to health care; the capacity to detect and isolate cases; and population behavior.
 - For an event such as contamination of a river by a chemical agent, the risk of human intoxication will depend on factors such as local practices about water use; season (cold or hot, rainy or dry); river flow; capacity to broadcast messages of prevention; and acceptability of control measures.

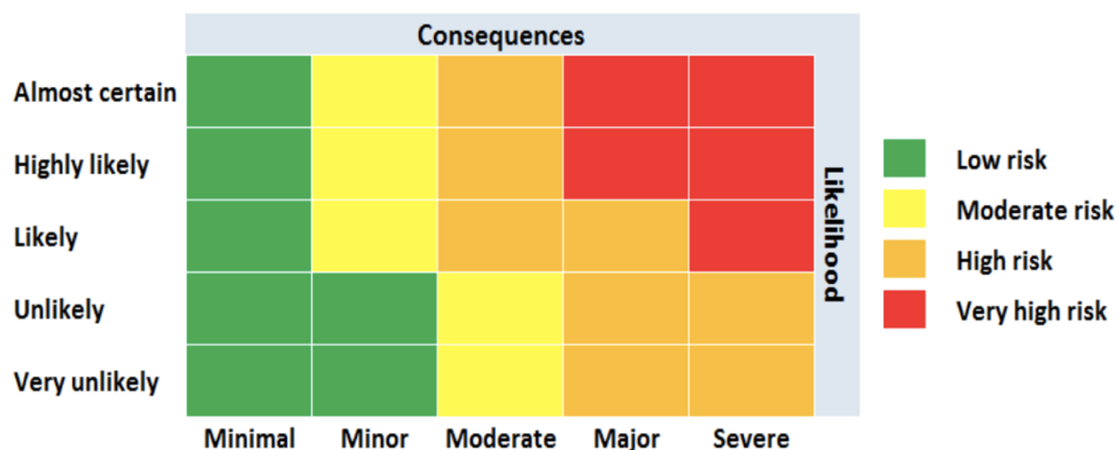
F.4. RISK CHARACTERIZATION

Once the risk assessment team has carried out the hazard, exposure and context assessments, a level of risk should be assigned through risk characterization⁴⁰. Oftentimes in the risk studies, it becomes necessary to put the degree of hazards or risks into different categories "risk characterization" for the risk management purposes²⁸. Risk characterization is qualitative and/or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of known or potential adverse health effects in a given population based on hazard, exposure and context assessments. The process of risk characterization is using a risk matrix where estimates of the likelihood are combined with estimates of consequences^{4,5}. Likelihood is the chance of an event or an incident happening, whether defined, measured or determined objectively or subjectively; while Probability: in statistics, is a measure of the chance of an event or an incident happening. Impact or consequences is defined as downstream effects that result from an action or condition that may be negative or positive.

The risk assessment matrix is a widely accepted and used in the risk assessment (including sector-specific and joint risk assessments), semi-quantitative tool for assessing risks, and setting priorities in the risk management⁴¹. Ideally, risk assessment and risk characterization process are integrated into a qualitative or quantitative assessment or both characterizing the probability of adverse public health effects in an exposed population³⁷. For some public health threats and OH significance events, where information is limited and

when the overall level of risk is obvious, the matrix may not be needed. If there is no mathematical output from a quantitative model or comparison with a guidance value, the risk characterization process [Figure 13] is based on broad descriptive definitions of likelihood and consequences⁵ and based on the expert opinion of the team^{4,5}. The perception of risk is an important factor which must also be considered in the risk assessment²⁵. All parties, both expert and non-expert, will have perceptions of risks³¹. The risk perception is a stakeholder's view on a risk that reflects the stakeholder's needs, issues, knowledge, beliefs and values.

Figure 13. A risk characterization matrix



Source: WHO (2014)⁴

The hazard, exposure and context assessments help to estimate the potential consequences of the event⁴. When applying the matrix, the definitions of likelihood and consequence [Table 8] can be refined to fit with the national or sub-national context in each country⁵.

- Need to decide on the level at which the rapid risk assessment is taking place (local, subnational, national)?
- The probability of contracting the disease for a given exposure or for any exposure?
- The timing during the course of the public health threat and the timing of consequences?
- Is the exposure of interest a daily one, monthly one or yearly one?
- Numbers of infections, illnesses, hospitalizations or death?
- Any subpopulation of interest or geographical areas (risk groups)?
- Level of perceived external interest in the event? And what are the needs of human-animal-environmental health managers?

Table 8. Definitions on likelihood and consequences for risk characterization

| Likelihood | | Consequences | |
|----------------|---|--------------|---|
| Level | Definition | Level | Definition |
| Almost certain | Is expected to occur in most circumstances (e.g. probability of 95% or more) | Severe | <ul style="list-style-type: none"> • Severe impact for a large population or at-risk group • Severe disruption to normal activities and services • A large number of additional control measures will be needed and most of these require significant resources to implement • Serious increase in costs for authorities and stakeholders |
| Highly certain | Will probably occur in most circumstances (e.g. a probability of between 70% and 94%) | Major | <ul style="list-style-type: none"> • Major impact for a small population or at-risk group • Major disruption to normal activities and services • A large number of additional control measures will be needed and some of these require significant resources to implement • Significant increase in costs for authorities and stakeholders |
| Likely | Will occur some of the time (e.g. a probability of between 30% and 69%) | Moderate | <ul style="list-style-type: none"> • Moderate impact as a large population or at-risk group is affected • Moderate disruption to normal activities and services • Some additional control measures will be needed and some of these require moderate resources to implement • Moderate increase in costs for authorities and stakeholders |
| Unlikely | Could occur some of the time (e.g. a probability of between 5% and 29%) | Minor | <ul style="list-style-type: none"> • Minor impact for a small population or at-risk group • Limited disruption to normal activities and services • A small number of additional control measures will be needed that require minimal resources • Some increase in costs for authorities and stakeholders. |
| Very unlikely | Could occur under exceptional circumstances (e.g. a probability of less than 5%) | Minimal | <ul style="list-style-type: none"> • Limited impact on the affected population • Little disruption to normal activities and services • Routine responses are adequate and there is no need to implement additional control measures • Few extra costs for authorities and stakeholders |

