

# Early Warning Alert and Response in Emergencies: an operational guide







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# Overview

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# Abbreviations

<b>AFP</b>	acute flaccid paralysis
<b>ARI</b>	acute respiratory infection
<b>AWD</b>	acute watery diarrhoea
<b>CBS</b>	community-based surveillance
<b>CEBS</b>	community event-based surveillance
<b>CFR</b>	case fatality ratio
<b>CHW / CHV</b>	community health worker/community health volunteer
<b>CSO</b>	civil service organization
<b>DHIS2</b>	District Health Information Software version 2
<b>EBS</b>	event-based surveillance
<b>eDEWS</b>	electronic disease early warning system
<b>EIOS</b>	epidemic intelligence from open sources
<b>EWAR</b>	Early Warning Alert and Response
<b>EWARN</b>	Early Warning Alert and Response Network
<b>EWARS</b>	Early Warning Alert and Response System
<b>GIS</b>	geographic information system
<b>GOARN</b>	Global Outbreak, Alert and Response Network
<b>GPS</b>	global positioning system
<b>HeRAMS</b>	Health Resources Availability Monitoring System
<b>IBS</b>	indicator-based surveillance
<b>IDSR</b>	Integrated Disease Surveillance and Response
<b>IHR</b>	International Health Regulations
<b>IOA</b>	Integrated Outbreak Analytics
<b>IPC</b>	infection prevention and control
<b>IPD</b>	in-patient department
<b>IT</b>	information technology
<b>MERS</b>	Middle East respiratory syndrome
<b>NGO</b>	nongovernmental organization
<b>OPD</b>	outpatient department
<b>PCR</b>	polymerase chain reaction
<b>PHSA</b>	public health situation analysis
<b>RDT</b>	rapid diagnostic test
<b>RRA</b>	rapid risk assessment
<b>RRT</b>	rapid response team
<b>SARS</b>	severe acute respiratory syndrome
<b>SMS/IM</b>	short message service/instant messaging
<b>SOP</b>	standard operating procedure
<b>UN</b>	United Nations
<b>VHF</b>	viral haemorrhagic fever
<b>WASH</b>	water, sanitation and hygiene
<b>WHO</b>	World Health Organization



# Glossary

**Alert:** A public health signal that has been i) verified to be an event; ii) risk assessed; and iii) requires an intervention (an investigation, a response or a communication with partners or the public) (1). (See also **signal** and **event**.)

**Alert management:** The systematic process of managing all incoming information from signal verification to risk assessment and characterization to decide if a response is required to mitigate the public health risk. (See also **verification** and **risk assessment**).

**Alert threshold:** A predefined number of cases (or, e.g., proportion, rate, trend). Once an alert threshold is reached or surpassed, a signal is triggered and the process of verification and risk assessment and risk characterization is started (2).

**Attack rate (or cumulative incidence rate):** The cumulative incidence of cases of a disease reported in a defined population at-risk since the beginning of the outbreak (2, 3).

**Case definition:** A set of standard criteria that must be fulfilled to classify a person as a case of a particular disease or health condition for the purposes of surveillance and outbreak investigation (not case management). Case definitions for EWAR are usually based on signs and symptoms. In outbreak investigations, case definitions are supplemented by time, place and person information in order to identify cases that belong to the outbreak in question (4).

**Case fatality rate (CFR):** The proportion of cases of a specified condition who die from that condition (4).

**Cluster:** An aggregation of cases of a disease or health condition that are linked in time and place (4).

**Community-based surveillance (CBS):** The systematic detection and reporting of events of public health significance or of cases of a specific disease, within a community, by community members (5).

**Complex humanitarian emergency:** A humanitarian crisis in a country, region or society where there is total or considerable breakdown of authority resulting from internal or external conflict, and which requires an international response that goes beyond the mandate or capacity of any single and/or ongoing UN country programme (6).

**Contact:** A person who has experienced an exposure to a hazard (e.g., infectious case, infectious animal, radio nuclear hazard).

**Contact tracing:** Identification of and measures applied to persons (contacts) who have experienced a potentially infecting exposure to a person infected with a communicable disease (case). The overall aim is to interrupt chains of transmission. Contacts of cases may be advised to restrict their social activities and mixing with others, e.g., home quarantine (1).

**Emergency:** A situation impacting the lives and well-being of a large number of people or a significant percentage of a population and requiring substantial multisectoral assistance (7). This includes humanitarian emergencies due to conflict, natural disasters, food insecurity, outbreaks and famine.

**Epidemic** (synonym **outbreak**): The occurrence of more cases of a particular type of disease, chronic condition or injury than expected in a given area or among a specific group of people, over a particular time interval (4).

**Epidemic-prone disease**: A disease likely to cause an epidemic or disease outbreak (4).

**Epidemic Intelligence**: The systematic collection, analysis and communication of information from different sources to detect, verify, assess and investigate events and infectious disease risks with the objective of providing early warning (1).

**Evaluation**: The periodic assessment of the relevance, effectiveness and impact of activities in the light of the objectives of the surveillance and response systems (8).

**Event**: The International Health Regulations (IHR (2005)) define an event as “[...] a manifestation of disease or an occurrence that creates a potential for disease; [...]” (9). It may include events that are infectious, zoonotic, food safety, chemical, radiological or nuclear in origin, and are transmitted by persons, vectors, animals, goods/food or through the environment. In the context of EWAR, an “event” refers to a signal that has been verified (1). (See also **signal** and **alert**.)

**Event-based surveillance (EBS)**: The organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding potential public health events or risks which may represent an acute risk to human health (1).

**EWAR (Early Warning Alert and Response)**: The organized mechanism to rapidly detect and respond to signals that might indicate potential acute public health events (2).

**Incidence rate**: The number of new cases during a given time interval in a specified population (10).

**Indicator-based surveillance (IBS)**: The systematic collection, monitoring, analysis and interpretation of structured health-related data (indicators), produced by health facilities or other defined sources. Reporting is based on standardized case definitions of selected priority diseases or conditions (1).

**Line list**: List of individual cases including relevant patient information (e.g., demographic information and date of onset of disease) used to monitor a suspected or confirmed disease outbreak (2).

**Monitoring**: Monitoring in the context of surveillance and response systems refers to the routine and continuous tracking of the implementation of planned surveillance activities, and of the overall performance of these systems (1).

**Outbreak**: See **epidemic**.

**Outbreak investigation**: Process that aims at determining the cause of an outbreak and who is at-risk so that control measures can be implemented, thus reducing morbidity and mortality. It should begin as soon as a signal detected by surveillance has been verified and an alert is raised. In the initial stage of an outbreak, the causative agent may not be known and general control measures must be taken, based on the best available data. Once the cause has been confirmed, specific measures to control the disease can be undertaken (2).

**Outbreak preparedness**: A state of having key resources and capacities in place for optimal outbreak response (2).

**Performance indicators**: Predefined metrics of how well a surveillance system is functioning. These indicators may measure the process of reporting (e.g., completeness, timeliness, effective community engagement), the action taken in response to surveillance information (e.g., the percentage of cases investigated) and the impact of surveillance and control measures on the disease in question (e.g.,

the percentage of outbreaks detected by the system, the drop in the number of cases over a specified time interval).

**Proportionate (or proportional) mortality:** The proportion of deaths attributable to a particular cause among all reported deaths during a selected period (4).

**Public health hazard:** Biological, chemical, physical or radionuclear agents with potential to cause adverse health effects in an exposed population (11).

**Public health risk:** The likelihood of an event that may adversely affect the health and livelihoods of human populations (9).

**Response:** Public health actions triggered by the detection of an alert. Response can include the following actions: monitoring the event, informing the population, field investigation and implementing control measures. The type of response should be adapted according to the nature of the public health risk (1).

**Risk assessment:** A systematic process of gathering, assessing and documenting information to assign a level of risk (**risk characterization**) to human health from an acute public health event, and to inform actions to manage and reduce the negative consequences of events (11).

**Risk characterization:** A process of assigning a level of risk to the combination of a hazard, exposure to it and context assessments, based upon its likelihood of occurring and the scale of the resulting public health consequences. This may be based upon quantitative models, comparisons against guidance values (e.g., in food safety risk assessments) or on expert opinion (11).

**Rumours:** Unverified information regarding disease occurrence received from informal sources (2).

**Secondary attack rate:** Proportion of cases among contacts of primary cases during a given time interval (3).

**Sensitivity:** The ability of a surveillance or reporting system to detect **all** true health events (2).

**Signal:** The initial detection (by IBS or EBS) of a potential public health event, prior to verification. Signals may consist of information/reports of cases or deaths (individual or aggregated), potential exposure of human beings to biological, chemical or radionuclear agents, or of the occurrence of natural or manmade disasters (1). (See also **alert**, **event** and **verification**.)

**Specificity:** The ability of a surveillance or reporting system to exclude events that are not, in fact, true health events (2).

**Triage:** The process of screening the data and information that are relevant for early detection purposes (i.e., screening out mild/irrelevant events from potential acute public health events, and cleaning to eliminate duplicates and correct obvious mistakes) (1).

**Verification:** The proactive assessment by EWAR of the validity of the signals collected – eliminating hoaxes, false rumours and artefacts. This may involve contacting the primary source or additional sources, or performing field investigations (1).

**Zero reporting:** The reporting of “zero case” when no cases have been detected by the reporting unit within a defined time interval. This allows the next level of the reporting system to be sure that no data have been lost or that any reporting was forgotten (2).



# Background to this operational guidance

## Aim

Populations affected by emergencies are continually at risk of outbreaks of epidemic-prone diseases and other public health hazards. This operational guidance aims to guide decision-making on when and how to implement and strengthen Early Warning Alert and Response (EWAR) in preparation for and response to emergencies. Each module aims to provide updated operational guidance for EWAR practices that may be more easily understood and applied during emergencies. Through its application, this operational guidance aims to contribute to:

- earlier detection of acute public health events
- earlier and more effective response
- reduced impact of emergencies on health
- increased trust of the population in the (public) health system
- fulfilling our collective commitments to the International Health Regulations (IHR, 2005).

“This operational guidance aims to guide decision-making on when and how to implement and strengthen Early Warning Alert and Response (EWAR) in preparation for and response to emergencies.”

## Development process

WHO, in collaboration with technical experts, partners and ministries of health, has previously published foundational guidelines on the implementation of EWAR, including:

- [Outbreak surveillance and response in humanitarian emergencies: WHO guidelines for EWAR implementation, 2012](#) .
- [Early detection, assessment and response to acute public health events: implementation of Early Warning and Response with a focus on event-based surveillance \(interim version\), 2014](#) .

These guidelines were successfully implemented in numerous emergencies and contributed toward strengthening of core surveillance capabilities at local, country, regional and global levels. Building upon this foundation, the WHO Health Emergencies Programme sought to provide updated operational guidance that incorporates lessons identified from EWAR implementation over the subsequent years, and (where possible) to standardize and consolidate existing guidance.

In 2017, the EWAR Technical Working Group was formed, consisting of experts from international organizations and humanitarian partners contributing towards EWAR in emergencies. The group convened three major technical consultation meetings:

- Early Warning, Alert and Response Systems Technical Consultation, WHO, Geneva, December 2017 (12)
- 2nd Technical Consultation on Early Warning and Response (EWAR), WHO Regional Office for the Eastern Mediterranean, Cairo, December 2018
- EWAR in Emergencies Technical Working Group meeting, IFRC, Geneva, December 2019.

Each meeting received the strong participation from global partners, WHO offices across the three levels and other UN organizations. These meetings shared common objectives: to formulate, develop and review this operational guidance; to share with and learn from countries and regions the implementation of EWAR and associated research; and to develop and progress a roadmap for the broader EWAR activities.

In 2021, a group of technical writers was established to update and consolidate contents through incorporating recommendations and outcomes of the technical consultations. Subgroups of the EWAR Technical Working Group were formed to thoroughly review individual modules; they convened virtually to agree upon major changes to be made. WHO undertook final technical editing.

