المركز الخليجي للوقاية من الأمراض ومكافحتها
Gulf Center for Disease Prevention and Control

مجلس الصحة
لدول مجلس التعاون
Gulf Health Council

Gulf CDC Technical Guide

for Rapid Risk Assessments of Acute Public Health Events

Executive Summary

After the COVID-19 pandemic, the global understanding of the risks encountering the public health sector has been heightened. Timely risk assessments of potential public health threats are crucial in minimizing the spread and negative impact on health, social and economic consequences. Recognizing this, the Gulf Center for Disease Prevention and Control (Gulf CDC), a newly established inter-governmental technical agency for public health, actively monitors threats to the Gulf Cooperation Council (GCC) countries by assessing associated risks to guide preparedness and response efforts. The development of a practical and reliable rapid risk assessment (RRA) technical guide tailored to the Gulf context was identified as a key priority by the six GCC countries to strengthen regional and national risk assessment capacities. To develop this guide, the Gulf CDC conducted a workshop with GCC representatives and leading global organizations such as the WHO, the European CDC and U.S. CDC, to understand existing risk assessment mechanisms and share best practices. With the support of the GCC representatives and the expert consultant, the Rapid Risk Assessment Technical Guide was developed internally by the Gulf CDC to be the second, yet most up-to-date, guide available to health authorities in the GCC countries.

Summary

Identifying an event of potential health relevance through EI signal detection activities

The organisation identifies an event of potential health concern through EI activities performed internally: a signal detected has been analysed and the related event has been verified.

Deciding for a Rapid Risk Assessment

The organisation decides, with the support of defined "triggering criteria", that the identified and verified event is potentially posing an immediate health risk for a population and therefore that there is an urgent need for a formal acute Rapid Risk Assessment (RRA). The process will define a specific level of health risk in relation to the event, and support evidence-based decision making for risk management and risk communication purposes.

Defining a RRA team

A dedicated team of experts is set up to produce the RRA. The team is led by a staff member defined through a roster and its composition will vary in relation to needs and staff availability; external experts may be involved.

Describing the Event

The team gathers all necessary details based on reliable sources of information and describes the event in a structured concise manner. All sources will be documented.

Defining of one or more Risk Questions

The team defines the scope of the RRA through the identification of one or more risk questions that need to be answered in relation to a health risk posed by the event. Questions will be defined in a standardised way, using simplified formats, and will include specific details in terms of hazard, exposed population, context and time.

Collecting data and Informative Contents

The team identifies what information is needed to answer the risk question/s and undertakes a systematic and structured documentation "around" the event. The step is based mainly on the use of reliable and proved informative sources however other sources may be considered. "Hazard", "Exposure" and "Context" are the thee domains of information around which informative needs will be collected.

Defining the Level of confidence of the information collected

The evidence collected "around" the event may be poor and led the team to rely on alternative sources including individual expertise. The team will document, evaluate, and qualitatively define the level of uncertainty associated with the information collected to ensure transparency and to weight any recommendation made.

Characterizing the level of Risk

Based on the information and on the evidence collected, the team qualitatively assigns a level of risk to the event. The step is expressed through the evaluation of two variables around the event, the likelihood of occurrence/spread, and the potential consequences on the population.

Stating the Risk

The team makes a final qualitative statement about the risk posed and complements it with the documented key scientific uncertainties and knowledge gaps around the information collected.

Performing a technical Interpretation of the Risk stated

The team provides decision makers with an overall technical review on process and outcomes, that includes critical options and recommendations on risk management aspects. Similarly, the team shares all interpreted outcomes with Risk Communication experts to allow the translation in key messages for different audiences.

Defining of one or more Risk Questions

The team defines the scope of the RRA through the identification of one or more risk questions that need to be answered in relation to a health risk posed by the event. Questions will be defined in a standardised way, using simplified formats, and will include specific details in terms of hazard, exposed population, context and time.

Content

Introduction: purpose, scope and audience of the document

This document outlines the methodological steps undertaken and suggested by Gulf CDC following the identification and confirmation, through epidemic intelligence activities, of an acute event of public health emergency of interest that requires a rapid assessment in terms of the health risk posed, or potentially posed, to the Gulf population. This process is commonly known in public health as Rapid Risk Assessment (RRA) and usually includes, in addition to the definition of a level of risk, a prompt identification of actions and recommendations to be considered for risk management and communication purposes in an acute phase.

RRA is nowadays an inherent component of activities undertaken by health actors at different levels including national, subnational authorities, international and regional health agencies or other stakeholders. The methodology used has been initially relying within these organisations mostly on the expertise of limited teams and individuals; however, procedures have been progressively standardised and documented for internal operational purposes and, more recently, in some cases they have be shared on the internet.

The objective of this document is to provide risk assessors in the GCC countries with a description of the main methodological principles and operational examples based on the experience of selected national and international health organisations directly involved in RRAs.

The purpose of this document is to support GCC countries in the definition of standardized operational procedures to ensure a timely and adequate RRA process, with the production of high-quality, consistent scientific outcomes. Specifically, this guide aims to assist GCC national health authorities as a complementary tool for conducting rapid risk assessments of acute public health events, in alignment with their obligations under the International Health Regulations (IHR). The guide is not intended to replace or override the established risk assessment procedures as outlined in Annex 2 of the IHR. In addition, this document seeks to help national health authorities define specific rapid risk assessment activities to implement within their country-level mandates in a manner that respects each State Party's ability to assess risks according to their unique public health systems and IHR plans.