Source: WHO (2012)⁵

During discussions, all types of consequences should be considered in addition to the expected morbidity and mortality, include the long-term health consequences of the public health event (disability) as well as the social, economic, environmental and policy consequences^{4,5}.

F.5. CAPACITIES AND VULNERABILITIES

Based on the identified information from hazard, exposure, and context assessment; the risk assessment team will be able to mapping the extent of capacity and vulnerability factors⁴². Vulnerability is a set of conditions determined by physical, social, economic and environmental factors that increases the susceptibility of a community to the impact of hazards. Vulnerability is a measure of how well prepared and equipped a community is as well as describing all protective measures in place to minimize the impact of or cope with hazards and estimating the likelihood of consequences.

Opposite to vulnerability is resilience which is defined as capacity of combination of all strength, attributes, and resources available within system, organization, community or society to manage and reduce disaster risks and strengthen resilience³ as well as to adapt to disruptions resulting from hazards by persevering, recuperating or changing to reach and maintain functioning. Capacities can decrease the likelihood and impact of the public health threat, while vulnerabilities can increase the likelihood and impact of the public health threat.

Table 9. Example of information that resulted by undertaking risk assessment

| Public health importance | Component | Assessment |
|--------------------------|---------------------|--|
| Avian influenza A(H7N9) | Hazard assessment | Avian influenza A(H7N9) virus is a subtype of influenza viruses that has been detected in birds in the past. This particular A(H7N9) virus had not previously been seen in either animals or humans until it was identified in March 2013 in China. However, since then, infections in both humans and birds have been observed in China. Most human cases presented with severe disease. The case fatality rate (CFR) among reported confirmed cases since 2013 is around 39%. Most of the cases of human infection with this avian influenza A(H7N9) virus have reported recent exposure to live poultry or potentially contaminated environments, especially markets where live birds are sold. The virus does not appear to transmit easily from person to person, and sustained human-to-human transmission has not been reported. A(H7N9) infections in poultry appear to be enzootic in China and the virus is mainly linked to a specific poultry type predominantly raised and consumed in China. Avian influenza A(H7N9) virus is low pathogenic for poultry and is therefore only detected in animals through sampling. Although the virus is changing since the detection of initial human cases, there are no virological indicators of higher virulence or more adaptation to infection in humans. |
| | Exposure assessment | <ul style="list-style-type: none"> As of 30 January 2017, a total of 1,101 laboratory-confirmed human infections with avian influenza A(H7N9) virus have been reported through IHR report since early 2013. The disease follows a seasonal pattern with higher number of cases in the northern hemisphere winter months. All of the cases reported have been exposed in China. In the current wave, since November 2016, a total of 303 human infections with avian influenza A(H7N9) virus, including 65 deaths have been reported by China through IHR. Current numbers indicate a higher wave than previous years especially as the peak might not have been reached and weekly numbers are already exceeding the weekly numbers of previous waves. There is one new province reporting cases and additional cities and counties are affected. The most affected provinces are Jiangsu, Zhejiang and Guangdong, with Jiangsu accounting for almost half of the cases. Most of the cases with available information on exposure history have reported contact with poultry or visiting live bird markets. Among reported cases in this wave, there are three, two-person clusters of possible human-to-human transmission, which is in accordance with previous waves. An increase in sporadic human cases is expected during this wave as there is apparently a high level of environmental contamination with avian influenza A(H7N9) virus (Zhou H7N9 in China (WPSAR publication Jan 2017)). Apart from a sharp increase in the number of human cases this wave, there is no evidence of changes in the epidemiology of the human cases, no evidence of sustained human-to-human transmission, no important changes in the clinical presentation (remains rapidly progressing severe acute respiratory distress and multi organ failure) and no indication of increased CFR. A longer incubation period has been recognized during case reviews (up to 10-14 days) (Information provided during clinical network teleconference). |
| | Context assessment | <ul style="list-style-type: none"> Thirty-three viruses from human samples from the early phase of this wave have been fully sequenced and cluster with the viruses isolated in the beginning of 2016. The genetic markers of mammalian adaptation and antiviral resistance (the virus is known to be highly resistant to M2 inhibitors but susceptible to neuraminidase inhibitors) remain similar to previous waves. <p>Sudden increases in the number of human infections with avian influenza A(H7N9) virus identified have been reported in previous years during this period of time (December-January). Poultry and human movement increases in the weeks around Chinese New Year (28 January 2017), which might lead to further spread. China has strong capacity to respond to the outbreak including regarding surveillance, risk assessment, and epidemiological and virological investigations in humans. However, the regular recurrence of this outbreak in humans for the 5th consecutive year suggests that the capabilities to control outbreaks in the poultry population is limited and its spread in the poultry sector will continue to present a risk for future human cases and pandemic potential. China Ministry of Health response includes publication of updated guidance for H7N9 clinical management and trainings convening 100 clinicians across the country. Referral hospitals are supplied with oseltamivir and peramivir for treatment and laboratory diagnosis is available within 24 hours. The preparedness level of not previously affected cities and counties is not known. Public health interventions have been implemented including measures to lower the risk of exposure (for example closure of live poultry markets, strengthening of regulations in live poultry markets, limitation of transport of poultry). However these are performed at the provincial or municipal level with no national coordination thus possibly contributing to a spread of the virus rather than to containment through ad hoc and unregulated sales and transportation of live poultry.</p> <p>Control measures are complicated by the fact that avian influenza A(H7N9) virus is of low pathogenicity in poultry and there is a robust cultural practice to buy live chickens from live bird markets. Closure of markets might even move the problem to non-affected, less controlled and rural areas. At present, A(H7N9) infections in poultry are mainly prevalent in a specific poultry type which is predominantly raised and consumed in China which might help explain why human cases have not been reported from other countries. Countries with substantial human and animal traffic with affected areas are at highest risk for A(H7N9) outbreaks in animals and humans. Several countries neighboring China have previous experience with avian influenza A(H5N1) and other avian influenza virus outbreaks and are able to detect and identify human and animal infections with avian influenza A(H7N9) virus and can respond appropriately. Nevertheless, there is a low confidence in the capacity of some of the neighboring countries to detect single infrequent human cases, in adequate surveillance in the animal and human sector, and in the capacity to respond and manage larger A(H7N9) outbreaks. Countries with substantial human and animal traffic with affected areas are at highest risk. Eight candidate vaccine strains were proposed in the VCM of Sept 2016 and there are several phase 2 clinical trials underway/planned.</p> |