## Target audience

This operational guidance is designed for persons responsible for disease surveillance across administrative levels, including:

- frontline healthcare workers and public health staff who can recognize unusual events and collect and report surveillance data;
- district teams and rapid response teams (RRTs) who are involved in receiving and verifying signals and responding to EWAR alerts;
- epidemiologists, data scientists and data/information managers who design, implement, monitor and evaluate surveillance systems, and use EWAR data to prevent, identify, monitor and mitigate the impacts of outbreaks and other public health emergencies; and
- advisors and policy-makers at Ministries of Health, WHO and nongovernmental organizations involved in public health decision-making and surveillance.

## Use and formats

This operational guidance is presented as a series of modules that follow a logical series of steps for implementing a new EWAR system or strengthening existing systems in an emergency. The guidance may also be used as supplementary material for EWAR training and as a basis for framing evaluations of a current EWAR system.

It may be studied from start to finish, or specific modules may be referenced separately. Cross references between complementary modules are included throughout and some key concepts are repeated in relevant locations, allowing for easy use of individual modules and navigation across modules .

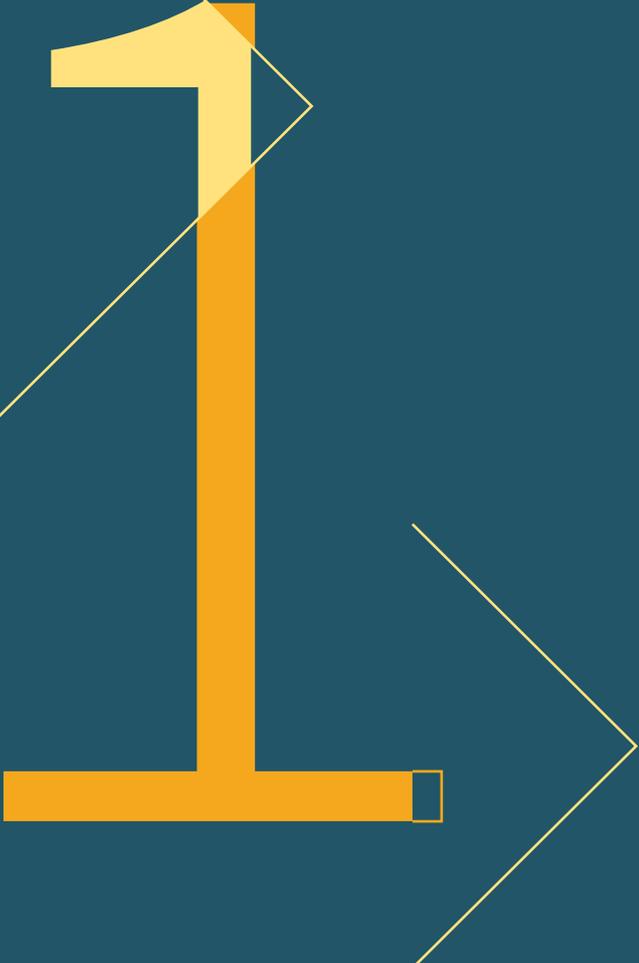
This operational guidance is intended to complement the wide range of existing readings available for the description and evaluation of EWAR in emergencies, indicator-based surveillance (IBS), event-based surveillance (EBS), and monitoring and evaluation of surveillance systems (see [Key Readings](#) )

## Terminology

Over the years, several terms have been used to describe systems and processes around early detection and assessment of public health threats in order to trigger an alert and initiate a response if needed. In this guidance, for the sake of consistency, we generally follow previous terminology used in the 2014 WHO publication *Early detection, assessment and response to acute public health events: Implementation of Early Warning and Response with a focus on Event-Based Surveillance (Interim Version) (1)*.

We use the term **Early Warning Alert and Response (EWAR)**. Similar terminology used elsewhere includes *Early Warning, Alert and Response System (EWARS)*, *Early Warning, Alert and Response Network (EWARN)*, *Disease Early Warning System (DEWS)*. All these terms represent surveillance and early warning reporting networks established for emergencies, either when routine surveillance is underperforming, disrupted or non-existent, or when it is integrated as a function of routine surveillance systems.

We apply a **signal-event-alert-response** schema ([Module 5: Fig. 2](#) ). Here, the initial information obtained by IBS or EBS undergoes a *triage* (where applicable) before being reported as a *signal*. All *signals* require *verification*. Verified *signals* become *events*. *Events* in turn require a *risk assessment* and *risk characterization* and are confirmed as *alerts* if they represent a potential *public health threat* that requires a *response*. Other guidance documents may apply different terms for this process; for example, the Integrated Disease Surveillance and Response (IDSR) strategy defines an *alert* as the initial early warning sign of a potential public health event that must be investigated further and verified as true or not (13). Additionally, there may be settings where EWAR is in place but a different terminology is used to describe either the process or the overall systems and networks.



# Introduction to EWAR

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# 1. Introduction to EWAR



## 1.1 What is EWAR?

EWAR stands for Early Warning, Alert and Response. EWAR is a system that provides an early warning of acute public health events and then connects this function to an immediate public health response. It is one of the most immediate and important functions of a surveillance system.

EWAR encompasses the following components and processes.

- **Early warning** – the rapid detection of signals that may indicate potential acute public health events. Sources of early warning data may include notifications from health facilities, community members and other entities, which feed into IBS and EBS systems.
- **Alert management** – the systematic process of managing all incoming information, from signal verification to risk assessment and characterization, in order to decide if a response is required to mitigate the public health risk. For efficiency, all signals should preferably be channelled into a common system so that they can be investigated and managed systematically.
- **Response** – public health actions triggered by the detection of an alert.



## 1.2 What is the role of EWAR in emergencies?

Emergencies also produce many risk factors that promote the emergence, transmission and outbreaks of communicable diseases, such as: food insecurity and progressive loss of livelihoods; disruption or breakdown of preventative or curative health and other essential services (e.g., access to safe water, sanitation); mass displacement of people into regimented or camp-like settlements or neighbouring

host communities, increasing the risk of overcrowding; sudden loss of livelihoods; and/or rapid environmental change due to a natural disaster (14–16). At the same time, national surveillance systems may be underperforming, disrupted or nonexistent during emergencies, which may adversely impact and delay the detection of and response to outbreaks (17, 18).

These factors can lead to excess morbidity and mortality due to outbreaks, or result in large-scale increases in disease transmission among emergency-affected populations. One of the most urgent priorities in an emergency is, therefore, to establish a functioning EWAR to rapidly detect and respond to events that may lead to outbreaks and other public health emergencies.

The overall aim of EWAR in an emergency is to reduce excess morbidity and mortality due to prioritized epidemic-prone diseases and other public health hazards, including:

- severe diseases and conditions with a potentially high case fatality ratio (CFR) and/or potential for spread (e.g., cholera, measles, meningococcal meningitis);
- emerging or re-emerging communicable diseases, including zoonotic diseases;
- diseases targeted for elimination or eradication (e.g., poliomyelitis); and
- diseases and hazards with potential for intentional release (e.g., anthrax, tularaemia, chemical poisoning).

To achieve this aim, EWAR systems must provide rigorous and continuous early detection and rapid response to such hazards in emergency-affected populations. EWAR should not be used to replace routine disease surveillance; however, functions should be re-integrated into the national surveillance system once the emergency phase ends (see [Module 16](#) .

The role of EWAR in emergencies is context dependent and should always consider existing country capacity, including national EWAR and surveillance structures (see [Module 2](#)  and [Module 3](#) .



## 1.3 When should EWAR be initiated?

For **sudden-onset emergencies** (e.g., due to large-scale displacement, natural disasters), given the potential for the rapid enlargement of outbreaks of epidemic-prone diseases, the establishment of **EWAR should be prioritized in the first week** after the onset of the emergency (19). The WHO's Emergency Response Framework performance standard timeline for strengthening an existing EWAR or establishing a new EWAR is **within three to ten days** after the sudden onset event/emergency (7).

For the majority of **gradual-onset emergencies** (e.g., due to slowly-evolving civil conflict, food insecurity and famine), the establishment of EWAR should also be prioritized **within the first week from the decision to activate EWAR** (19).



# 1.4 Who is involved in EWAR and what are their roles?

Usually, the national public health authorities lead the implementation of EWAR with support from WHO and other partners. Responsibilities and involvement of different partners will vary according to the context and the capacity (Table 1). Of note, the Health Cluster and the Water, Sanitation and Hygiene (WASH) Cluster should play key roles in the coordination of partners and dissemination of EWAR reporting among partners.



Table 1. Lead roles in EWAR of different stakeholders

Partners	Technical advisory	Design	Implementation	Coordination	Dissemination
Ministry of Health		✓	✓	✓	✓
WHO Country Office	✓	✓	✓		
Health Cluster				✓	✓
WASH Cluster				✓	✓
Other UN Agencies			✓		
NGOs	✓		✓		

## 1.5 Where is EWAR used?

Ideally, all national surveillance systems should have an EWAR function that can rapidly detect and respond to disease outbreaks and other acute public health events. In this guidance, we focus on the implementation of EWAR in emergencies due to conflict, natural disasters, food insecurity and famine, and other humanitarian events. This is because the implementation of EWAR in emergencies is challenging and, consequently, may require the improvement or development of additional components of the national surveillance system. Moreover, emergencies may have a significant impact on the lives and well-being of a large number of people and require substantial multisectoral assistance (7).

## 1.6 How to achieve EWAR objectives

The successful implementation or strengthening of EWAR is dependent on ensuring appropriate coordination, assessment, planning, resourcing and collaboration across all stages.

### Prior to EWAR implementation

- ✓ Secure the leadership of the national public health authorities and the support of all potential partners, including WHO, Health and WASH Clusters, and nongovernmental organizations (NGOs).
- ✓ Discuss all stages of the design, implementation, management and exit/integration strategy for EWAR in full coordination with other health partners in the country, through the national public health authorities and other coordinating bodies (e.g., the Health Cluster). This is essential for their participation and for the contribution of human and operational resources and of technical expertise. It is also essential for securing a network of health facilities and/or community volunteers for reporting (see [Module 2](#) .
- ✓ Involve communities in EWAR design and implementation where feasible to establish trust, generate a feedback mechanism and promote the involvement of local populations in all aspects of decision-making and future responses (see [Module 2](#) .
- ✓ Define the set of epidemic-prone diseases and public health hazards to be monitored, according to the context, and differentiate these from the full range of reportable diseases and conditions. This requires good understanding of context and the affected population, as well as assessment of the epidemic profile of the country/region and of the existing national surveillance system. This critical understanding helps to identify gaps in the existing reporting network of health facilities, electronic or manual data collection, data analysis, reporting, investigation and/or response mechanisms (see [Module 3](#) .