The methodology described here is mainly based on selected technical guidelines and manuals that are currently available for the scientific community (see references). Contents collected have been analysed in detail and integrated, when necessary, with the outputs of a technical workshop organised on 6th and 7th of June 2023 in Saudi Arabia by Gulf CDC convening selected health experts involved in RRA at different levels and in different regions across the globe. During this event ("All-Hazard Risk Assessment Tools and Methods - Expert Consultation Workshop") participants had the opportunity to describe the main aspects of their own RRA processes and to cross-share experiences and lessons learned on the topic during recent years, reflecting together on practices, gaps, challenges, and defining areas of potential improvements. In addition to theoretical concepts, practical examples are provided of the RRAs conducted by GCC countries in coordination with the Gulf CDC.

Background

Gulf Center for Disease Prevention and Control

The Gulf Center for Disease Prevention and Control (Gulf CDC) is a semi-autonomous technical body of the Gulf Health Council whose establishment has been approved by the Supreme Council of the Gulf Countries Corporation in January 2021. Gulf CDC is an inter-governmental technical agency for public health aiming at strengthening public health coordination, capacity building and evidence generation to enable prevention, preparedness, response, and recovery to regional health emergency emergencies across the six member states of the Gulf Cooperation Council (in Arabic Alphabetical order): United Emirates, Bahrain, Saudi Arabia, Oman, Qatar, and Kuwait).

Epidemic Intelligence for Early Detection and Risk Management

Epidemic Intelligence (EI) is the production of timely and verified Intelligence around health events of epidemic/pandemic nature to be acted upon by health authorities and/or other actors. It is usually defined as a systematic collection from various sources of structured and unstructured health and health-related information which is verified, analysed, assessed, and subsequently converted into actionable knowledge to gain insights and inform subsequent tasks.

The objective of EI is to speed up the detection of potential health threats and promptly define appropriate control measures for a timely and adequate response. EI is considered a key public health surveillance approach at international level since the early 2000s, with professionals and dedicated teams that have been progressively involved within several health organisations. During the last decade the concept has become more common and better understood at national level and new terms have started to be used in replace or aside EI, with a reference to all-hazard risks and to a multisectoral dimension, as "Public Health Intelligence" and, more recently, "One Health Intelligence".

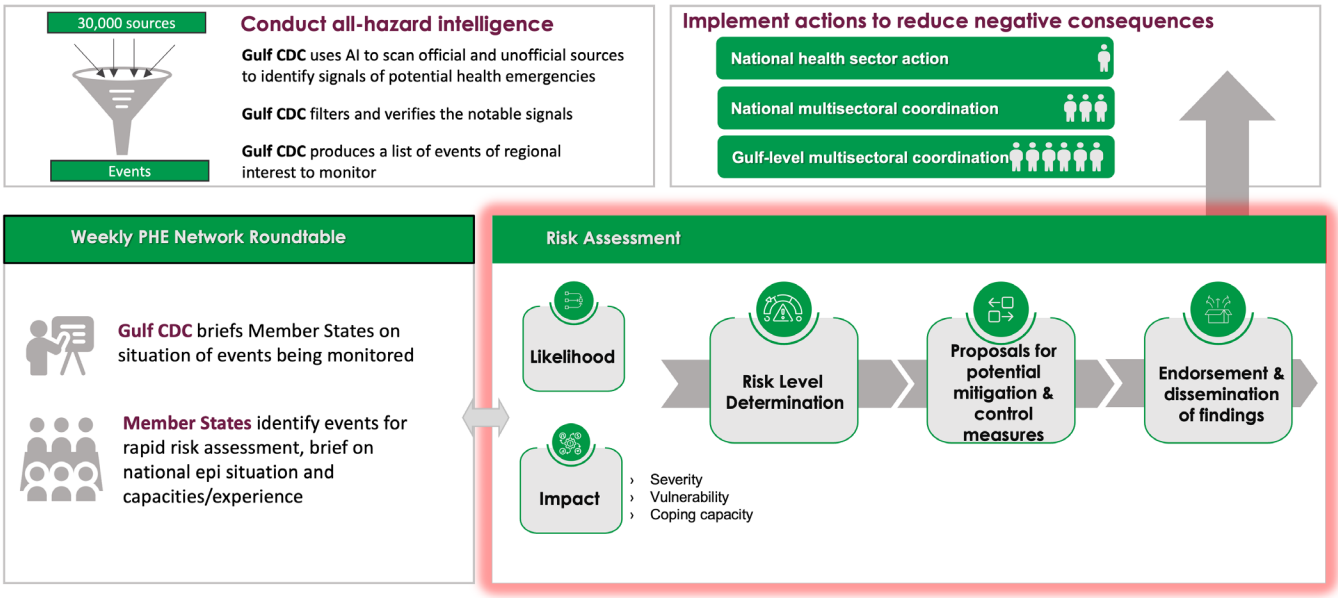
EI is implemented by health organisations at all levels in collaboration with external partners and experts. All EI related activities should be continuously tracked and documented ideally with the support of an event management information system. EI processes differ from organization to organization; key components of these processes are described in Table 1.