| Public health importance | Component | Assessment |
|--------------------------|---------------------|---|
| | Capacities | <ul style="list-style-type: none"> China-has adequate capacities (case detection, treatment and lab facilities). Candidate vaccine virus has been selected and vaccine trials in phase II in China. Antivirals available. |
| | Vulnerabilities | <ul style="list-style-type: none"> Lack of timely virus sharing beyond China WHO CC. A(H7N9) virus is low pathogenic in poultry, therefore infected animals cannot easily be identified which renders control in animals more difficult. As animals are not visibly sick, there is less incentive for animal sector to control the disease. Market closure in bigger cities might push the problem to unaffected areas which are less prepared. Uncertainties about level of control of trade of possibly infected live poultry. |
| Yellow Fever (YF) | Hazard assessment | <p>YF is an acute viral disease transmitted by infected mosquitoes. Once contracted, the YF virus incubates in the body for 3 to 6 days. Many people do not experience symptoms, but when these do occur, the most common are fever, muscle pain with prominent backache, headache, loss of appetite, and nausea or vomiting. In most cases, symptoms disappear after 3 to 4 days. In approximately 15% of cases, there is a brief remission of hours to a day followed by jaundice and hemorrhagic signs. Half of the patients who enter the toxic phase die within 10 to 14 days, the rest recover without significant organ damage. Vaccination is the most important means of preventing the infection. Vaccination against YF provides life-long protection. There is no specific treatment for YF, only supportive care to treat dehydration, respiratory failure, and fever. Associated bacterial infections can be treated with antibiotics. Supportive care may improve outcomes for seriously ill patients, but it is rarely available in poorer areas. Brazil is a country at risk of YF transmission in endemic areas. Vaccination is recommended before travelling to Brazil for all travelers aged 9 months or over going to states with known YF transmission. Updates on yellow fever vaccination recommendations for international travelers related to the current situation in Brazil are available at: http://www.who.int/csr/don/04-april-2017-yellow-fever-brazil/en/.</p> |
| | Exposure assessment | <ul style="list-style-type: none"> Overall, between 1 December 2016 and 9 May 2017, Brazil reported 1,392 cases (729 confirmed and 663 suspected), including 294 deaths (249 confirmed and 45 suspected). The overall CFR is 29% and 34% among confirmed cases. Cases have been reported from 15 states [Amapá (AP), Bahia (BA), Espírito Santo (ES), Goiás (GO), Maranhão (MA), Mato Grosso do Sul (MS), Minas Gerais (MG), Pará (PA), Paraná (PR), Rio Grande do Sul (RS), Rio de Janeiro (RJ), Rondônia (RO), Santa Catarina (SC), São Paulo (SP), and Tocantins (TO)] and the Federal District. In addition, for the same period, 3,660 epizootics (474 of which were confirmed for YF) were reported in 21 states (Alagoas, Amazonas, Bahia, Goiás, Espírito Santo, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraíba, Paraná, Pernambuco, Rio Grande do Norte, Rio Grande do Sul, Rio de Janeiro, Rondônia, Roraima, Santa Catarina, São Paulo, Sergipe, and Tocantins) and the Federal District, including in areas bordering Argentina, Bolivia, Colombia, Guyana, Paraguay, Perú, Suriname, Uruguay, and Venezuela. A matter of concern is the recent confirmation of epizootics in the State of Rio de Janeiro, which triggered a preventive vaccination campaign in the whole state. On 4 April, the WHO IHR Secretariat updated for the fourth time the yellow fever vaccination recommendations for international travelers and determined that the State of Rio de Janeiro (including the urban areas of Rio de Janeiro City and Niterói), and the State of São Paulo, with the exception of the urban areas of São Paulo City, should also be considered at risk for yellow fever transmission. As a global trend, human cases have been decreasing since March 2017; however, the risk of occurrence of new cases persists, given the internal movement of people, the spread of epizootics throughout natural ecosystems, and rainy season (till end of May/June) and pockets of unvaccinated populations in difficult-to-reach areas. In MG, no new cases have been confirmed in April. In ES, confirmed cases continue to be reported; however, no new municipalities have been affected since the beginning of April. Preliminary results of entomological surveys have indicated that <i>Aedes</i> spp. captured in different ecosystems of selected areas of MG (city of Belo Horizonte), ES (municipality of Domingo Martins), and RJ (municipality of Casimiro de Abreu) were negative for YF. It is important to note that <i>Haemagogus</i> spp. captured in an area of edge habitat in ES have tested positive for YF. To date, there is no evidence that <i>Aedes aegypti</i> is implicated in transmission; However, the risk of involvement of <i>Ae. aegypti</i> still remains considering that some municipalities where YF transmission occurs have also high transmission of chikungunya and dengue, which suggests high incidence of <i>Aedes</i>. 5 municipalities in MG, 2 in TO, and 1 in SP have reported the highest dengue incidence in Brazil during 2017. With regard to chikungunya, the municipalities of Conselheiro Pena, Governador Valadares, and Teófilo Otoni in Minas Gerais have been those with the highest chikungunya incidence rate at national level during 2017. Zika has been circulating at low levels in ES, MG, RJ, SP, and TO during 2017. These 4 arboviruses can be transmitted to humans by day-biting <i>Aedes</i> mosquitoes. |
| | Context assessment | <p>Laboratory-confirmed and suspected cases are being reported from 15 states and the Federal District. The latest confirmed cases reported in RJ State (Maricá) and reports of epizootics in relative proximity to Belo Horizonte, São Paulo, Rio de Janeiro, and Vitória (respectively, the capital cities of MG, SP, RJ, and ES) are concerning and highlight the persistence of the risk of urbanization of the outbreak. Suspected epizootics have been reported in rural areas of states at risk for YF bordering Argentina, Bolivia, Colombia, Guyana, Paraguay, Perú, Suriname, Uruguay, and Venezuela. Vaccination coverage is improving, with more than 62% of prioritized municipalities (n=984) having optimal coverage, exceeding 75%. Laboratory capacities have been strengthened with decentralized laboratory capacity in Espírito Santo and Bahia.</p> |
| | Capacities | <ul style="list-style-type: none"> Epizootics and vector control: <ul style="list-style-type: none"> Vector control activities to eliminate <i>Ae. aegypti</i> adults and larvae in breeding sites are carried out in the affected municipalities. Surveillance, Laboratory and Investigation: <ul style="list-style-type: none"> The State and Municipal Secretaries of Health are being supported by epidemiological teams from the MoH; The MoH and the State Secretaries of Health are jointly producing technical notes, monitoring the event and coordinating services and health professionals; The General Coordination of Communicable Diseases of the Brazil Ministry of Health is disseminating technical guidance to improve surveillance and differential diagnosis; Since 1 March, PAHO Regional and CO with MoH are permanently deployed to MG, ES and RJ states to strengthen analysis, epizootic surveillance and AEGI surveillance. Diagnostic capacity is available in the states of BA, ES, MG, RJ, and SP and at the national level. Vaccination: <ul style="list-style-type: none"> The Brazil MoH has distributed 25 M doses of YF vaccine to 5 states, with more than 27 M persons having been vaccinated. A house-to-house and fixed post immunization campaign is being conducted in the rural areas of affected municipalities. The state of RJ received 4.8 M doses, of which 1.9 M have been administered. The cumulative vaccination coverage is as follows: ES 82.2%, MG 79.8%, BA 51.3%, SP 51.1%, and RJ 41.2%. An estimated 19.1 M persons remain unvaccinated in these states. Bio-Manguinhos/Fiocruz will deliver 24 M doses until the end of the year. In the context of the YF outbreak, Bio-Manguinhos is not exporting the YF vaccine. Brazil national authorities are preparing the implementation of fractional doses in selected municipalities in SP and BA in case of proved urban transmission. |