- ✓ Decide whether to strengthen an existing EWAR or develop a new EWAR. It may be that the existing EWAR can be strengthened with additional support during an emergency, rather than needing to be replaced with a new emergency version (see [Module 3](#) )

### During the early phase of an emergency

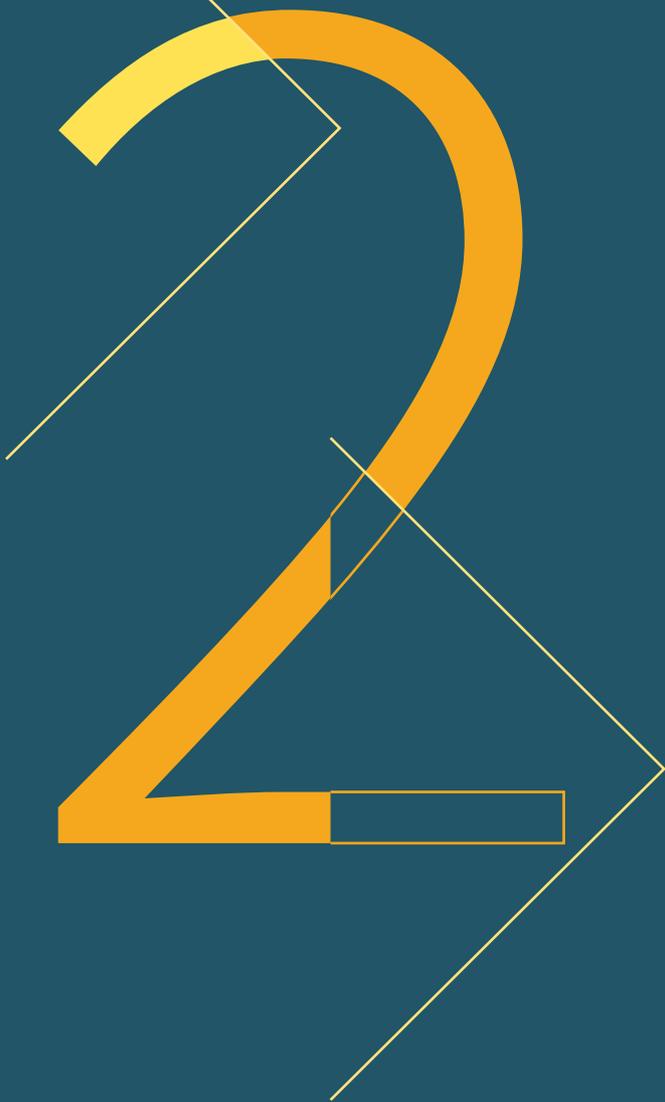
- ✓ The national public health authorities or equivalent may require significant support from WHO and other partners in strengthening and/or implementing EWAR. They must remain at the forefront of decision-making on how EWAR is used.
- ✓ Ensure EWAR in emergencies uses existing national public health authorities' human resources and systems as far as possible, and merges with national public health authorities-supported disease surveillance systems (e.g., IDSR-based) to avoid duplication of efforts.
- ✓ Remember that ownership of all data generated from EWAR remains with the national public health authorities (or its delegated equivalent). These authorities should oversee how data are used, shared and stored.

### During the decreasing phase of the emergency

- ✓ Plan for the (re)integration of EWAR into the national system when the emergency is over. EWAR in an emergency should be seen as a function of, not a replacement for, the routine disease surveillance system. EWAR should be scaled down or integrated as a new component of the national disease surveillance system if this was absent before the emergency. The implementation strategy for EWAR should be expressly linked to a transition strategy appropriate for the context (see [Module 16](#) )

### Avoid common mistakes/pitfalls

- ✗ Confuse the role of EWAR in an emergency with the broader role of a national surveillance system.
- ✗ Try to cover objectives that are inappropriate for EWAR, such as applying it to measure the full burden of communicable and noncommunicable diseases, malnutrition, mortality in a population, or health programme performance, workload and healthcare utilization.
- ✗ Fail to fully address common challenges when implementing EWAR in emergencies, such as:
  - a lack of a defined strategy for data collection (see [Module 5](#) )
  - including too many diseases/conditions under IBS/a lack of prioritization (see [Module 6](#) )
  - insufficient use of EBS to complement IBS (see [Module 7](#) )
  - failing to incorporate EWAR in local/national systems for the detection of signals or management of alerts (see [Module 8](#) )
  - delayed or overly complex compilations of data and presented analysis to be used effectively to direct public health actions (see [Module 10](#) )
  - insufficient capacity to respond to public health alerts (see [Module 11](#) )
  - failing to share or link EWAR data to public health action (see [Modules 11](#)  and [15](#) )
  - inadequate or irregular training and supervision of health facility and community health workers (see [Module 13](#) )
  - insufficient feedback to health facilities and other data collection points, surveillance partners and communities on the findings and actions resulting from EWAR (see [Module 15](#) )



# Preparedness for EWAR

- > **2** Preparedness for EWAR →
- > **2.1** Levels of EWAR capacity in context →
- > **2.2** Assessing capacity for EWAR →
- > **2.3** Preparedness as a step toward rapid assessment and implementation →

≡ **Contents**

## 2. Preparedness for EWAR

Preparedness is a key pillar of the emergency cycle and preparedness for the implementation of EWAR is no different. To reduce the impact of outbreaks and public health emergencies, countries must strengthen their capacity to complete the cycle of public health emergency prevention, preparedness, response and recovery, while reviewing and strengthening EWAR capabilities at each step.

Human resources, material resources and coordination for EWAR are ideally identified and improved ahead of time to allow these components to be rapidly implemented/scaled-up when needed. Moreover, EWAR tools suitable to local needs and context should be pre-identified in agreement with local stakeholders, and the capacity should be built to use and deploy these tools. Once developed, these tools need to be continuously maintained, refreshed and exercised as essential ongoing health emergency readiness capabilities. These actions will save time and effort. At the onset of an emergency and following a rapid assessment, the EWAR implementation team can then focus on increasing the effectiveness of existing components and expanding the reach of the surveillance network to cover previously silent areas and populations that have been displaced.

“To reduce the impact of outbreaks and public health emergencies, countries must strengthen their capacity to complete the cycle of public health emergency prevention, preparedness, response and recovery, while reviewing and strengthening EWAR capabilities at each step.”

Preparedness checklists in this chapter should be used in the preparedness phase (prior to an emergency). Moreover, these should be reviewed annually, as the potential rapid turnover of staff and systems could lead to structures and institutional knowledge being rapidly eroded if checklists are not regularly updated.

### 2.1 Levels of EWAR capacity in context

The level of preparedness for undertaking EWAR routinely or in response to an emergency is dependent on the local context. Moreover, preparedness extends beyond EWAR itself. It depends heavily on the format of local and national surveillance systems, as well as outbreak and emergency preparedness and response plans. For some emergencies (e.g., due to conflict or a natural disaster), health systems and

surveillance structures may be severely damaged/disrupted and new response plans and systems may need to be developed and implemented.

**Low capacity:** During acute/recurrent conflicts (e.g., Syria crisis (20)), sudden-onset natural disasters (e.g., Tropical Cyclone Idai in Mozambique (21)) or the rapid establishment of new displacement camps (e.g., during the crisis in north-eastern Nigeria (22)), surveillance systems and the health care infrastructure that they are reliant on may be severely disrupted or destroyed. In some cases, the infrastructure may not be under the national health authority's governance. In such settings, it can be expected that the level of preparedness may be very low; therefore, the establishment of a new EWAR system should be considered as part of the assessment.

**Moderate capacity:** During protracted crises where large-scale outbreaks occur among emergency-affected populations (e.g., cholera outbreaks in Yemen (23)) and in countries with regular cycles of natural disasters (e.g., flooding in Pakistan (24)), a moderate level of EWAR capacity may exist; however, surveillance systems may be prone to chronic underinvestment. It is expected that some core functions can be used as a platform for strengthening routine EWAR functions. At the onset of emergencies, authorities may consider either leveraging these systems or establishing new EWAR systems, dependent on the outcome of assessments.

**High capacity:** In some scenarios, most of the core functions of EWAR may be present. In these settings, efforts should focus on strengthening existing systems to enhancing early warning capacity as a routine function and reviewing how these systems may be leveraged/scaled in preparedness for emergencies. This does not preclude rolling out additional tools when needed to augment existing capacity. For example, during Tropical Cyclone Winston in Fiji (25), the existing sentinel surveillance system was reinforced with EWARS-in-a-box to facilitate the logistics and communications in additional healthcare facilities.

## 2.2 Assessing capacity for EWAR

Assessments of EWAR capacity should reflect upon the core functions, that is, **early warning** capacity to detect signals through IBS or EBS systems; ability to **manage alerts** including undertaking signal verification, risk assessment and risk characterization; and capacity to **respond** to risk-assessed events. The following five question checklists serve as a basis to critically assess these core functions. A more detailed set of checklists is available in the [Joint external evaluation tool: international health regulations \(2005\), 3rd edition](#) .

- **Preparedness Checklist 1: Surveillance system** – Capacity of routine surveillance system and specific components to support EWAR implementation.
- **Preparedness Checklist 2: Coordination** – Existence and coordination of networks of governmental and NGO partners across the area who can support an EWAR network.
- **Preparedness Checklist 3: Laboratory support** – Capacity of the laboratory network.

- **Preparedness Checklist 4: Response linkage** – Linkages between surveillance and response capacity.
- **Preparedness Checklist 5: EWAR tools for filling gaps** – Identification of EWAR tools to fill gaps in core functions.

### 2.2.1 Preparedness Checklist 1: Surveillance system

The following elements should be reviewed to understand how prepared the routine surveillance system is for implementing EWAR at the onset of an emergency. Note that these criteria are not intended to provide a more rigorous evaluation of EWAR capacity (see [Module 14](#) ).

1. A communicable disease epidemiological profile has been recently developed/updated to identify prioritized diseases and conditions (e.g., epidemic-prone diseases and environmental hazards) (see [Annex 1](#) .
2. Other potential hazards and the likelihood of these hazards occurring are identified (e.g., acute conflict, displacement, natural disasters, food insecurity).
3. IDSR or an equivalent surveillance strategy is in place that comprehensively organizes public health surveillance and response systems for priority diseases, conditions and acute public health events. The major strengths and limitations of the public health and surveillance system for detecting and responding to acute public health events are identified and corrective measures proposed.
4. EWAR has been implemented previously and still exists.
5. Some form of IBS is set up.
  - a. Staff at reporting sites transmit information using pen and paper; staff at reporting sites transmit information electronically (e.g., phone/tablet, online).
  - b. A reporting frequency is set and regular.
  - c. There are timely processes for IBS case reporting, data analysis and dissemination.
  - d. There is routine dissemination of results for use by relevant stakeholders.
6. Standard surveillance tools are available from national public health authorities (or equivalent) (e.g., case definitions adapted to context, alert thresholds, case investigation forms, line list forms, epidemiological summary template, standard operating procedures (SOPs)).
7. There is a well-defined surveillance network.
  - a. Types of reporting sites that feed into IBS are identified (e.g., health posts, public and private hospitals and other health facilities, laboratories, community-based surveillance).
  - b. The reporting network provides adequate coverage of the population.
  - c. An updated map showing the current capability of reporting sites surveillance is available, including reporting sites potentially destroyed or otherwise nonfunctional (e.g., lack capacity or cellular/internet connectivity to report).
  - d. Identify the populations that are excluded from surveillance (e.g., populations that are displaced, remote, rural, in slums).
8. There is capacity for the early warning of public health events.
  - a. If a comprehensive surveillance system (e.g., IDSR or the equivalent) is in place, it has early warning components.
  - b. There is a system for alert management in place.



- c. Syndromic surveillance is used (e.g., in sentinel sites, emergency departments).
- d. Identify existing forms of EBS to receive unstructured information (e.g., community telephone hotline to report rumours of outbreaks, media monitoring).
  - i. EBS is done locally and/or at the national level.
  - ii. There is capacity for immediate reporting (e.g., a free telephone hotline for the public).
  - iii. Timely action taken on reported EBS signals.
  - iv. Community-based surveillance (CBS) networks exist. Partners who support CBS are identified (e.g., National Red Cross volunteers, community health workers).
- 9. Laboratories which support the surveillance system are identified and have the capacity to detect pathogens with epidemic potential.
  - a. Point of care tests (including rapid diagnostic tests (RDT), GeneXpert) for prioritized diseases are positioned at health facilities or at the district level.
  - b. Health workers routinely use the point of care tests.
- 10. Dedicated public health teams are identified and responsible for the investigation of public health events.
- 11. Dedicated teams are identified and responsible for rapid response to public health events.
- 12. Routine performance monitoring and evaluation are conducted.

### 2.2.2 Preparedness Checklist 2: Coordination

Coordination among EWAR networks and partners is critical from the start to ensure all are following a standardized process for implementing EWAR quickly at the onset of an emergency. Check on the following points.