Table 1: Epidemic Intelligence cycle: simplified steps description

Signals Detection	*The identification of signals about events of potential health relevance through Event-Based Surveillance and Indicator-Based Surveillance activities from official and non-official (open and public sources).*
Event Verification	*The verification of an event of potential health relevance identified from a signal through formal and informal mechanisms in place at different levels*
Rapid Risk Assessment	*A prompt evaluation of the level of health risk in relation to a verified acute event (more details in this document).*
Operational Communication	*The sharing for operational purposes of the results of the overall EI process within and across health organisations, and with decision makers.*
Risk Communication	*The interactive transmission and exchange of information, advice and opinions among experts, community leaders or officials and the people who are at risk or who have a direct influence on risk mitigation due to their practices or behaviour.*

The EI is one of the many tools for risk management of public health threats. Figure 1. Demonstrates the key components of the GCC regional EI-based risk management cycle, developed by the Gulf CDC and its Member States. For this document, only Rapid Risk Assessment (RRA) will be defined in detail in the following paragraphs.

Figure 1: GCC Regional EI-based Risk Management Cycle



Note: Some of the risk management cycle is within GCC countries or beyond the scope of Gulf CDC

Rapid Risk Assessment as a Concept

RRA can be defined as an initial assessment of risk undertaken within a short time frame in the very early stages of an event of potential public health concern. It typically relies on experts' opinion and experience, as information is frequently limited and/or rapidly evolving and is associated with uncertainty. The RRA is a systematic, standardised, and ongoing process of gathering, evaluating and documenting information in relation to an acute health event. The process implies the definition of a level of risk in terms of health for a defined human population at a specific time (typically early stages).

RRA is one of the key procedural steps of the risk management cycle that applies to outbreaks and other acute events considered of potential health relevance based on specific criteria internally defined by an organisation. The purpose of a RRA is to support risk management decisions through the provision of mitigation options and recommendations to be timely acted upon. The outcomes are used to inform risk managers, policy makers and operational partners in general, and support them in evidence-based decision-making about how to manage and minimize the consequences of an event by implementing adequate and timely control measures. In addition to that, RRA can play a key role in terms of risk communication, as the information collected can support the definition of appropriate informative content for health professionals and the public about an event. Other more specific purposes and objectives may be defined at any level.

Rapid Risk Assessments and the International Health Regulations (2005)

The International Health Regulations (IHR) provide an international framework for health cooperation and response to public health emergencies. All countries must develop core public health capacities under the IHR, including the ability to assess risks from health events occurring within their borders.

Risk assessment is an important part of the IHR requirements for disease surveillance and response. This Rapid Risk Assessment guide aims to help GCC countries establish standardized procedures to conduct timely risk assessments. Though separate from specific IHR Annex 2 Risk Assessment tool (aimed at identifying whether an event is internationally reportable), following this guide supports GCC health authorities in meeting their global health security obligations. This guide provides health authorities with a more granular classification of the risk level for appropriate actions to be taken based on its magnitude.

Triggering a Rapid Risk Assessment

Within its responsibilities, the Gulf CDC implements all-hazard EI activities on a daily basis. This includes the identification of EI signals through dedicated staff using, in addition to manual searches, artificial intelligence and other automated systems to scan online sources of information, including media, social media and official reports. EI signals are filtered and verified internally to allow the identification of potential public health threats to the Gulf that need to be discussed with the countries. The signals and potential threats are shared with GCC countries (the Gulf CDC Public Health Emergency Network - PHEN) and a roundtable meeting is organized on a weekly basis. GCC countries also individually conduct EI and risk assessments based on national priorities and present them in this forum for discussion and joint consensus on regional threats and events of interest.

In most of cases, the threats identified and verified do not represent an immediate health risk for the population and therefore Gulf CDC continues to monitor them and re-evaluate the risk if new relevant information becomes available. If an event is considered to potentially pose an immediate health risk, PHEN considers it to promptly go through a formal and full Rapid Risk Assessment process. This decision is based on specific triggering criteria that should define what may represent a threat in terms of health for the Gulf population. Despite that, it must be always considered that any list created for this purpose should be seen as a tool "in support" to this decision, as many other factors not described may play an important role and drive this evaluation process. Below (Table 2) is a list of RRA triggering criteria defined by Gulf CDC that should be considered as an example to be adapted to specific contexts and to be used with professional judgement.

Table 2: RRA triggering criteria for Events of Regional Interest to the Gulf (2023)

Events that ALWAYS REQUIRE a RRA	***Events that MAY REQUIRE a RRA***
A novel disease in humans detected anywhere.	*An increase in expected/usual incidence of a disease compared to expected/usual trends (epidemic/ pandemic).*
An emerging/re-emerging disease detected anywhere.	*A report of falsified and counterfeit drugs or vaccines in the Gulf Region (toxic/hazardous material).*
A zoonotic spillover documented in the Gulf Region.	*A food/water contamination in the Gulf Region.*
Known disease reported for the first time in the Gulf Region	*An environmental contamination/exposure in the Gulf region.*
A new/recombinant variant of a disease in the Gulf Region.	*A health emergency due to human-induced hazard, e.g. armed conflict, civil unrest, terrorism, transportation crash, fires, (only upon request).*
An accidental release or deliberate use of biological, chemical agents, or radio-nuclear material in the Gulf Region	*A natural hazard (earthquake, tsunami, extreme temperature, etc.) occurring in any location with travel links to the Gulf Region.*
A natural hazard (e.g., earthquake, tsunami, flooding, extreme temperature etc.) occurring in the Gulf Region.	

Planning a Rapid Risk Assessment

A Rapid Risk Assessment is implemented to complement the information gathered about a newly event with pre-existing formal evidence base and readily available data, which has been appraised to ensure the best quality evidence is used. The information collected is used to answer one or more key risk questions that have been preliminary defined based on specific roles and responsibilities of an organisation. As time and evidence are limited, the process will often rely on specialist expert knowledge and interpretation.