| | |
|-----------------|---|
| | <ul style="list-style-type: none"> - The MoH and the State Secretaries of Health are jointly producing technical notes, monitoring the event and coordinating services and health professionals; - The General Coordination of Communicable Diseases of the Brazil Ministry of Health is disseminating technical guidance to improve surveillance and differential diagnosis; - Since 1 March, PAHO Regional and CO with MoH are permanently deployed to MG, ES and RJ states to strengthen analysis, epizootic surveillance and AEGI surveillance. - Diagnostic capacity is available in the states of BA, ES, MG, RJ, and SP and at the national level. <ul style="list-style-type: none"> • Vaccination: <ul style="list-style-type: none"> - The Brazil MoH has distributed 25 M doses of YF vaccine to 5 states, with more than 27 M persons having been vaccinated. A house-to-house and fixed post immunization campaign is being conducted in the rural areas of affected municipalities. The state of RJ received 4.8 M doses, of which 1.9 M have been administered. - The cumulative vaccination coverage is as follows: ES 82.2%, MG 79.8%, BA 51.3%, SP 51.1%, and RJ 41.2%. An estimated 19.1 M persons remain unvaccinated in these states. - Bio-Manguinhos/Fiocruz will deliver 24 M doses until the end of the year. In the context of the YF outbreak, Bio-Manguinhos is not exporting the YF vaccine. - Brazil national authorities are preparing the implementation of fractional doses in selected municipalities in SP and BA in case of proved urban transmission. • Risk communication: <ul style="list-style-type: none"> - The local press office is working together with the MoH; - A web portal has been launched by MoH and affected states to inform the public about the situation and provide guidance. • Coordination: <ul style="list-style-type: none"> - State and municipal authorities are carrying out massive campaigns with the participation of the public and private sectors, Army and Navy, community leaders, and traditional and social media. - Situation Rooms have been established in the affected states and at the national level. |
| Vulnerabilities | <ul style="list-style-type: none"> • Epizootics and vector control: <ul style="list-style-type: none"> - Activities aimed at controlling Ae. aegypti had a limited impact on the dynamics of the Zika transmission in the coastal areas of Brazil during 2015-16; similarly, actual entomological indices may not be adequately low to protect urban areas from an Ae. aegypti transmitted YF cycle. • Surveillance and Laboratory: <ul style="list-style-type: none"> - Suboptimal epidemiological characterization of human suspected cases complicates the early detection of any changes suggestive of YF transmission in urban setting. - Delays in testing for obtaining laboratory results still persist in RJ and MG. • Vaccination: <ul style="list-style-type: none"> - Even though vaccination campaigns are being carried out by State and Federal health authorities, pockets of unvaccinated populations in difficult-to-reach areas still persist. - A request for 20 M syringes (0.1 ml) was channeled to PAHO/WHO on 30 March 2017 for the administration of fractional doses. Without the additional syringes, the country will not be able to implement this strategy. - Results from the surveillance of AEFIs have been received but require further analysis. - Some UK travel clinics have reported shortages of the European vaccine. • Coordination: <ul style="list-style-type: none"> - Brazil is a federal country: Brasilia is in charge for the vaccines supplies while States are in charge of the strategies regarding surveillance and vaccination campaigns leading to a slow process with no harmonization and poor coordination |