1. A trained EWAR Coordinator and Focal Points (at the district and provincial/state levels) are pre-identified, at least for the initial period.
2. There is a list of existing networks of partners who provide patient care and whose healthcare facilities can be readily engaged as reporting sites (e.g., public healthcare facilities and health posts, national and international NGOs operating healthcare facilities and mobile clinics, community-based surveillance networks).
3. There is a list of governmental organizations, NGOs, civil society organizations (CSOs) and partners responsible/available for executing the outbreak response activities.
4. There is a list of fixed and mobile laboratories.
5. There are protected start-up funds accessible, at least for the initial period.
6. Transportation dedicated to EWAR is identified and secured, at least for the initial period (i.e., motorcycles and vehicles).

### 2.2.3 Preparedness Checklist 3: Laboratory support

Wherever appropriate, subnational level laboratories (e.g., district/provincial/state, mobile) should be designated and equipped to conduct diagnostic testing for prioritized pathogens as close to the EWAR sites as possible to shorten delays to outbreak management. Diagnostic capacities for specific diseases should be checked against any existing Public Health Situation Analysis (PHSA) and communicable

disease epidemiological profiles in order to adequately fit the need. In addition, some diseases like malaria and cholera may have effective and relatively inexpensive RDTs available, which may be useful both clinically (e.g., for malaria) and in verifying signals (e.g., for cholera). In addition, mechanisms should be established for the rapid referral of laboratory specimens and/or isolated pathogens to identified national/international reference laboratories (preferably within a regional network) to facilitate confirmatory testing and sequencing, as required. The following elements should be critically reviewed as minimum components required for the laboratory to support EWAR.

1. There is existing capacity for laboratory investigation of prioritized epidemic-prone diseases.
2. SOPs and systems for sample collection, packing and specimen transport, including the use of unique identification numbers, are available.
3. The laboratory data management system is linked with existing EWAR (when applicable) or routine public health surveillance system.
4. There are established methods and platforms for communicating results to point of care in a timely manner.
5. Biosafety and biosecurity protocols, including personal protective equipment for sampling, transport and testing, are available.

For more information on the supplies needed, see the [Technical guidelines for IDSR in the African Region: Section 1](#) .

#### 2.2.4 Preparedness Checklist 4: Response linkage

While planning a comprehensive response to outbreaks and other acute public health events is broader than EWAR's primary function of early warning, the linkage between EWAR and response activities should be clarified before implementation. Check the following points.

1. Integrated and/or disease-specific national outbreak preparedness and response plans are available and used. They adequately address surveillance and response activities, resources, roles and surge capacity (including from partners).
2. EWAR systems and outputs have been strongly linked with existing Emergency Operations Centres and the Incident Management System (during recent emergencies).
3. Surveillance reports/outputs (with interpretation) are regularly disseminated to decision-makers and relevant stakeholders at local and national levels. These outputs are reviewed regularly at routine meetings for the management of acute events, and adequately understood.
4. District/provincial/state outbreak response teams are trained in EWAR's core functions.
5. EWAR surveillance coordinators have an adequate understanding of core national policies and decision-making mechanisms for triggering a response. They know how and when to initiate requests for reactive vaccination from the relevant global vaccination stockpiles.

#### 2.2.5 Preparedness Checklist 5: EWAR tools to fill gaps in surveillance functions

The impact of acute emergencies on surveillance infrastructures can be challenging to predict. In all countries (including countries with strong surveillance capacity and established EWAR networks), tools should be pre-identified and familiarized with to rapidly fill gaps, scale-up capacities and adapt core functions.

1. An EWAR electronic software, hardware and other infrastructure is identified and will be deployed in the event of an emergency.
  - a. An agreement among government and key partners about which tools will be used in-country has been reached.
  - b. There is local capacity to deploy and use these tools.
  - c. The data generated can be readily integrated into existing surveillance systems (see [Module 9](#) ).
2. Disease data collection standards and investigation tools are available and recently updated to support outbreak investigations (see [Module 12](#)  and the [WHO Outbreak Toolkit](#) .

Previous case studies and evaluations of EWAR that outline procedures for implementing EWAR may also support the identification and preparation of EWAR tools pertinent to the local context (see [Key readings](#) .



## 2.3 Preparedness as a step toward rapid assessment and implementation

Once the preparedness steps have been verified and improvements to capacity discussed and acted upon, the infrastructure will be better primed for EWAR implementation. At the onset of the emergency, a rapid assessment for EWAR should be completed to identify the urgent needs for implementing EWAR (see [Module 3](#) ). During this assessment process, and if the decision is taken to implement/extend EWAR, these preparedness checklists and resulting reports may be revisited to evaluate both the core functions that are present and adequate as well as those components that may require improvement.



# Rapid assessment of surveillance priorities

- > **3** Rapid assessment of surveillance priorities →
- > **3.1** Determine the geographical area and populations to be covered by surveillance →
- > **3.2** Set a timeline and geographical scope for the rapid assessment →
- > **3.3** Review key information sources and setup community consultation mechanisms →
- > **3.4** Identify priority epidemic-prone diseases, conditions and hazards →
- > **3.5** Verify existing surveillance capacities →
- > **3.6** Make actionable recommendations targeted toward implementation →

# 3. Rapid assessment of surveillance priorities

A rapid assessment always precedes the implementation of EWAR, with the objective of producing a set of actionable recommendations for developing a system that is fit-for-purpose for a particular emergency and context. The national public health authorities (or designated equivalent) lead the rapid assessment, with support from WHO and other partners, as needed.

“A rapid assessment always precedes the implementation of EWAR, with the objective of producing a set of actionable recommendations for developing a system that is fit-for-purpose for a particular emergency and context.”

Rapid assessments involve a series of key steps (Box 1) for the identification of priority diseases and conditions, the geographical scope of surveillance, existing surveillance capacity, and immediate logistical and resource needs. If preparedness assessments and planning for EWAR have been completed (see [Module 2](#)), rapid assessments should build on these findings and plans, extending to accounting for the impact of the particular emergency, and potentially new geographical areas and populations affected.

Note that there are overlaps with a PHSA and/or a Rapid Risk Assessments (RRA), which are broader evaluations of public health needs and priority interventions and risks associated with the event. Some steps (e.g., identifying priority diseases and acute public health events) may be informed by PHSA or RRAs. The evaluation of surveillance needs, however, is primarily the objective of the EWAR’s rapid assessment.



## Box 1. Key steps of rapid assessment of surveillance priorities

1. Determine the geographical area and populations to be covered by surveillance.
2. Set a timeline and geographical scope for the rapid assessment.
3. Identify and review key sources of information and setup of a community consultation mechanism.
4. Identify the priority epidemic-prone diseases, conditions and environmental hazards through a risk assessment.
5. Verify existing surveillance and response capacities.
6. Make actionable recommendations targeted toward implementation.



## 3.1 Determine the geographical area and populations to be covered by surveillance

Assess which populations are affected, the presence of any vulnerable groups or hidden populations, where populations have been displaced to, and where and when more displacement of populations is likely to occur. This mapping will help to determine the boundaries of the geographical area under surveillance.



## 3.2 Set a timeline and geographical scope for the rapid assessment

Develop a high-level assessment plan, outlining the timeline for key activities to be completed, and the overall geographical scope of areas/populations to be included in the rapid assessment. Rapid assessments should take no more than three days to carry out, including the design and formulation of recommendations.

To cover a large geographical area, the rapid assessment team could be expanded to include focal points for the EWAR system to cover all affected districts or provinces. Some areas may have limited access due to insecurity and/or infrastructure damage from the impact of natural disasters. Consideration should be paid to balancing the feasibility of physically accessing sites. Contact with focal points via telephone, radios or internet, if this is possible, should be considered to avoid omitting areas from the assessment. Alternatively, sampling a representative set of areas and generalizing the findings may be sufficient.

## 3.3 Review key information sources and set up community consultation mechanisms

Where possible, **gather key documents**, which may be available for the area proposed for surveillance from the national public health authorities (or equivalent), WHO, NGOs or the Health and WASH Clusters. These reports can be helpful to analyse immediate health threats and current surveillance system capacity.

- **Communicable disease epidemiological profile of the area**, including epidemic-prone diseases and environmental hazards. The profile will need to be updated to account for the current emergency, including risk factors (e.g., living conditions and endemicity of diseases among displaced populations).
- **Documentation on existing surveillance systems** to build an understanding on how these systems function, practically, and their overall effectiveness. This may include weekly epidemiological reports, outbreak investigation reports, surveillance tools (e.g., local case definitions, case and laboratory reporting forms, SOPs, digital tools) and prior surveillance evaluations.
- **Documentation of health system and health workforce capacity prior to the onset of the emergency** (e.g., routine vaccination coverage, existing health workforce).
- **Documentation of the impact and extent of the unfolding emergency**, including information on impacts, resident and displaced populations affected (and their sizes) and the geographical extent of the crisis. These may include rapid health assessments, PHSA, RA/RRA, [Health Resources Availability Monitoring System \(HeRAMS\)](#)  reports, [Integrated Outbreak Analytics \(IOA\)](#)  reports, vaccination coverage estimations and population estimation reports. See also the [WHO Health Cluster guide](#)  for a description of tools.
- **Lists of potential partners delivering primary health care**, including NGOs, CSOs, private organizations and governmental units. Disruptions of (sub)national healthcare services and increased demand on services may require the support of multiple partners to fill healthcare gaps, as well as gaps in detecting and reporting acute public health events for EWAR. Partners' lists, the Health and WASH Clusters' membership lists, and Health Cluster 3/4W matrices (*who is doing what, where and when*) will be helpful.

**Informal interviews with key staff** who plan or interact with the surveillance system from all levels will be useful to identify key strengths and gaps. This may include staff who manage surveillance systems at national and provincial/state levels, as well as health and other frontline workers who support the detection of events/cases at healthcare facilities and in affected communities. Discussions should focus on the key domains (i.e., priority diseases and conditions, geographical extent of current surveillance, outstanding logistic and resource needs), including informal practices and mechanisms.

Undertake **community consultations**, which complement the epidemiological and health service-based assessment above, to supplement risk assessment. This can involve setting up a feedback mechanism with members of affected communities to better understand the drivers of disease transmission, health-seeking behaviour, mechanisms for reporting disease events in the community, and the specific strengths and vulnerabilities in the current emergency context that drive or prevent transmission.



## 3.4 Identify priority epidemic-prone diseases, conditions and hazards

Before setting up the EWAR, conduct a risk assessment of potential acute public health events to determine the set of epidemic-prone diseases, conditions and environmental hazards that have the potential to cause an outbreak or acute public health emergency. Or they could trigger a significant increase in morbidity and/or mortality in communities affected by the emergency. The set that is generated should include a maximum of 8–12 priority diseases and conditions, which should be matched to potential risks among the emergency-affected populations and be included in EWAR surveillance. These diseases and conditions will be mainly captured as syndromes (i.e., a set of signs and symptoms). In some settings, probable/confirmed cases may be included (e.g., malaria RDT positive cases). Examples of the diseases and conditions which may be prioritized for different emergencies are outlined in Table 2, [Annex 1](#)  and [Module 6](#) . Note that risks may change over time and therefore it is possible that additional syndromes may be added when these risks become apparent (e.g., Zika in Fiji below). Conversely, when EWAR aims to reinforce surveillance for a specific outbreak, only a single disease may be monitored (e.g., Ebola virus disease outbreak surveillance in the Democratic Republic of the Congo).

Remember that not all communicable diseases have epidemic potential or lend themselves to being monitored by EWAR. Communicable diseases such as HIV/AIDS and tuberculosis are typically not prioritized for EWAR, and are captured instead through dedicated clinical monitoring and associated surveillance systems.

The process for deciding on the prioritized syndromes involves three steps.

- Narrow down by the type of event and associated disease risk.
- Evaluate vulnerabilities of the population (based on agent, host and environmental factors).
- Characterize the likelihood and potential impact of each potential disease.