Defining the Assessment Team

A dedicated team of experts should be set up as soon as the decision to produce an RRA has been taken and should be internally defined as the "RRA team" with clear roles and responsibilities. This team should be formed by the program manager dedicated to the process in relation to a specific event only. The RRA team is ideally led by a staff member representing the main contact within the organisation during the overall process and for all the time needed. (Tip: a roster of RRA personnel may be preliminary defined among the staff to ensure that the role is always covered during working hours). A 24/7 roster may be also considered, if sustainable for the organisation, especially in case of ongoing health emergencies or during mass gathering events).

The decision for a RRA is organisational. The team leader will be immediately informed and by default be involved in the definition of the RRA team. The organisation should be able to delegate this leading task to a different expert for any technical or operational reason, when needed.

The composition of the team varies in relation to organisational needs and staff availability; however, each member should be carefully defined as knowledge and expertise will influence quality and completeness of all RRA related products. (Tip: The responsibility of being a RRA team member for a defined event should be recognised within the organisational structure to ensure that it is known and accepted that some regular activities performed in relation to defined professional roles may be affected for a defined time).

The following roles should be ideally always covered within a RRA team, in addition to the leader:

- a member of the RRA responsible for signal detection activities. This person should provide accurate initial information about the event and integrate in real time additional details from different sources. This can be one of the EI analysts.
- an internal health professional, other than the team leader. This person, ideally a subject matter expert, will provide support on the identification of content needs and on the production of related intelligence.
- a communication expert supporting the revision of all RRA products in terms of content quality, any sensitivity, and key messages to different audiences: this role is particularly important in case of outputs targeted to the general public.
- external disease-specific experts may be required at any time of the process: the decision of involving them should be based on real needs identified by the team leader and the other members in the different steps of the process.

Setting the Assessment Scope

The RRA team, in addition to the program manager, should appraise the event criticality as quickly as possible to assign the type of RRA depending on the need for inputs from direct stakeholders and subject-matter experts (SMEs). The program manager shall then set the expectations (deadlines, quality, length, etc) from the team, stakeholders and SMEs and follow up accordingly to ensure compliance.

Example of RRA scope setting at the Gulf CDC includes:

- Type A: No input needed, produced in 72 hours.
- Type B: Input from SME needed, produced in 5 working days.
- Type C: Input from PHEN and SME needed, produced in 10 working days.

Outlining the Background/Context

Describing the Event

The RRA team should start by ensuring a detailed and precise description of the event under RRA process and summarise all details collected in a structured and concise manner. All reliable sources should be specified as well as the availability of additional details from further sources: the team needs to define precisely what is known, what has been already validated and what needs further investigation. The information should ideally include direct details provided from the local level through defined contact points or other complementary reliable local sources. The importance of this step should not be underestimated as the organised information will inform any actor involved in the process, represent a key component in defining the risk questions (see below) and determine what further specific information and evidence is needed for the overall RRA process. If the event spans across multiple locations and timepoints previously detected (e.g., increase in the expected/usual incidence of epidemic/endemic diseases globally), gather information relating to all the occurrences.

This RRA team could also choose to describe the context of the event. This component may be difficult to describe as potentially referring to unlimited informative fields, ranging from health care related aspects (e.g., quality of a healthcare system or concrete availability of effective treatment/control measures) to factors that may play an indirect role in terms of risk assessment and/or risk perception, as environmental, social, ethical, economic, and political aspects. Tip: While considering the description of contextual factors, the RRA team needs to maintain a balance between information gathered, time requirements and actual informative needs defined through the risk questions: what may sound interesting around an event is not always necessarily useful for the specific purposes of a defined RRA.

Describing the Hazard

The team is required to gather reliable and updated information to be able to describe in a comprehensive and simple way the hazard including details about the known effects on the population under assessment (e.g., a disease). The level of detail necessary may vary significantly in relation to the nature of the hazard. For example, in the case of a known viral disease, the information should include epidemiological details supporting the description of the main route/s of introduction, reservoirs, infectiousness, incubation period and length of asymptomatic infection. In addition, the team will need to collect information about the disease presentation, progression, severity, and details on groups at higher risk, but also diagnostic options, treatment efficacy, prophylaxis, and other control measures available.

As RRA are typically performed at initial stages, when limited details may be available, the hazard may be unknown, or not clear. In this case, the team should start by listing possible causes (“likely hazards”) based on what is known and on contextual factors such as the burden of diseases in the affected population (e.g., past outbreaks) or other possible “local” hazards (e.g., presence of nuclear plants, farms, exposure to wild animals, food consumption etc.). Ongoing and recent health events in neighbouring areas and regions should be considered as well.

Describing the Epidemiological Situation

The RRA team would gather information on disease occurrence globally (including temporal trends and previous incidents) using reliable sources (e.g., WHO). It is important to ensure identification of countries/areas with highest burden/transmission. Then, the team would gather information about the GCC region/country epidemiological information, including whether the hazard has previously been detected, and if so, then the trends of its detection and population groups most affected.