F.6. LEVEL OF CONFIDENCE

Risk assessments rely on currently available knowledge, which is usually incomplete or difficult to validate, so RA always include an indication of uncertainty. Level of uncertainty depends on (a) the quality and quantity of data or detail of information available at the time of assessment, and (b) opinion of the technical team²⁹. Uncertainty is the lack of confidence level in the estimate of a variable's magnitude or probability of occurrence²⁸. There is always possible uncertainty about the reliability of risk assessment process and should be transparent in the results of risk assessment process^{25,31}. It is important to document the level of confidence in the risk assessment and reasons for any identified limitations⁵. If uncertainties are not communicated properly, various misinterpretation might be occur and the further communication to stakeholders, including consumers, can be affected³⁹. There is some criteria [Table 10] that can be considered for estimating the level of uncertainty as follow:

Table 10. Criteria for estimating level of uncertainty

| Confidence | Type of evidence |
|------------|---|
| 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 |

Source: WHO, FAO, & OIE (2020)²⁹

Confidence level describes how sure the assessment team is of an estimate. It reflects what some disciplines call the certainty or uncertainty around an estimate. Even with available perfect data and information (i.e. no ‘uncertainty’), but natural variation (‘variability’) still exists. This will depend on the reliability, completeness and quality of the information used, and the underlying assumptions made with respect to the hazard, exposure and context⁵. The degree of confidence can be expressed using a descriptive scale that ranges using 2 scales (e.g. low- high), 3 scales (e.g. poor-medium-good or low-moderate-high or low-reasonable-high), etc. The more evidence level there is to inform the hazard, exposure and context assessments; the greater confidence the team can have in the assessment results.

Table 11. Evaluating the quality of evidence (confidence) using 2 scales level

| High level of confidence | Low level of confidence |
|--|--|
| Hazard assessment based on: <ul style="list-style-type: none"> a detailed clinical description of cases provided by hospital-based physicians etiological (i.e. causative) agents known to have caused similar outbreaks in the previous two years surveillance data | Hazard assessment based on: <ul style="list-style-type: none"> a non-specific clinical description of cases reported in newspaper article no historical data included in the report |
| Exposure assessment based on: <ul style="list-style-type: none"> epidemiological investigation of the rapid response team peer-reviewed articles and evidence from previous outbreaks | Exposure assessment based on: <ul style="list-style-type: none"> the likely routes of transmission consistent with the clinical features reported in the media report (e.g. food- or water-borne transmission causing an acute disease with nausea, vomiting and diarrhea) |
| Context assessment based on: <ul style="list-style-type: none"> health-care system performance during previous outbreaks external reviews local sources: detailed information from local leaders and health authorities | Context assessment based on: <ul style="list-style-type: none"> the knowledge and experience of a staff member in the risk assessment team |

Source: WHO (2012)⁵

Table 12. Evaluating the quality of evidence (confidence) using 3 scales level

| Confidence | Type of evidence |
|--|--|
| Good Further research unlikely to change confidence in information. | <ul style="list-style-type: none"> • Etiological agents known to have caused similar outbreaks in the previous 2 years • Peer-reviewed articles and evidence from previous outbreaks • Multiple reliable sources • Expert group risk assessments, or specialized expert knowledge, or consensus opinion of experts |
| Medium Further research likely to have impact on confidence of information and may change assessment. | <ul style="list-style-type: none"> • Non-peer-reviewed published studies/ reports but consistent results published in grey literature • Detailed clinical description of cases (observational studies / surveillance reports/ outbreak reports |
| | <ul style="list-style-type: none"> • Reliable local sources: detailed information from local leaders and health authorities • Agreement between experts or opinion of two trusted experts |
| Poor Further research very likely to have impact on confidence of information and likely to change assessment. | <ul style="list-style-type: none"> • Individual case reports with non-specific clinical description of cases • No historical data Grey literature • Individual (non-expert) opinion • Uncertainty/ conflicting views amongst experts |

Table above illustrate how levels of confidence can be estimated. It should be emphasized that a risk assessment with very low or low confidence does not indicate a poor risk assessment; rather it reflects the information available when the risk assessment was undertaken and the limitations of data. It is important to include the confidence level in any conclusions and recommendations of a risk assessment⁵. To ensure that there is a good understanding of the uncertainties in the existing data, and therefore the robustness of the risk assessment during an emergency, it is important to develop a prior awareness of the existence and causes of such uncertainties through regular team dialogue during non-emergency situations³⁹. In the next iteration of the risk assessment, when new information is available to inform and improve results, the level of uncertainty potentially decreases²⁹. In addition; political will, relevant sector engagement, access to information, and risk assessment capacity are key elements of joint risk assessment (JRA) which need to be established.