Table 2. Examples of priority diseases and syndromes in different emergencies

Large-scale displacement in Cox’s Bazaar, Bangladesh, 2017 (26)	Cyclone Winston, Fiji, 2016 (25)	Humanitarian crises in the Eastern Mediterranean Region (27)
<p>12 syndromes:</p> <ul style="list-style-type: none"> <li>• Acute watery diarrhoea (AWD)</li> <li>• Acute bloody diarrhoea</li> <li>• Acute jaundice syndrome</li> <li>• Suspected meningitis</li> <li>• Measles/rubella</li> <li>• Acute flaccid paralysis (AFP)</li> <li>• Acute respiratory infection</li> <li>• Suspected haemorrhagic fever</li> <li>• Malaria</li> <li>• Unexplained fever</li> <li>• Neonatal tetanus</li> <li>• Adult tetanus</li> </ul>	<p>9 syndromes:</p> <ul style="list-style-type: none"> <li>• AWD</li> <li>• Acute bloody diarrhoea</li> <li>• Acute jaundice syndrome</li> <li>• Suspected meningitis</li> <li>• Acute fever and rash</li> <li>• Prolonged fever</li> <li>• Influenza-like illness</li> <li>• Suspected dengue</li> <li>• Zika-like illness (added 3 weeks after surveillance started)</li> </ul>	<p>8 syndromes (on average)</p> <ul style="list-style-type: none"> <li>• Cholera</li> <li>• Dysentery</li> <li>• Hepatitis</li> <li>• Meningitis</li> <li>• Measles</li> <li>• Pneumonia</li> <li>• Polio</li> <li>• Haemorrhagic fever</li> </ul>

### 3.4.1 Identify the hazard and associated risks

First, select the type of current emergency (or combination of multiple emergencies), for example: natural disaster (earthquake, flood, tsunami), acute or protracted conflict, or severe food insecurity.

Related to the type of emergency, describe the major risk factors for transmission, for example:

- population displacement, including specific risk factors, size and duration of displacement
- overcrowding
- lack of access to clean water and adequate sanitation
- child and adult malnutrition
- lack of access to preventative and curative health care
- vectors present in the area (e.g., mosquitoes)
- common injuries (e.g., during a natural disasters leading to tetanus (28)).

### 3.4.2 Evaluate the vulnerability of the population(s) based on the epidemiologic triangle and increased risk of infection, severe morbidity and mortality

The epidemiologic agent-host-environment triangle can be used to consider the specific vulnerabilities of the population at-risk (Table 3). [Annex 1](#)  lists diseases with epidemic potential in emergencies and population-level risk factors for their emergence and persistence.



Table 3. Epidemiologic triangle to assess vulnerabilities of the population at-risk (29)

<b>Agent</b>	<ul style="list-style-type: none"> <li>• Epidemic-prone diseases, especially those that have caused outbreaks recently in the area (e.g., measles, cholera, shigellosis, meningitis)</li> <li>• Endemic diseases that may increase in incidence over time (e.g., acute respiratory illness, malaria)</li> <li>• Acquired resistance that may increase morbidity and mortality</li> </ul>
<b>Host</b>	<ul style="list-style-type: none"> <li>• Age and gender</li> <li>• Malnutrition and poor health status</li> <li>• Population status, such as host, internally displaced person (IDP) or refugee, as it can influence their access to basic needs and immune status, not only through endemic pathogen exposure, but also through different vaccine schedules in host countries (e.g., hepatitis E among the resident population (30))</li> <li>• Zoonotic considerations, including the host species' range of vectors of transmission (e.g., for rabies), amplifying host species (e.g., dogs and rodents for leishmaniasis or livestock for Middle East respiratory syndrome (MERS))</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>• Overcrowding</li> <li>• Level of access to clean water and sanitation</li> <li>• Level of access and quality of shelter</li> <li>• Level of access and quality of health care</li> <li>• Presence of vectors (e.g., mosquitoes, rats)</li> <li>• Any toxic exposures in the environment (e.g., lead in the soil (31))</li> </ul>

### 3.4.3 Characterize the outbreak risk of each disease by its impact and likelihood

Evaluate the risk to population health of each disease by considering the potential health impact to the population, and the likelihood of an outbreak or public health emergency occurring caused by the agent in question (Fig. 1).

Table 4 provides examples of risk assessments for prioritized conditions during the conflict in Ukraine for the three month period from March 2022 (conducted as part of a PHSA) (32), and for earthquake-affected areas in Indonesia in 2006 (33).



Fig. 1. Risk assessment matrix based on potential health impact to the population affected, and the likelihood of an outbreak to occur for a given agent

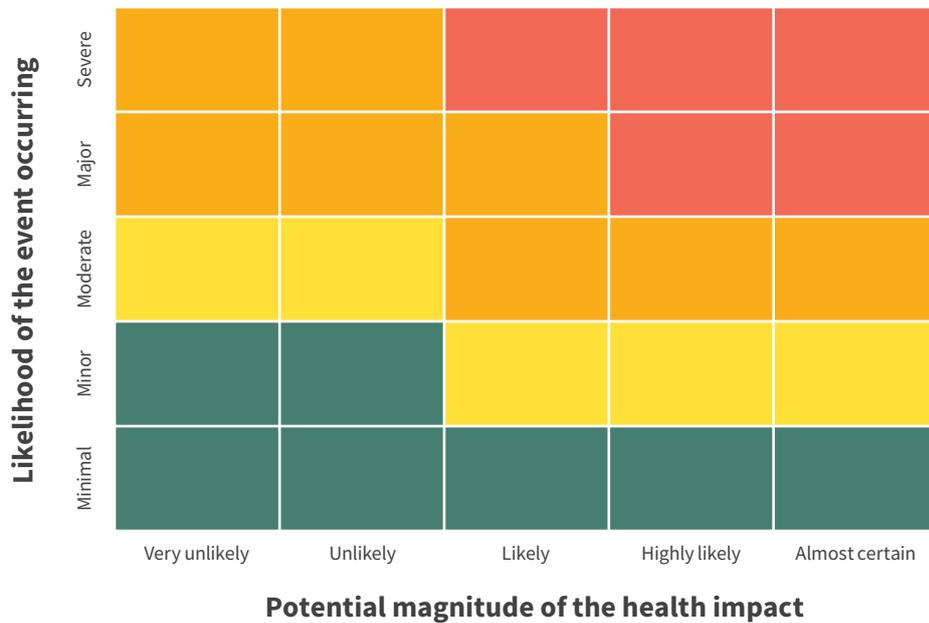


Table 4. Examples of epidemic-prone diseases and conditions prioritized for EWAR during emergencies

**A. Conflict in Ukraine, priorities for the next three months, March 2022 (extract from PHSA (32))**

Disease or condition	Risk level*		Rationale
	Month 1	Month 2-3	
<b>COVID-19</b>	Red circle	Orange circle	Decreasing trends, but from very high level of incidence and bed occupancy for ICU care. Limited oxygen supplies substantially impact capacity to treat severe patients. Unsanitary, crowded living conditions with poor ventilation; low vaccination coverage.
<b>Other infectious respiratory diseases, including influenza</b>	Orange circle	Yellow circle	Poor hygiene and sanitation, overcrowding, poor shelter, cold. Low risk of influenza-associated morbidity given low levels of seasonal circulation, further reducing as season abates.
<b>Diarrhoeal diseases</b>	Yellow circle	Yellow circle	Poor hygiene and sanitation, overcrowding.
<b>Measles</b>	Orange circle	Orange circle	Increased risk of measles transmission given crowded living conditions with poor ventilation, prior endemicity and reduced vaccine coverage in recent years.

Disease or condition	Risk level*		Rationale
	Month 1	Month 2-3	
<b>Polio</b>			Ongoing outbreak of circulating vaccine-derived poliovirus type 2 (cVDVP2) and low uptake mass immunization campaign (22%). Risk of spread into surrounding countries.
<b>Cholera</b>			Last outbreak in 2011. Poor hygiene and sanitation, overcrowding, poor shelter, disruption to water and sanitation.
<b>Technological and environmental health risks</b>			Chemical and radio-nuclear sites could represent major health risk if damaged during ongoing conflict. Low risk of accidental exposures to biological hazards, as country not known (not likely) to have collections of high consequence pathogens.

**B. Earthquake-affected areas in Indonesia, 2006 (adapted from the report Indonesia earthquake-affected areas: Communicable disease risks and interventions, May 2006. Geneva: World Health Organization; 2006 (accessed 13 October 2022) (33))**

Communicable disease	Risk *
Dengue	
ARI	
Typhoid	
Bacillary dysentery (shigellosis)	
Influenza (seasonal)	
Hepatitis A	
Hepatitis E	
Measles	
Meningitis	
Plague	
Rabies	
Cholera	
Scrub typhus	
Leptospirosis	
Tuberculosis	
Malaria	

Red: Very high risk. Could result in high levels of excess mortality/morbidity. Orange: High risk. Could result in considerable levels of excess mortality/morbidity. Yellow: Moderate risk. Could make a minor contribution to excess mortality/morbidity. Green: Low risk. Will probably not result in excess mortality/morbidity.

## 3.5 Verify existing surveillance capacities

The objectives of this assessment are the following.

1. Understand the capacity for the early detection of public health events.
2. Identify components of the core functions that require strengthening.
3. Via #1 and #2, assess whether a new EWAR system is required or what inputs are required.

EWAR preparedness assessments (where available) will be useful to rapidly identify and verify the existing capacity of the surveillance system to support EWAR functions (see [Module 2](#) ).

The following domains should be rapidly assessed with a focus on identifying essential gaps in the core functions that can be acted on. The most important function from the outset is outbreak detection capacity. Documents and informal interviews can be analysed to answer the following questions (modified from the WHO [Technical guidelines for IDSR in the African Region, 3<sup>rd</sup> edition, Annex B: Tool for assessing surveillance and response at the district level](#) ).

### 1. Population under surveillance

- a. Who are the affected populations (e.g., IDPs, refugees and other crisis-affected residents)? Where are they located? If in camps and informal settlements, how long will they stay open? Are there plans for the relocation of the population in the near future?
- b. Are there updated population estimates for these communities? Have they been mapped to specific geographical areas?
- c. Is there significant insecurity that prevents humanitarian access and their access to health care?
- d. Does the district/provincial health system have access to these populations and does this provide adequate coverage of health care?
- e. Are there NGOs, emergency medical teams, private health facilities and/or traditional healers supporting health care among these populations? Do they have the means to input into district/provincial surveillance?

### 2. Diseases and conditions under surveillance

- a. Does the district/provincial surveillance system already include priority diseases and conditions resulting from epidemiological risk assessment conducted during the emergency?
- b. Is the existing surveillance system capable of detecting newly emerging diseases? For example, is there EBS in place? Is there laboratory surveillance and communication in place?

- c. Are health and other frontline workers trained to detect priority diseases and report according to standardized SOPs?
- d. Do networks exist between local, national and regional reference laboratories to provide rapid collection, transport and testing of laboratory samples? What diseases are eligible for rapid testing or confirmation through district/provincial laboratories?

### 3. Early warning and surveillance

- a. According to the SOP and ground realities, does the surveillance system include weekly or more frequent reporting of routine surveillance, in other words IBS, as a source of early warning data?
- b. Is there a list of diseases under EWAR with appropriate case definitions?
- c. Is there any form of EBS included as a source of early warning data (e.g., community health workers reporting suspected events, hotlines from communities, rural community leaders, humanitarian partners, immediate reporting from health facilities)? Who are the focal points for each source?
- d. What data collection tools are being used for:
  - case data or line listing
  - health facility data
  - lab-specimen data
  - unstructured event data (e.g., a means of registering rumours, telephone hotlines, media monitoring)?
- e. Are health workers trained in the objectives and procedures for surveillance? Is there supportive supervision in place?
- f. Do communication channels in the national system allow for immediate reporting of any suspected disease or events, including unknown morbidity and mortality, clustered cases of disease or syndromes or unusual or unexpected disease patterns?
- g. Is there immediate reporting through basic (e.g., mobile text messages) or more advanced electronic Health Information System (e.g., DHIS2)? Who has access to these applications and devices?
- h. Is there evidence that epidemic-prone diseases and acute public health events are rapidly detected and reported?
- i. Are there SOPs available to indicate what information should be reported with which frequency?