Conducting a Rapid Risk Assessment

Defining the Risk Question(s)

Once the background/context has been described, the team will further define the scope of the RRA process through the identification of one or more questions that need to be answered in relation to the risk posed or potentially posed in terms of health by the event. The formulation of appropriate "risk questions" is key to ensure that the process is practical and relevant: all the steps of the overall process are closely depending on this definition. Risk questions should be defined in a standardised way, using general and simplified formats. The formulation could be based first on generic drafts to be internally discussed within the team, taking in consideration specific organisational roles and responsibilities. Each risk question should ideally mention:

- Hazard, or likely hazard, with details on its source, if available (e.g., a known virus of animal origin)
- Health event, the health condition observed (e.g., a disease, a set of symptoms)
- Location, a geographical limitation to the assessment (e.g., a district)
- Contextual factors: Environmental, animal, and other factors related to, or contributing to, the hazard.
- Population, a specific population under assessment (e.g. overall population or unvaccinated children)
- Time, a specific time frame under assessment (e.g., a month, a week)

Risk questions can vary even in relation to the same event, depending on several factors including the role and the level at which an organisation is operating, but also timing, definition of specific sub-populations at risk, or level of interest or awareness by the public or media. An approach to be considered consists in defining different possible questions and then critically revise and discuss them in the team in order to define some level of priority. The team should try to be as specific as possible in relation to a defined context and move quickly from generic formulations as "what is the public health risk in relation to this event?" to more articulated questions such as "what is the health risk for the population of district "X" in relation to this event occurring in district "Y" during the next two weeks?". The table below (Table 3) includes a simplified list of potential risk questions in relation to a generic acute event.

Table 3: Example of Risk Questions

Event	Examples of Risk Questions
Respiratory vaccine preventable disease of bird origin that has affected people visiting a live bird market in X this week	*What are likelihood and impact for the population of X for the coming 2 weeks?*
	What are likelihood and impact for unvaccinated adults of X this year?
	What are likelihood and impact for people attending the market in the next 2 months?
	What are likelihood and impact for population of Y visiting X this month?
	What are likelihood and impact for population of Y in relation to poultry importation from X during this outbreak?

Collecting the Data for Assessment

The identification and collection of the required information to answer the risk question/s is commonly considered one of the key foundations of the overall RRA process. The team is required to undertake a systematic and structured documentation "around the event" to characterize the level of risk and define recommendations in terms of risk management and communication.
The step is based on the use of reliable evidence-based sources: peer-reviewed literature and official publications are prioritized; however, in case of limited documentation available, other sources will be considered as well, as grey literature. Experts' feedback may be also necessary, and, in this case, the involved professionals should clarify if the information provided is based on personal experience, professional opinion, or knowledge of evidence base (with references included). To summarise, the nature of any source of information directly or indirectly used for RRA purposes must be recorded and documented in any RRA output.

Likelihood parameters

The Likelihood of an event under RRA can here be defined as the chance of a situation described in a risk question happening, for example the occurrence of an event, or its spread. Due to the nature of the process, the estimation of likelihood is assigned only qualitatively through the use of simplified decisional tools.

This could include the collection of information describing the possible level of exposure to the hazard of a defined population. In case of a human population, for example, together with the susceptibility to the effects of the hazard, the team should consider other factors that may play a role, as demographic information, level of immunity, age-specific aspects, or, in case of toxic agents, a quantification of the exposure (e.g., dose ingested). For some hazards, the exposure can be influenced by factors not directly attributable to the population, for example, the distribution of competent vectors for vector-borne diseases, or the presence of animal hosts/reservoirs for zoonosis: this information needs also to be documented.

Example of Gulf CDC considerations include:

- Availability of routes of introduction
- Previous occurrence of the event or similar event
- Travel connectivity between the country where the hazard occurred and the GCC countries (see Appendix 3).
- 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

Impact Parameters

With impact we refer to the negative consequences and their magnitude in relation to the occurrence of a defined event. Within the RRA process the estimation of Impact is performed for a specific population and is measured in terms of direct health consequences. It should be noted that consequences could be considered in specific cases, and due to specific requests, also in terms of other sectors as economy, society, environment and more. Impact estimates within the RRA process are assigned qualitatively.

Typically, impact encompasses the **severity** of the adverse effects, the **vulnerability** of individuals and communities to those effects, and the **coping capacities** or resources available to mitigate and manage the impact.