Chapter G:

Control Measures

Control measures is defined as interventions put into place to reduce the effect of a hazard on the exposed population. Control measures include measures that are aimed at reducing the impact of the human-animal-environmental health significance events and preventing spread⁴. Risk control measure use of a combination of tools, which include communication, assessment, training, and physical and operational controls, to reduce the risk of an incident/ event to an acceptable risk. The risk assessment cycle will determine the strategy that should be used to control the risks and the specific types of risk control measures required^{30,34}.

The outcome of hazard, exposure and context assessment in which the event is occurring; helps to identify evidence-based control measures, rank the suitability and feasibility of the control measures, and ensure that control measures are proportional to the risk posed to public health threats. The overall level of risk assigned to the public health threats and One Health significance events will help identify the urgency and extent of the control measures needed⁵. There are a number of different strategies that may be used to reduce and control risks, such as: elimination of the hazard, reduction and substitution of the risk, isolation of the hazard, environment and personnel protection, and compliance on administrative controls/ SOPs in place³⁴.

After level of risk has been assigned through the risk characterization, the following are several actions of control measures [Table 13] based on the level of overall risk:

Table 13. Matrix on actions based on level of overall risk

| Level of overall risk | | Actions |
|-----------------------|----------------|--|
| | Low risk | Managed according to standard response protocols, routine control programmes and regulation (e.g. monitoring through routine surveillance systems) |
| | Moderate risk | Roles and responsibility for the response must be specified. Specific monitoring or control measures required (e.g. enhanced surveillance, additional vaccination campaigns) |
| | High risk | Senior management attention needed: there may be a need to establish command and control structures; a range of additional control measures will be required some of which may have significant consequences |
| | Very high risk | Immediate response required even if the event is reported out of normal working hours. Immediate senior management attention needed (e.g. the command and control structure should be established within hours); the implementation of control measures with serious consequences is highly likely |

Source: WHO (2012)⁵

At any stage, appropriate control measures should be carried out and adapted according to new information being received as well as risk framing and technical considerations. The following Table 14 provides the example for the linkage between risk framing to the management and communication options:

Table 14. Example for the linkage of risk framing and control measures management

| Risk | Technical Considerations | Possible Actions and Management Options |
|---|--|--|
| a. Safety of live animal markets (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) |
| b. Transmission of pathogen in households | 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 |
| c. Disease coming across a border | 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 |
| d. Transmission from 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 | |
| | Frequency and likelihood of transmission associated with contacts between people and environments contaminated by wild animals | Measures to decrease contact between people and potentially contaminated environments |

Source: WHO, FAO, OIE (2020)²⁹

Control measures should never be delayed because investigations are still ongoing⁴. The risk matrix also helps to assess and document the changes in risk before and after control measures are implemented⁵, as well as the likelihood that a control measure will prevent further spread and consequences of implementing each control measure. Assessing the likely effectiveness and consequences of control measures helps to ensure that they are appropriate to the risk of public health threats and One Health significance events.

Table 15. The likelihood that control measure will prevent further spread and the consequences of implementing each control measure

| Likelihood | | Consequences | |
|----------------|--|--------------|---|
| Level | Definition | Level | Definition |
| Almost certain | Is expected to prevent additional cases in most circumstances | Severe | <ul style="list-style-type: none"> • Severe social impact • Considerable ethical considerations • Considerable economic costs • Severe political impact |
| Highly certain | Will probably prevent additional cases in most circumstances | Major | <ul style="list-style-type: none"> • Major social impact • Significant ethical considerations • Major economic costs • Major political impact |
| Likely | Will prevent additional cases some of the time | Moderate | <ul style="list-style-type: none"> • Moderate social impact • Some ethical considerations • Moderate economic costs • Moderate political impact |
| Unlikely | Could prevent additional cases some of the time | Minor | <ul style="list-style-type: none"> • Minor social impact • Limited ethical considerations • Limited economic costs • Some political impact |
| Very unlikely | Could prevent additional cases under exceptional circumstances | Minimal | <ul style="list-style-type: none"> • Limited social impact • No ethical considerations • No or very little economic impact • No or very little political impact |