### 4. Alert management

- a. Does the surveillance system have alert and epidemic thresholds to detect suspected outbreaks? Is there evidence that it is used effectively?
- b. Does the surveillance system include an alert log to document all signals, events and alerts? (A signal log is used to document the occurrence and response to all signals.)
- c. Are signals, events and alerts managed according to an agreed, standardized workflow?
- d. Are there SOPs available to verify and risk assess incoming reports?



## 5. Outbreak response

- a. For each confirmed alert identified, what is the corresponding response activity according to the SOP?
- b. Does the surveillance system have updated case investigation forms for each of the priority diseases in the event of a confirmed outbreak?
- c. Does the surveillance system have SOPs in place for notification and investigation of cases during an outbreak?
- d. Are mechanisms in place to conduct heightened surveillance through the surveillance system during an outbreak, for example, through active case-finding or contact tracing?
- e. Is there evidence of capacity to investigate and respond to outbreaks rapidly (i.e., RRTs at the district level or NGO support that could be used for response to public health events)?
- f. Is there a systematic performance monitoring and evaluation system in place?

## 6. Data analysis and sharing

- a. Does the surveillance system regularly allow for analysing and sharing surveillance data using standardized information products (e.g., weekly or monthly epidemiological bulletins, graphs, maps)?
- b. Are data protection operations in place?

## 7. Infrastructure

- a. Are minimum human resources available at the level of the crisis (district/province/national), including healthcare staff for case detection, data collection and analysis, and outbreak investigation and response?
- b. What are the gaps in human resources?
- c. Are there existing electronic tools available for data collection, analysis and rapid dissemination of information?

## 8. Coordination

- a. Is there a trained EWAR Coordinator and are there pre-identified Focal Points (at the district and provincial/state levels), at least for the initial period?
- b. Is there a partner list of existing networks of government and NGO partners who provide patient care and can be engaged as reporting sites (e.g., health facilities and national and international NGOs that are operating health facilities)?
- c. Is there a list of fixed and mobile laboratories?
- d. Is there transportation (e.g., motorcycles or vehicles) that can be dedicated to EWAR?

## 3.6 Make actionable recommendations targeted toward implementation

A concise and focused analysis of key questions for EWAR capacity should be undertaken to determine the overall gaps that require external support. The results of the assessment should be synthesized in the following ways to maximize communication with key stakeholders and humanitarian partners.

- Brief written report (two to three pages) to document the main findings including:
  - proposed populations to be covered and geographical extent of surveillance
  - priority diseases and conditions under surveillance
  - existing capacity and gaps that need to be urgently covered to begin implementation.
- Brief face-to-face presentation of findings to EWAR partners (i.e., different branches of national public health authorities (or equivalent), Ministry of Health, health, WASH and other clusters, and donors).

The findings should clearly indicate the current level of capacity to detect and respond to outbreaks, identify specific gaps that impede EWAR, and recommendations on how to bridge these gaps. The main recommendation should be unequivocal on the following primary objectives.

- Identify the gaps in meeting the EWAR core functions adequately using the current surveillance system, namely:
  - human resources (think about core staff, training and supervision);
  - material resources (communications, computers, tablets) and replenishable products (laboratory); and
  - transportation requirements (think about training and supervision, and support for specimen transport).
- Recommend that a new EWAR system and coordination mechanism are urgently needed to be resourced and deployed. In this scenario, there is no minimum reporting network in place and health facilities will have to be briefed on how to conduct surveillance.

# 4

## Implementation team structure and resources

- > 4 Implementation team structure and resources →
- > 4.1 Institutional representation →
- > 4.2 Team role and responsibilities →
- > 4.3 Team composition →
- > 4.4 Resources →
- ≡ Contents

# 4. Implementation team structure and resources

The composition of an EWAR Implementation Team is context dependent. When establishing this team, it is important to ensure institutional representation within the team, that the roles and responsibilities of the team are defined, that the right profile of team members are included to meet these responsibilities and effectively secure other resources needed to successfully implement EWAR in this context (see [Module 1 paragraph 1.4](#) .

## 4.1 Institutional representation

An EWAR Implementation Team should represent the national public health authorities, WHO and other partners who will contribute to the EWAR system, including the humanitarian partners who will input into the system, for example, the Health Cluster and NGOs. Where possible, the EWAR Implementation Team should be led by the national public health authorities.

The team should meet frequently (namely, daily) throughout the design, implementation, monitoring and evaluation phases of a new or existing EWAR in an emergency, in order to ensure a coherent and well coordinated approach.

“An EWAR Implementation Team should represent the national public health authorities, WHO and other partners who will contribute to the EWAR system, including the humanitarian partners who will input into the system, for example, the Health Cluster and NGOs.”

## 4.2 Team role and responsibilities

1. It develops the EWAR strategy that is needed to achieve the key aim and objectives.
2. It identifies partners and specialists, including provincial/district focal points, of the existing EWAR network who are operating at different levels within the system, including non-health actors such as the WASH sector.
3. It develops an EWAR implementation plan, including data and reporting flow, and timelines for implementation, monitoring and evaluation.
4. It drafts and agrees on SOPs for EWAR (in general) and SOPs for outbreak preparedness and response for each priority disease under surveillance.
5. It agrees with EWAR partners on the selection, piloting and dissemination of data collection tools for IBS and EBS to health facilities, community volunteers and other reporting sites.
6. It coordinates the implementation of EWAR, including training and supervision of key operational staff with an emphasis on key principles, priority conditions, case definitions, alert detection and response.
7. It agrees on a plan for data analysis and reporting and ensures that all necessary tools are available.
8. It develops and disseminates the epidemiological reports to all relevant stakeholders and communicates findings to health and WASH clusters, affected communities and health facilities.
9. It monitors and evaluates the performance of EWAR based on key indicators, and ensures that concrete recommendations are formulated and implemented to further strengthen the functioning of EWAR (see [Module 14](#) ).
10. It identifies and agrees on a transition strategy with relevant partners (see [Module 16](#) .

## 4.3 Team composition

Key profiles of each team member are described below; however, the specific roles and responsibilities are context dependent. Each member of the EWAR implementation team should have a clear job description and terms of reference. Team members can come from the national public health authorities, WHO, NGOs and other institutions. Team members do not necessarily need to work in the same location, or all be field-based – some roles can be suitably undertaken remotely. Moreover, while some roles should be dedicated to EWAR activities, other roles (e.g., logistics) may be shared among the overall emergency response.

### **Coordinator/Lead epidemiologist**

- This is a public health expert with experience in IBS and EBS, disease control in emergencies, EWAR and the local disease epidemiology.
- Dedicated technical oversight and supervision of EWAR at all levels, including representation at the cluster level, at health facilities, community-level components and subnational EWAR teams, is provided by the expert.
- The expert works closely with other partners involved in public health efforts to ensure optimal coordination between disease monitoring and continuing public health intervention among the emergency-affected population.
- The expert holds the overall responsibility for the implementation process, safeguarding technical standards, producing high quality data, which include outputs such as epidemiological bulletins, and serving as an EWAR coordination focal point.

### **Epidemiologist(s)/Public health specialist(s)**

- They are specialized in communicable disease surveillance and laboratory surveillance.
- They provide input on the local epidemiological context, adherence to national standards and the local surveillance infrastructure and network.
- They support the training and supervision of key staff (e.g., health staff in surveillance sites who will collect data).
- They support IBS and EBS implementation and data analysis.
- They contribute to the risk assessment of alerts, contact tracing, outbreak investigations, active case-finding and other RRT responsibilities (as needed).
- They produce epidemiological bulletins and other reports as needed.

### **Surveillance officers**

- They receive, monitor and verify alerts.
- They contribute to the risk assessment of alerts.
- They coordinate active case-finding and contact tracing (as needed).
- They are recruited locally and speak the local language. It can be beneficial if the surveillance officer has strong ties with the community under surveillance.

### **Information management officers**

- They are responsible for the configuration and management of data systems (e.g., undertaking and automating daily data management, data cleaning, analyses and reports).
- They contribute to the epidemiological bulletins.

### **Health Cluster/NGO health coordinators**

- They provide technical input and advice during the design phase, followed by a significant role in decentralized supervision and monitoring during implementation.

### NGO epidemiologists/Monitoring and evaluation advisors

- They offer remote backstopping and/or direct technical assistance at field level, with expertise in different areas of EWAR implementation (e.g., IBS, EBS, alert management, response, and monitoring and evaluation).

### IT specialist

- If electronic data collection tools are used, the IT specialist develops/customizes and configures tools and provides technical support.
- The specialist should have expertise in implementing field-based EWAR systems and digital tools, including EWARS-in-a-box.
- In countries where a Health Cluster is set up, the [Information Management Task Team](#)  will be responsible for these tasks.

### Logistics coordinator

- Logistical support for EWAR implementation, including procurement of materials and transportation, is provided by the logistics coordinator.



## 4.4 Resources

In addition to human resources, implementing EWAR also requires considerable financial and operational resources. The performance of EWAR relies on the availability and the correct use of resources. Like all surveillance systems, EWAR should be supported by field-level experts who can guarantee that the system is working adequately, and that adequate resources are in place and are being correctly used. To ensure feasibility and efficiency, operational resources should be integrated with the ongoing health response as much as possible. For instance, security protocols should be harmonized between EWAR and the rest of the health response, and IT equipment may be used for multiple activities in the health response, not only for EWAR implementation.

Prior to implementation, the resources required to establish and maintain EWAR should be clearly defined and budgeted for, for the duration of the initial phase of the emergency.

Resources required for EWAR implementation can be categorized as financial, human and operational.

### Financial resources

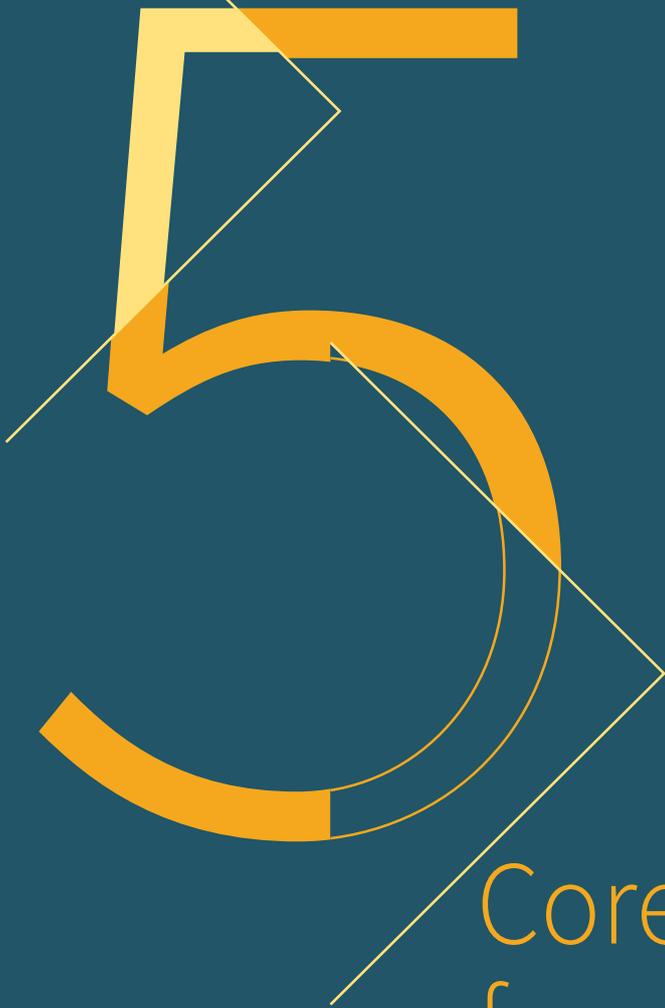
- An adequate, dedicated budget for the whole system should be decided on and made available to ensure sustainability of the system.
- An evaluation may also be budgeted for, if feasible, from the outset of the emergency (see [Module 14](#) .