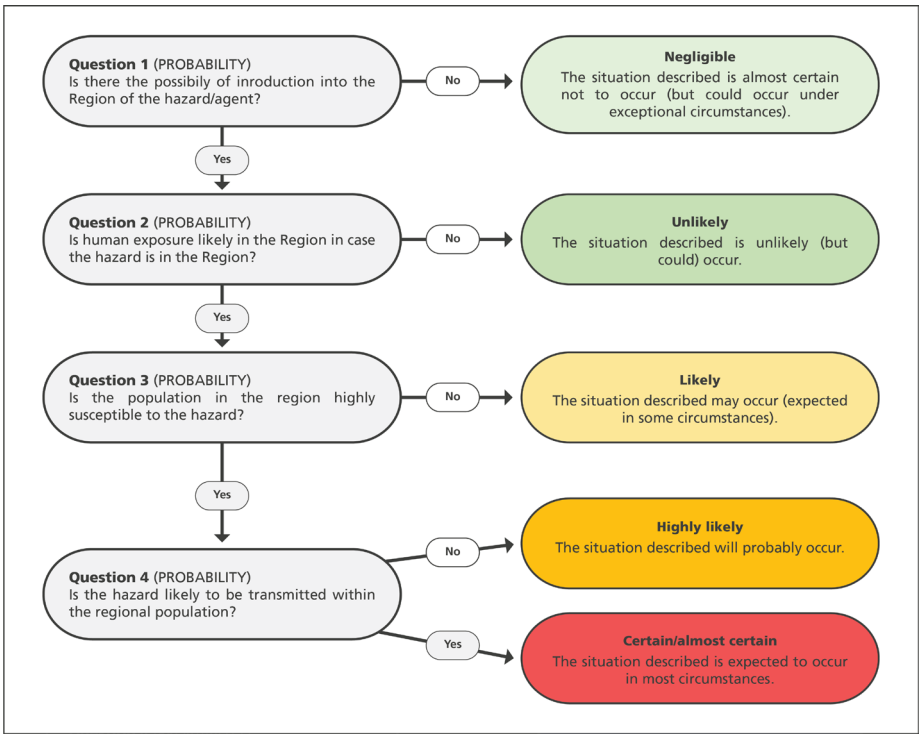
- Severity: Evaluate the severity of the health consequences, including morbidity, mortality, and long-term health effects.
- Vulnerability: Consider the susceptibility to the effects of the hazards and factors such as, demographic information, level of immunity, age-specific aspects.
- Coping capacities: Gather information about the regional/country capacities to detect and respond to the hazard. Prioritize the collection of data on key contextual factors that directly impact risk assessment and risk perception. Focus on factors that have a significant influence on the event, its consequences, and the effectiveness of risk management strategies. Consider the following:
    - Latest public health systems' capacity assessment reports. This includes availability of treatments, diagnostics, and vaccines.
    - Current ongoing activities to prevent/control the hazard
    - Relevant contextual information: environmental factors, social dynamics, ethical considerations, economic factors, and political influences.

Characterizing the Risk Level

Estimating the Likelihood Score

Likelihood could be characterized using the algorithm (Figure 2). The tool is based on modified models defined by national and international health organisations and currently in use (see references).

Figure 2: Example of a RRA algorithm for the estimation of likelihood of occurrence/spread (simplified questions)



If the information available is limited and does not allow an estimation of the likelihood this must be recorded and stated in any RRA output, together with a description of the details missing for that definition. After that, the team will still go through all the other steps of the process for the defined risk questions.

Estimating the Impact Score

Estimate the impact by scoring the severity, vulnerability, and coping capacities specifically for a defined population. The matrices below are based on adaptation of models defined by national and international health organisations that are currently in use (see references).

Severity: Severity refers to the magnitude or intensity of the adverse effects caused by a public health emergency. It focuses on the direct and indirect consequences of the emergency on various aspects of public health, society, and the affected population. When assessing severity, consider factors such as:

- Health Impacts: Evaluate the severity of the health consequences, including morbidity, mortality, and long-term health effects.
- Psychological Impacts: Consider the psychological and emotional toll on individuals and communities affected by the emergency.

Score	*Level of Severity*
1	*Very low*
2	*Low*
3	*Moderate*
4	*High*
5	*Very High*

Vulnerability: Vulnerability refers to the susceptibility of individuals, communities, or systems to the adverse effects of a public health emergency. It encompasses various factors that influence the likelihood and extent of harm experienced. When assessing vulnerability, consider factors such as:

- Socioeconomic Factors: Evaluate the social and economic conditions that make certain populations more susceptible to the impacts of the emergency, such as poverty, inequality, or lack of access to healthcare.
- Demographic Factors: Consider the age, gender, disability, and other demographic characteristics that may increase vulnerability.
- Health Infrastructure: Assess the capacity and resilience of healthcare systems and infrastructure to respond to the emergency and provide necessary healthcare services.
- Community Factors: Evaluate the level of community preparedness, awareness, and social support networks that can mitigate or exacerbate vulnerability.

Score	***Level of Vulnerability***
1	*Very low*
2	*Low*
3	*Moderate*
4	*High*
5	*Very High*

Coping capacity: Coping capacities refer to the resources, capabilities, and measures available to individuals, communities, and systems to respond to and recover from a public health emergency. The focus is on the ability to manage and mitigate the impacts of the emergency. When assessing coping capacities, consider factors, such as:

- Emergency Response Systems: Evaluate the effectiveness and efficiency of emergency response mechanisms, including coordination, communication, and mobilization of resources.
- Healthcare Capacity: Assess the availability of healthcare facilities, medical supplies, trained personnel, and surge capacity to handle the increased demand during the emergency.
- Community Engagement: Consider the level of community engagement, participation, and empowerment in emergency response and recovery efforts.
- Risk Communication: Evaluate the effectiveness of information dissemination, public awareness campaigns, and risk communication strategies to promote preparedness and response.

Score	***Level of Capacity***
5	*Very low*
4	*Low*
3	*Moderate*
2	*High*
1	*Very High*

Calculate the impact score:

Divide the sum of the assigned scores for severity, vulnerability, and coping capacities by 3. The impact is then assigned by what the quotient is equivalent to in the following impact matrix:

Score	Impact Level	Definition
1	Negligible	• Limited impact on the affected population. • Little disruption to normal activities and services. • Routine responses are adequate, there is no need to implement additional control measures. • Few extra costs for authorities and stakeholders.
2	Minor	• Minor impact for a small population or at-risk group. • Limited disruption to normal activities and services. • A small number of additional control measures needed that require minimal resources. • Some increase in costs for authorities and stakeholders.
3	Moderate	• Moderate impact as a large population or at-risk group is affected. • Moderate disruption to normal activities and services. • Some additional control measures needed and some of these requiring moderate resources to implement. • Moderate increase in costs for authorities and stakeholders.
4	Major	• Major impact for a small population or at-risk group. • Major disruption to normal activities and services. • A large number of additional control measures needed, including some requiring significant resources. • Significant increase in costs for authorities and stakeholders.
5	Severe	• Severe impact for a large population or at-risk group. • Severe disruption to normal activities and services. • A large number of additional control measures needed and most of these require significant resources. • Serious increase in costs for authorities and stakeholders.