Source: WHO (2012)⁵

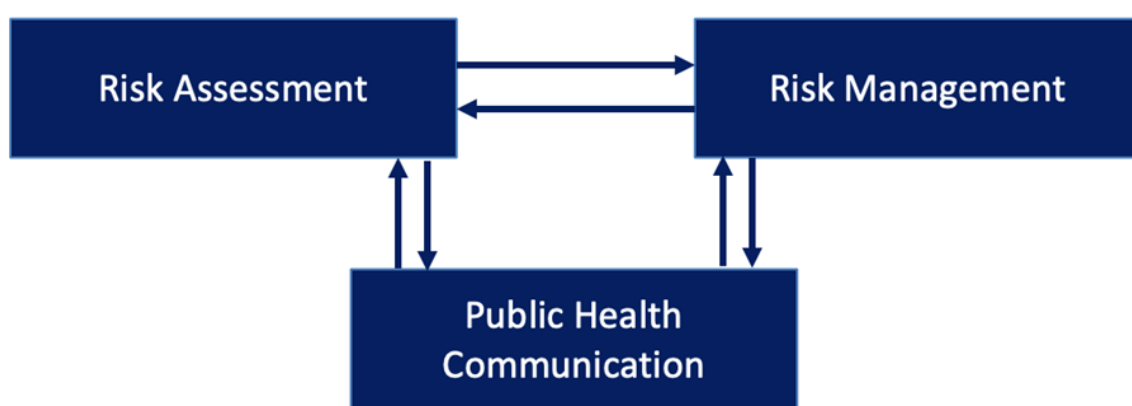
This assessment can help the risk assessment team convince decision-makers of the most appropriate set of control measures and to assist in deciding on the level of acceptable risk. The control measures that are most likely to prevent spread or reduce adverse health and other consequences and that have minor to moderate negative consequences are the most acceptable. However, in the exceptional circumstances where the event is determined as high risk (i.e. almost certain to happen with serious consequences) and/or there is a low level of confidence (i.e. a high level of uncertainty) requiring a cautious or precautionary approach, control measures that may have only a limited chance of preventing additional cases or spread of the hazard may be acceptable⁵.

Chapter H:

Risk Management and Communication



Figure 14. Three components of the Codex approach to risk analysis



Source: WHO (2012)⁵

Risk analysis is a process that incorporates three components: risk assessment, risk management and risk communication³⁶. Risk analysis provides a systematic approach to estimating the risks, in order to identify and implement appropriate measures to control the risk of public health threats, and to communicate information about the risks and the control measures applied. In emergency situations, the risk analysis process may be more dynamic and intense, and the risk management actions may be taken before the completion of risk assessment³⁹. Risk assessment is the first component in a risk analysis process³⁸ that has been described in the previous chapter. Risk assessments provide evidence for decisions on risk management and risk communication. Risk assessments link results directly to management decisions. Risk assessment processes function best within the governmental structures that support risk management and risk communication, by engaging decision-makers and policy-makers from all relevant sectors. The general options will be provided for the 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 also be proposed ²⁹.

H.1. RISK MANAGEMENT

Risk management is a process, distinct from risk assessment, of weighing policy alternatives in consultation with all interested parties, considering risk assessment and other factors relevant for the health protection of consumers and for the promotion of fair trade practices, and, if needed, selecting appropriate prevention and control options^{5,36}. Risk management combines socioeconomic, political, legal, and scientific approaches to manage risks²⁸. The risk management will differ depending on the local laws and customs, the availability of technical skills and the resources, and political prerogatives; therefore the risk assessment should be a principal component of health and regulatory programs⁴³. The essential tasks of risk management:

- a. To determine what hazards present more danger than society (as represented by its government) is willing to accept;
- b. To consider what control options are available; and
- c. To decide on appropriate actions to reduce (or eliminate) unacceptable risks.

At the broadest level; risk management includes a range of management and policy-making activities: agenda setting, risk reduction decision making, program implementation, and outcome evaluation. Risk assessment includes cost analyses, and other analytical tools can assist the good judgment of the policy maker in making such decisions. While risk communication covers a range of activities directed at increasing the public's knowledge of risk issues and participation in risk management.

In addition, the success of a joint risk assessment depends on effective communication among the sectors

throughout the whole process, ideally leading to a consensus on the outcome of the assessment and production of a joint or aligned assessment document. The JRA process is normally iterative (repeated periodically), so strengthening regular exchanges between sectors fosters intersectoral understanding of the perceptions, needs, mandates, and constraints of all involved sectors in human-animal-environment interface.

H.2. RISK COMMUNICATION

As an integral part of risk management process, risk communication is the activities and exchange of information required³⁶ through the preparedness, response and recovery phases of a human-animal-environmental health significance events between responsible multisectoral authorities, partner organizations, the upward cascades (government, other agencies, etc.) and communities at risk to encourage informed decision-making, positive behavior change and the maintenance of trust^{24,31}. The risk assessment team should compose of or consult with risk communication experts to tailor the risk communication messages. Established channels of communication with partners⁴ are used to:

- a. Report to all signals which may constitute a risk of public health threat, as well as any measure implemented in response - a continuous communication should be maintained;
- b. Consolidate the information available through data provided by partners to analyze the public health threat and associated risk;
- c. Disseminate information during unexpected or unusual public health threats to the IHR (2005) NFP and to relevant partners, including those responsible for surveillance and reporting, points of entry, public health services, clinics and hospitals and other MoH departments;
- d. Consult experts and other relevant information sources on appropriate health measures;
- e. Respond to requests for information and verification.

The aim of public risk communication is to enable the target population to make informed decisions³¹ about recommended personal and community-based prevention and mitigation measures. Communication is vitally important in risk assessment and certain principles apply to the processes of risk communication such as who needs to be informed and how they should be informed²⁴. Ensuring good communication between decision-makers and affected population from the start of the process will increase the likelihood of effective implementation of control measures, especially those requiring engagement³¹ and behavioral change⁵. There are two equally important components to risk communication:

a. Operational communication

The structured communication that organizations use to meet their work goals and strategic objectives, including coordination internally and with people and groups outside the organization. Operational communication occurs between the risk assessment team and relevant stakeholders (technical specialists, policy-makers, other response agencies, the private sector etc.).

b. Communication with the public

Communication to provide key findings from risk assessments at regular intervals. Regular communication helps to ensure that the public is informed of the nature and level of risks and the desired behavioral changes that can minimize them. Quarterly bulletin, dedicated website, or press releases can be used to inform about an on-going event or to release alert and prevention messages.