## Human resources

- Sufficient, multidisciplinary and well trained human resources should be dedicated in-country to coordinate EWAR implementation, to implement the system, to provide technical advice to the response and to form a RRT (see [paragraph 4.3](#) )

## Operational resources

- **Security:** EWAR systems will often have to operate in unstable contexts where security may be a challenge to the whole system. Security risk assessments and protocols will be crucial for the safety of the teams in all contexts. Security protocols for any activities that relate to field presence (e.g., data collection, training workshops) must be in place to minimize the identified risks. Consult the Health Cluster's *Programming in access-constrained environments*  guidance for a framework on evaluating and responding to security challenges.
- **Transport:** Vehicles should be available to the teams to move to and from the different locations where they need to perform their activities. A movement plan should be in place to coordinate and optimize the use of these vehicles.
- **Communication:** Communication devices and associated resources (i.e., electricity to charge them, internet and/or phone credit) should be planned in advance and made available to all team members.
- **IT equipment:** Data collection, data flow and analysis will rely on the availability of the best fit technology. Laptop and desktop computers, tablets, smartphones, networks and other relevant IT material with adequate software should be planned for and made available. In addition, secure electronic data storage should be organized in places where electronic tools are used (see [Module 9](#)  paragraph 10.3).
- **Data collection and management tools:** Specific document packages (according to the role) should be defined and all pertinent forms, data collection platforms and repositories should be included and made available for every member of the team. These packages should be available in a digital format (computer files) and, when necessary, also in printed format. These printing needs should be anticipated and printing capacity should be made available.
- **Medical and laboratory equipment:** Identification of partners who are involved in the EWAR systems and collaboration in the procurement of adequate medical and laboratory supplies is essential for the implementation of the surveillance system, and also for the safety of the team members and populations (e.g., personal protective equipment).



# Core functions for early warning, alert and response (EWAR)

>	<b>5</b>	Core functions for early warning, alert and response	→
>	<b>5.1</b>	Early warning	→
>	<b>5.2</b>	Management of signals, events and alerts	→
>	<b>5.3</b>	Response to outbreaks and public health emergencies	→
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# 5. Core functions for early warning, alert and response

EWAR provides an early warning of public health events and connects this function to an immediate public health response (1). In this chapter, we outline each of the EWAR functions in emergencies and how they relate to each other (Fig. 2). Moreover, we review the three key components of EWAR (Table 5), and their associated terms and processes.

“EWAR provides an early warning of public health events and connects this function to an immediate public health response.”

Fig. 2. Components of EWAR

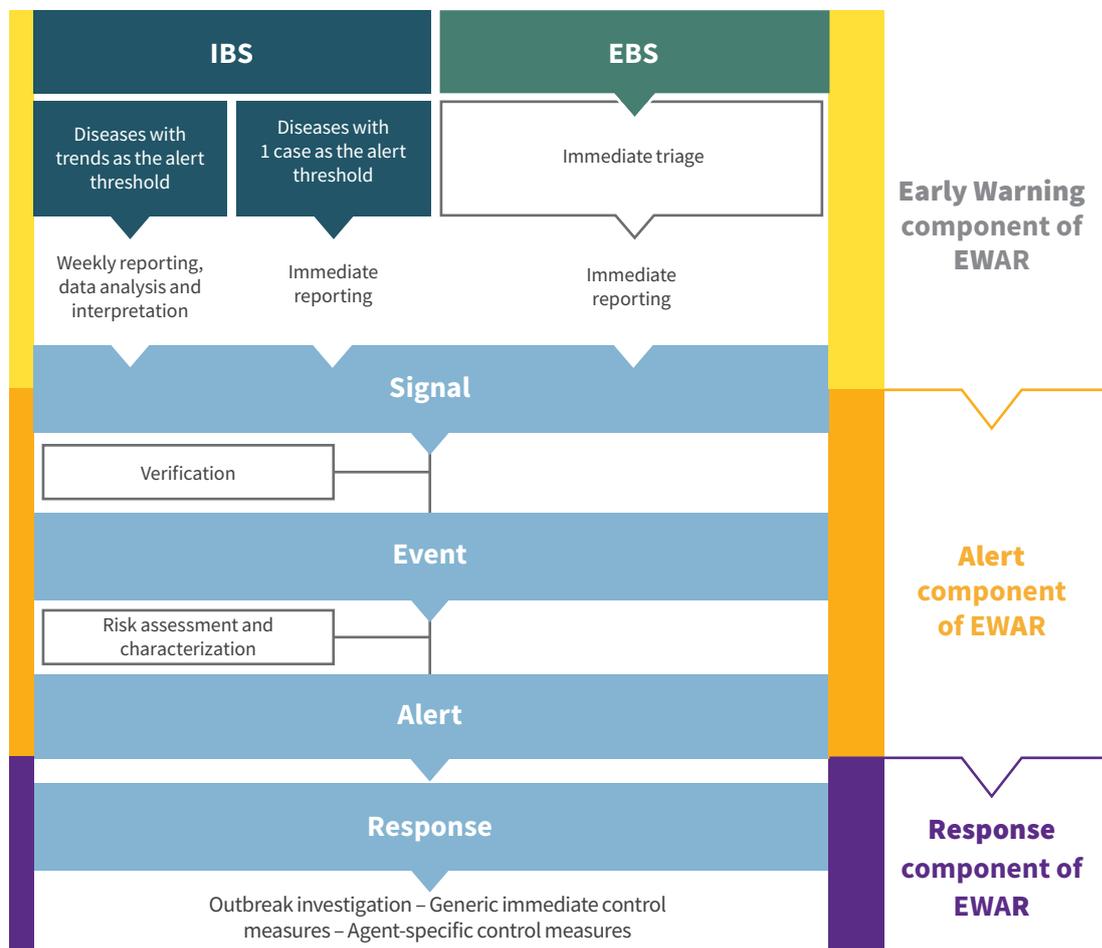




Table 5. Key components of EWAR

**Early Warning**

Early warning refers to the rapid detection of signals that might indicate outbreaks/ clusters of epidemic-prone diseases. The sources of early warning data are categorized as IBS and EBS (see [Modules 6](#) and [7](#)). IBS information becomes a signal when a specific threshold (e.g., number of cases) is crossed. EBS information is triaged to check if it is non-duplicate information that may represent an acute public health event. After positive triage, the EBS information becomes a signal. Signals feed into the alert management process.

**Alert**

Alert management describes the systematic process of managing all incoming information from signal verification to risk assessment and characterization, to decide if a response is required to mitigate the public health risk. Regardless of the source of the information, all signals should be managed according to a standardized workflow:

1. Signal → Verification → Discard, monitor or verify as event
2. Event → Risk assessment and characterization → Discard, monitor or confirm as alert
3. Alert → Response.

The key steps in the alert management workflow are verification, risk assessment and risk characterization (see [Module 8](#)).

**Response**

Response refers to any public health action that is initiated based on the risk assessment of events. As part of a public health response, this guidance focuses on the following activities to enhance surveillance through EWAR:

1. Triggering an outbreak investigation and early response measures
2. Supporting passive and active case-finding
3. Providing surveillance data to guide and monitor outbreak and control measures.

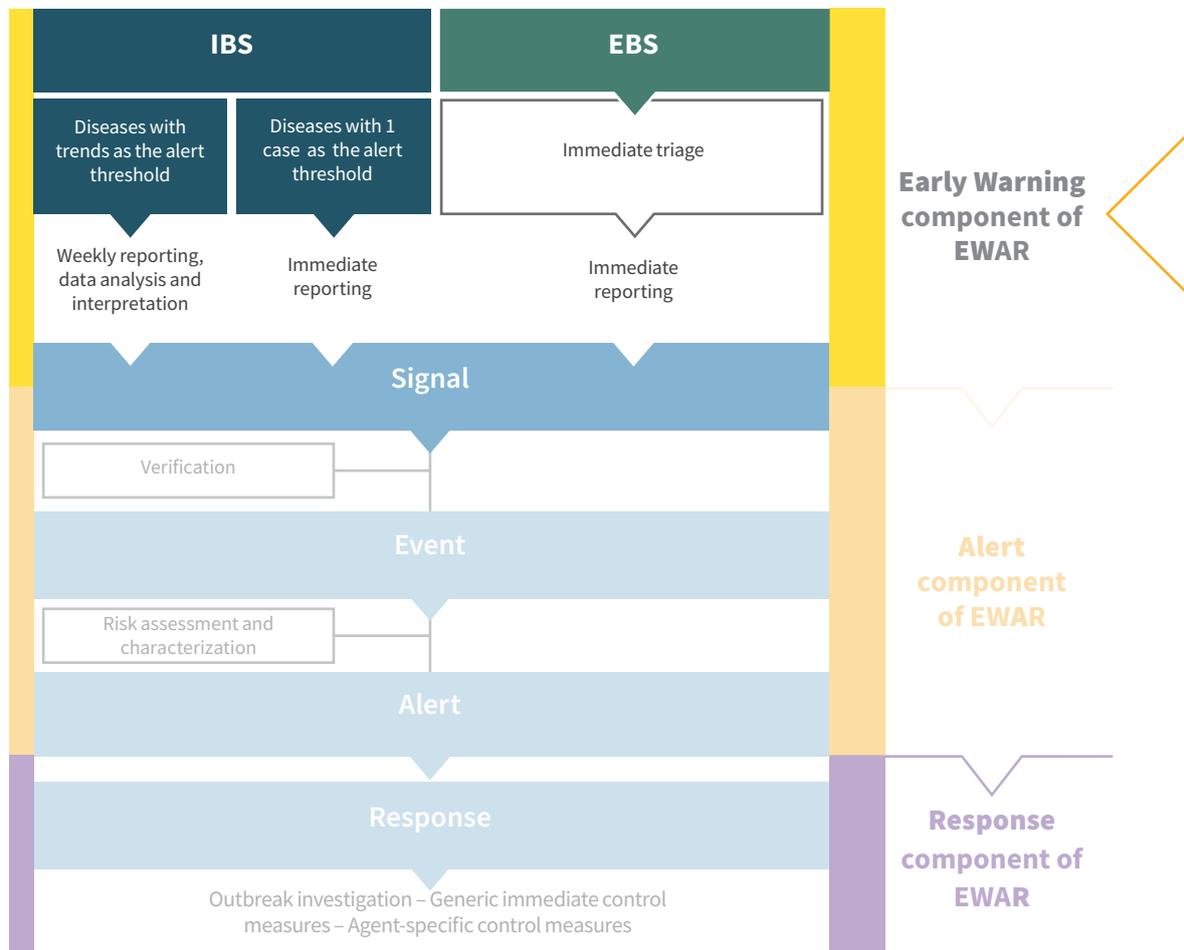
During early phase of an emergency



# 5.1 Early Warning

Early Warning is the first component of the EWAR system. It consists of IBS and EBS that detect signals that require further investigation (Fig. 3). IBS and EBS are complementary sources, which together contribute to the early warning function of surveillance systems by detecting signals that can potentially constitute acute public health events (1). Key characteristics and comparative advantages of IBS and EBS are presented in Table 6. While such distinctions remain relevant in some settings, case and event definitions share many similarities, and IBS and EBS may be integrated into common systems for early warning.