Assigning a Risk Level

This step involves assigning to an event a level of risk posed for a defined population during a specific time. The assignment should follow the risk questions specifications and be based on the information collected, together with an evaluation of its quality of evidence. A risk is usually expressed as a combination of two variable in relation to an event that are typically assessed separately, "Likelihood" (probability) and "Impact" (consequences). Depending on what specified through the risk questions, these parameters will be assessed at a generic or at very defined level of population (e.g., specific vulnerable sub-groups).

Risk = Likelihood x Impact

The Risk Characterization consists in the definition of an overall risk level for each of the risk questions defined and is important to facilitate linking the event to potential options for risk management. As both parameters need to be considered, a risk matrix can be used to combine the separate estimates in a unique level of risk, using a qualitative approach.

Table 6 is a risk characterization matrix for RRA purposes adapted from existing models that has been defined by national and international health organisations and are currently in use (see references). Similar tools can be used at any level if adapted to specific contexts and organisational roles.

Table 6 Example of a RRA Risk Characterization matrix I (ranking by levels)

Likelihood	***Impact***				
	Negligible	***Minor***	***Moderate***	***Major***	***Severe***
Negligible	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Unlikely	*Negligible*	***VERY LOW***	***LOW***	***LOW***	***MODERATE***
Likely	*Negligible*	***LOW***	***LOW***	***MODERATE***	***MODERATE***
Highly likely	*Negligible*	***LOW***	***MODERATE***	***MODERATE***	***HIGH***
Almost certain/ sure	*Negligible*	***MODERATE***	***MODERATE***	***HIGH***	***CRITICAL***

Note: Some of the risk management cycle is within GCC countries or beyond the scope of Gulf CDC

Reflecting on the Level of Confidence

Rigorous scientific evidence around an acute event under RRA may be poor for several reasons including time constrains or limited information available at the early stages. For this reason, there is often the need to rely on sources of information as observational reports, individual experts' knowledge or opinions or other internal documentations. When reporting or discussing likelihood and impact estimates, the RRA team needs to evaluate, documents, and expressly define the level of uncertainty associated with the information collected for each of the risk questions answered, together with details about the reasons for any limitations. Factors as reliability, completeness, consistency, relevance, and quality of the information used should be defined, and any underlying assumption made by the team with respect to hazard, exposure and context should be stated. Grading the evidence of the information collected is important not only to ensure an overall transparency of the process but also to weight any response or mitigation recommendation that may be made (see next paragraph). The level of confidence
can be expressed using a simplified descriptive qualitative scale as in the following categorization (Table 7).

Table 7: Example of a qualitative scale for Level of Confidence

Good Evidence	*further research is unlikely to change confidence in the information.*
Satisfactory Evidence	*further research may have an impact on confidence and change the assessment.*
Unsatisfactory Evidence	*further research is likely to have an impact on confidence and likely to change the assessment.*

Developing the Risk Statement

A final qualitative statement should be finalised by the team to describe the separate estimations and the overall risk evaluation performed in a simple and clear way, in response to a define risk question initially posed. This should include the key scientific uncertainties and knowledge gaps documented throughout the overall RRA process and specify, when possible, recommendations for addressing these gaps. An example of risk statement structure is provided below and could be adapted to specific needs and roles:

Based on the available data at this point of time, within the next <time frame>, the overall risk of <event under RRA> is assessed as <overall risk ranking>

The likelihood of is <estimation level> for the general population/high-risk population (specify) and is driven by Y. There is a <level of confidence> due to Z.

The magnitude of the impact of <event under RRA> on individuals of the general population/high-risk population (specify) is X, driven by Y There is a <level of confidence> due to Z.

Present the final risk level in an easy-to-understand and replicable style. The following format is suggested:

Risk Assessed					
Negligible	*Very Low*	*Low*	*Moderate*	*High*	*Critical*

Interpreting Results of a Rapid Risk Assessment

Technical Interpretation for Risk Management purposes

As one of the main purposes of the process is to support, within the objectives framed, risk management strategies, the team may consider at this point to provide an overall technical review of the assessment conducted to be shared with decision-makers that includes critical options and recommendations, entirely based on technical outcomes. The support in terms of risk management consists in the definition of key options for response planning purposes and/or the identification of potential mitigation strategies potentially able to minimize the risk of spread and alleviate the impact of an event on the population. Each option or recommendation suggested should refer to a specific period and to a defined context, should be scientifically justified, and ideally include a documentation of expected benefits, potential consequences, and costs: this information will support their prioritization by decision-makers.

Technical Interpretation for Risk Communication purposes

The interpretation of RRA outcomes is also meant to support risk communication activities in relation to an event. Either through the direct finalisation of RRA products (e.g., reports, documents) specifically addressed to defined audiences or by sharing outcomes with risk communication experts, the RRA team needs to provide potential key messages based on the technical evidence gathered that will be adequately addressed in terms of language, risk perception to the different targets, and shared through specific communication channels.

Documentation and Operational Use

A comprehensive documentation through all steps conducted needs to be ensured while conducting an RRA as the team must be able to review any activity and decision taken and easily trace sources of information and expert opinions gathered: the documentation of the process will allow the team in any moment to justify contents and assumptions included and will also be important to estimate an evolving risk in case of new and relevant details.