Planning for an appropriate risk communication strategy is particularly important for managing a public health emergency or crisis situation, since the level of community concern is bound to be heightened³¹. The results of the risk assessment nevertheless have often proven helpful for the local health professionals in the context of risk communication to the public³⁵. Decisions on risk communication include what, whom and how should be part of overall risk communication strategy^{30,34}. The communication strategy for each public health threat should be agreed as soon as possible to ensure that there is two-way communication between the risk management team and multisectoral stakeholders⁵. Problems in the risk communication might arise because of the differences in standpoint experiences³³ and world view between specialists and the public. Effective risk communication relies on the timely and transparent sharing of all relevant information²⁴, and the building of trust and empathy. The strategy should include:

- a. How the team will provide regular feedback on the risk assessment, and in what format;
- b. Clearly defined roles and responsibilities (e.g. focal points) for communications functions;
- c. How and in what format the information should be presented to stakeholders and public.

Risk communication and community engagement in practice, not only focuses on enhancing risk assessments and improving decision-making, by providing evidence; but also acknowledging the concerns of communities, increasing opportunities for communities to participate in the design of public health measures and other response interventions, and ensuring the accountability of those implementing the response (e.g., governments, organizations, institutions)⁴⁴. Lessons learned from dealing with outbreaks have shown that an outbreak is promptly brought under control only when communities actively participate in control and prevention activities, and are ready to adopt and sustain preventive and mitigation behaviors. Social mobilization interventions focus on affected communities and participatory approaches, viewing affected communities as partners in finding solutions to control outbreak⁴.



Chapter I:

Monitoring, Evaluation, and Sharing Information

Risk assessment should be continuously repeated or redoing until clear or closed the event, as new information becomes available. It may also be repeated on a regular timetable. Each time risk assessment is undertaken for an event, it builds on the previous assessment⁵. As a basis of the decision making, each risk assessment (including data and information available at the time it was undertaken) should be documented³¹. Uncertainties should also be identified, clearly documented and communicated and the assessment updated in light of new evidence over time²⁴. If documented consistently, risk assessment provides a record of the rationale for changes over the course of the event including the assessed level of risk, recommended control measures, key decisions and actions. Documentation is an important part of monitoring and evaluation of risk assessment⁵. This information is documented and sharing among stakeholder. After no risk or case is closing, risk assessment maybe concluded, and RA team maybe need dissolution.

Monitoring is an ongoing process/ act of observing and checking over a period of time, and regularly gathering and analyzing data on inputs, processes, and outputs of risk assessment on public health threats and OH significance events³. Evaluation is the periodic assessment of the relevance, effectiveness and impact of activities in the light of the objectives of the risk assessment on public health threats and OH significance events⁴. Monitoring and evaluation activities will vary according to the type of emergency and the capacity of the countries involved³⁹. As a general principle, indicators used for monitoring and evaluation can be grouped into categories: input, process, output, outcome/ impact indicators. At the beginning of risk assessment implementation, emphasis should be placed on the input and process indicators. As the activities stabilize over time, emphasis shifts systematically to outcome, output and impact indicators⁴.

Regular or daily briefings or meetings (both formal and informal, and by using all available channels such as phone calls, e-mail and teleconferencing³⁹) should be organized with risk assessment team and experts to examine on-going events and new signals received, using a listing of public health threats. The meeting forum updates the current risk assessment of significance events being tracked, assigns responsibility for action, decision-making and response coordination for the management of public health threats. The risk assessment should be revised whenever additional information is available; this may be on a regular basis³⁹ (e.g. daily basis⁴). For some events, different risk assessment teams may be required to work collaboratively to assemble the information for a composite picture of risk (e.g. clinical severity, transmission dynamics, and control measures). In addition, because the risk is assessed repeatedly during an event, risk assessment offers authorities an opportunity to adapt control measures as new information becomes available⁵.

At the conclusion of the public health threats, all of the risk assessment should be formally reviewed. The risk assessment performed during an emergency should be reviewed more rapidly, through an active and frequent communication among risk assessors, as well as between the risk assessors and risk managers³⁹. Systematic analysis of well-documented risk assessments able to identify where improvements can be made in the management of public health threats and provides an evidence base for future risk assessments and responses to events. A systematic approach to risk assessment also supports effective risk communication through the rapid dissemination and information-sharing and identification of key prevention and mitigation measure⁵.

Sharing of important information on the result of risk assessment (including capacities and vulnerabilities mapping, potentials for health emergencies/ disease outbreaks, key program areas and technical expertise of operational partners) are critical for partners, resource mapping and better further coordination³. It is recommended that all information be considered public; however before any decision is made about its sharing, any information collected should be systematically classified as confidential, restricted or public⁴:

- a. Confidential or operational information is only shared among risk assessment team and coordination unit (e.g. not yet verified information);
- b. Restricted information may only be shared among specific groups such as the national and provincial partners, and recipients are requested to avoid further dissemination of the information provided; and
- c. Public information is, by definition, shared with everybody and may be disseminated on the website, or in the form of press releases, scientific publications, etc.



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Annex

1. Potential Information Required²⁹ for the Assessment

a. 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).

b. 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.

c. General and interface information

- Sources of potential human exposure (human, animal, environment);
- Seasonality or other known effects e.g. seasonal and cultural behavior 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.

d. 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.

e. 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 behavior, holidays;
- Political situation, security issues;
- Economic and social consequences;
- Cross-border movement of people.

2. Potential Information Sources²⁹ for the Assessment

a. 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.

b. 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 behavior, 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).

c. 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.