RRA outcomes should be summarised in a document (e.g., a report) using templates internally defined by the organisation. The structure of this template should be based on specific objectives and responsibilities of the organisation (see. Annex II for Gulf CDC example). The document may include details about specific concerns identified by the team during the process, as a missing expertise, a lack of evidence in relation to a specific step performed, or the suggestion for further risk questions to be considered in the future.

The time frame to produce the report may vary in relation to the urgency of the assessment and/or the role of an organisation; however, it should ideally not exceed 72 hours from the moment when the RRA was decided. The process may need to be updated in light of new information available and in case of specific developments potentially changing the risk level defined or suggest different risk management and communication strategies: the decision for a formal revision is usually taken internally; however, it could follow a specific external request for different purposes.

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Annex I: Definitions and Terminology

Acute Event of Public Health Relevance: an event representing an immediate threat to human health and requiring prompt action.

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

Environment: the complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival; it refers to the physical location and context in which people live and interact.

Epidemic Intelligence: the systematic collection, analysis, and communication of any information to detect, verify, assess, and investigate events and health risks with an early warning objective.

Event: a manifestation of disease or an occurrence that creates a potential for disease, which can include events that are infectious, zoonotic, chemical, radiological or nuclear in origin and transmitted by persons, vectors, animals, goods/food, or through the environment.

Event Verification: within the Epidemic Intelligence cycle, the verification of an event of potential health relevance identified by a signal through formal and informal mechanisms in place at different levels.

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

Grey Literature: Information produced on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing i.e. where publishing is not the primary activity of the producing body.

Hazard: anything with the potential to cause harm/adverse effects in exposed population. Note that the presence of a hazard does not automatically imply a threat.

Impact: within the RRA process, the negative consequences, and their magnitude in relation to the occurrence of a defined situation for an event described in a risk question.

Level of Confidence: within a RRA process, the uncertainty associated with the information collected for each risk question.

Likelihood: within the RRA process, the chance of a situation described in a risk question happening

Mitigation Measures: activities implemented to reduce or eliminate risks to a population from hazards and their effects, addressing likelihood and/or consequence.

Operational Communication: the sharing for operational purposes of the results of the overall EI process within and across health organisations, and with decision makers.

Public Health Threat: the occurrence of a hazard to human health.

Response: a set of measures aimed at mitigating the public health impact resulting from the occurrence of an event.

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

Rapid Risk Assessment: within the Epidemic Intelligence cycle, an initial evaluation of risk undertaken within a short time frame in the very early stages of an event of potential health concern, mainly for risk communication and management purposes.

Rapid Risk Assessment Team: an internal dedicated team of experts set up as soon as the decision to produce a Rapid Risk Assessment has been taken.

Rapid Risk Assessment Triggering Criteria: internal criteria that should support an organisation in the definition of an event potentially posing an immediate health risk that needs a to promptly go through a formal and full Rapid Risk Assessment process what may represent a threat in terms of health for the population.

Risk: the combination of consequences (impact) of an event and the associated likelihood of a harmful effect to a population.

Risk Assessment: the overall process of risk identification, risk analysis and risk evaluation that consists in a systematic process of gathering, assessing, and documenting information to estimate the level of risk and associated uncertainty related to an event, during a specific period of time and in a specified location. Data collected through the process are used to inform risk characterization and support risk management and communication.

Risk Characterization: the assignment of a level of risk posed by an event for a defined population during a specific time. It is based on the collection and analysis of reliable information about hazard, exposure and context.

Risk Communication: the interactive transmission and exchange of information, advice and opinions among experts, leaders or officials and the people who are at risk or who have a direct influence on risk mitigation due to their practices or behaviour.

Risk Management: the process of identification and implementation of policies and activities to avoid or minimize the likelihood and/or the impact of an ongoing health event.

Risk Question: a question formulated in relation to a risk posed, or potentially posed, by an event in terms of health. Risk questions define scope and objectives of a Rapid Risk Assessment process.

Signals Detection: within the Epidemic Intelligence cycle, the identification of signals about events of potential health relevance through Event-Based Surveillance (EBS) and Indicator-Based Surveillance (IBS) activities.

Annex II: RRA Report Template Structure (Example)

RRA Title

Population, Event, Location, Time (Example: Human, Ebola Virus Disease - Country X, date)

Date of Trigger

When the event has been opened.

Reason for Trigger

Reason the hazard is considered to be an event

Production Date

Date of the report being produced and has been finalized

Information disclaimer

Example: This document provides guidance based on the information available to XXX as of "date".

Background

Short description based on initial information available (sources included):

The Event

The Hazard

The Epidemiological Situation of the health condition/hazard (global and GCC/national level)

Risk question(s)

Description of one or more risk questions defined.

Risk Characterization: Estimation of Likelihood and Impact

Separate qualitative estimation for each of the two risk components supported by risk tools.

Level of Confidence

Qualitative definition of the level of uncertainty associated with the information collected

Risk Characterization: Overall risk definition

Combined qualitative risk evaluation supported by a risk matrix.

Risk Statement

Final simplified statement on the overall risk in response to a define risk question initially posed

Recommendations

Technical review to be shared with decision makers with response options and recommendations.

References

List of references, including external experts involved.

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Further acknowledgements

Authors

List of internal experts involved (optional, may be referred as internal RRA team)

Note: The Gulf CDC has established SOPs, tools, and templates for RRA and EI.

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