Fig. 3. The Early Warning component of EWAR



During early phase of an emergency



Table 6. Strengths and characteristics of IBS and EBS (13,34,35)

	IBS	EBS
<b>Key features</b>	Provides reliable and structured information on selected priority diseases and conditions in a defined frequency	Provides real-time signals for any event of public health concern, including ad-hoc information not limited to pre-identified priority diseases and conditions, reaching beyond healthcare-centred sources
<b>Who is reporting?</b>	Defined reporting sources, often health care facilities and laboratories, potentially extending to community health worker and volunteer networks and others	EBS systems can be restricted to defined reporting sources (e.g., health facilities or community health workers), and/or be open to anyone to report (e.g., phone hotlines, media)
<b>What is reported?</b>	Cases meeting pre-defined case definitions for 8-12 priority diseases and conditions	Events meeting pre-defined event definition – these can be deliberately broad or tailored to detect events related to a specific threat/ongoing outbreak  Not restricted to specific prioritized diseases or hazards, may be based on unstructured information and can include other sectors (e.g., animal or environment health)
<b>What is the frequency of reporting?</b>	Systematic and regular reporting  Pre-defined frequency of reporting, complemented by immediate reporting for selected alert thresholds	Ad hoc reporting (when an event is detected)  Immediate reporting to supervisor for immediate triage and prompt notification as a signal  Daily when zero reporting
<b>When does the reported information become a signal?</b>	When predefined, disease-specific alert thresholds are crossed	When triaged information is assessed to be non-duplicative information about a potential public health event
<b>Precision</b>	Fewer discarded signals expected	More discarded signals expected
<b>Resource considerations</b>	Requires less staff for alert management as less false signals are generated  Often already well-established prior to emergency; better resourced with more trained staff readily available	Requires more resources for alert management as many false signals are generated  Initial systems can be implemented rapidly

During early phase of an emergency

All established components of the Early Warning should be clearly described in SOPs. This includes, but is not limited to, the following:

- overall surveillance strategy
- sources and the exhaustiveness of the system
- roles and responsibilities
- data to be reported, in which format, including definitions and data dictionaries
- frequency of reporting
- reporting lines and feedback channels
- reporting tools
- criteria/thresholds for reporting.

Ensuring there are clear and simple SOPs, and ensuring adequate training in those SOPs, is critical for successful implementation of EWAR.

### 5.1.1 What surveillance strategy should be applied?

Outlining a strategy for implementing the IBS and EBS systems effectively is an important early step. When deciding on a surveillance strategy for EWAR the following questions should be systematically considered.

- **WHO** should be reporting to the surveillance network?
- **WHAT** priority diseases, conditions and events should be reported?
- **WHEN** and **WHERE** should the data be reported?
- **HOW** does data collection and reporting occur? What is the process for reporting?

Aspects that are similar for IBS and EBS are described in this Module. Aspects specific to each approach are described in [Modules 6](#) and [7](#), respectively. Table 7 outlines where to find further information regarding each of these questions and factors.



Table 7. Factors to consider when deciding on an EWAR surveillance strategy, and where to find further information

Questions	Decisions to be made	Module 5. EWAR core functions	Module 6. IBS	Module 7. EBS
Who should be reporting?	Decide on sources for the surveillance network (e.g., health facilities, community sources)	✓	✓	✓
	Decide on the coverage of the surveillance system	✓		
What should be reported?	Identify potential hazards	✓		
	Identify priority diseases and conditions by epidemiological context and set case definitions		✓	
	Identify priority events for early warning of outbreaks and set event definitions			✓
	Check minimum standards for data collection are met	✓		
	Choose IBS reporting formats (e.g., aggregate vs case-based data, minimum case information required)		✓	
	Choose EBS reporting formats (e.g., minimum information required about events)			✓
When should it be reported?	Frequency of reporting		✓	✓
	Triage of incoming information			✓
Where should it be reported to?	Set reporting lines	✓		
	Define feedback loops for partners and population	✓		
How should it be reported?	Define reporting mechanisms and tools	✓		
	Additional considerations for reporting mechanism only relevant to EBS (e.g., phone hotlines)			✓

During early phase of an emergency

The following additional factors should be considered when deciding on the structure of the surveillance system, the choice of reporting site, and case and event definitions.

- Identify the existing surveillance systems, including the capacity of existing reporting sites to report additional hazards in IBS or EBS formats at potentially higher frequency. The EWAR system should complement surveillance systems existing before the emergency, ideally use the infrastructure and trained data providers that are already in place, and avoid duplicating already existing functions.
- What is the extent of disruption/destruction of previously existing health and surveillance infrastructure and systems?
- What is the capacity of partners and their existing reporting sites?
- What is the availability and willingness of potential new reporting sites and sources?
- Is there community engagement on the feasibility and acceptability of EWAR mechanisms?
- What is the ability of the current reporting software to be used as EWAR software? (See [Module 9](#).)
- What resources are available to train personnel and supervise reporting sites? (See [Module 13](#).)
- What resources are available to verify signals generated, to conduct risk assessment and characterization of events and to confirm alerts generated by IBS and EBS? (See [Modules 4](#) and [8](#).)
- How will the effectiveness of the EWAR system be monitored and evaluated? (See [Module 14](#).)
- What will be the transition strategy when the emergency is over or extends into a protracted crisis? (See [Module 16](#).)

The choice of surveillance strategy will initially depend on what is available and feasible to attain in the first weeks of the crisis – the EWAR system should be implemented at speed. The priority should be to set up a simple EBS network across all health facilities to leverage the immediate reporting and investigation of public health events. At the same time, the infrastructure to support a functional IBS system and/or expand IBS and EBS beyond facilities should be revived/implemented.

Over the period of weeks to months, this can be scaled to a more exhaustive IBS system, including all or most health facilities reporting priority diseases and conditions, and progressively complemented by additional sites and sources reporting to EBS. The strategy should be reviewed in real time throughout the emergency as the context and the availability of resources change.

### 5.1.2 Who should be reporting?

Depending on the context and objectives, a comprehensive EWAR system will ideally incorporate a range of sources and partners (examples in Table 8). This will require close collaboration with government-run facilities, private enterprises, faith-based organizations, NGOs and community-run institutions.



Table 8. Potential sources of IBS and EBS data

Sources*	IBS	EBS
<b>Laboratories</b>	Routinely used – e.g., routine reporting of positive cases	Often used – e.g., identification of a disease not previously detected in the region, new antimicrobial resistance profile
<b>Inpatient health facilities (IPDs)</b>	Routinely used – e.g., routine reporting of individual case-based data/line lists	Often used – e.g., reporting an unusual increase in patients with fever and rash, diseases not resolving with usual treatment
<b>Outpatient departments/ health facilities (OPDs), ambulance services, pharmacies</b>	Routinely used – e.g., routine reporting of aggregate/total numbers of cases with a defined syndrome	Often used – e.g., reporting a group/family with similar symptoms
<b>Community health workers (CHWs) and community health volunteers (CHVs)</b>	Sometimes used – e.g., CHWs reporting weekly counts of suspected cases in their assigned region during an outbreak	Often used – e.g., CHWs and CHVs reporting clusters of severely sick children with unknown disease
<b>Other community members with specific functions (e.g., traditional healers, religious leaders, village leaders, school teachers, large employers)</b>	Sometimes used – e.g., traditional birth attendant reporting cases of neonatal tetanus based on community case definitions	Often used – e.g., religious/village leaders reporting clusters of deaths in their community
<b>Government agencies, NGOs, humanitarian and other partners working in the affected area</b>	Sometimes used – e.g., animal health NGO implementing CBS for suspected Rift Valley fever	Sometimes used – e.g., regional animal health authorities reporting mass animal die off
<b>General public</b>	Not applicable	Sometimes used – e.g., public hotlines to report acute public health events

\*Sources listed are not exhaustive. Other surveillance sources should be considered according to context.

During early phase of an emergency

The sources of IBS and EBS data and information may be the same persons/sites or can be different facilities. For example, health facilities and CHWs might both report to IBS and EBS systems. The choice of the reporting site does not automatically determine the type of surveillance system.

For each of the potential sources of data, a decision is required whether all of the facilities should be reporting (exhaustive surveillance) or a selection of them to achieve adequate surveillance coverage. An exhaustive surveillance strategy is more resource intensive but has increased potential to detect outbreaks earlier if there is capacity to process the resulting signals in a timely manner. Conversely, good quality data from a selection of strategically located outpatient health facilities can be more useful than an exhaustive network of all outpatient health facilities reporting poor data with no supervision.

Whichever strategy is implemented, it is important to consider and document areas and populations that may be hidden/missed. Select a combination of sources that will be able to detect signals among vulnerable and mobile populations, and ensure that coverage of these groups is taken into account when interpreting the data. Community engagement and community consultations can provide information about vulnerable groups and ideas for surveillance sources that might be able to give notice of events and diseases or conditions affecting these groups. Additionally, information about health-seeking behaviour can support the interpretation of the surveillance data.

#### 5.1.2.1 Health facility-based surveillance

Routine surveillance of communicable diseases in health facilities and laboratories typically forms part of the national surveillance system. In an emergency, the following additional factors should be considered for EWAR:

- coverage of all newly displaced, hard-to-reach and/or vulnerable populations;
- disruption of health facilities (e.g., due to lack of electricity, lack of staff or destruction of buildings) – impacting provision of services (treatment capacity) and surveillance capacity;
- potential need to increase the frequency of reporting (e.g., weekly or even daily in case of an outbreak); and
- capacity for immediate reporting of single cases of highly epidemic-prone disease is needed.

During emergencies with major disruptions to healthcare infrastructures, starting IBS reporting with a few health facilities is not a choice but a given. A possible strategy in such a scenario might be to start with IBS in the health facilities that can provide such data and complement the patchy IBS system with an exhaustive EBS system. Additionally, health facilities might contribute to EBS by immediately reporting any public health event of concern (including diseases or clusters of cases beyond the defined priority disease or condition).

#### 5.1.2.2 Community-based surveillance (CBS)

CBS is the systematic detection and reporting of signals that could represent events of public health significance within a community by community members (5, 13, 34). CBS can contribute to IBS or EBS by identifying signals earlier than health facility-based surveillance as it is not dependent on patients reaching or seeking formalized health care.

CBS may cover large areas or target specific populations and can be especially valuable where health facilities are scarce or are hard to reach for the population, where health facilities cannot provide IBS

data, and where alternative sources for IBS reports are required. CBS might better capture vulnerable populations, cross-border events, One Health hazards, such as animal death, or environmental hazards.

It is advantageous to integrate CBS networks that may already exist in the area (e.g., National Red Cross Society volunteer networks and CHW networks).

The integration of **CBS in IBS systems** often involves CHWs or volunteers who work in an assigned area in their community with a known population size. CHWs count deaths and/or diseases in their assigned area and report their counts in a defined frequency (e.g., weekly for deaths and some defined diseases and conditions; immediately for additional defined priority diseases of high epidemic potential). Reporting should be based on simplified case definitions, often called community (or lay) case definitions (13), that allow systematic case reporting by non-medical staff. [Annex 2](#)  lists commonly used community case definitions.

In settings where a functioning system of CHWs for surveillance or other functions such as integrated community case management were already in place prior to the emergency, it can represent a valuable source of community-based data for mortality trends and for a limited number of defined diseases and conditions. However, CBS for IBS can be resource-intensive, which can impact on the sustainability of the system. Substantial numbers of CHWs or volunteers are needed to cover a whole area, CHWs require training, supervision and support, and data generated require close quality control to produce reliable trends and signals. In places where no such system was in place prior to the emergency, careful consideration is needed to weigh the additional benefit of community-based IBS systems against the resources needed to implement such a system.

The integration of **CBS in EBS systems** – also known as community EBS (CEBS) systems – may also be based on CHWs or volunteers assigned to a specific area and population in the community. CHWs and volunteers in EBS systems report signals that could represent public health events immediately to the EBS system. CEBS systems can also be based on more informal or unstructured reporting – engaging sources such as local representatives, community leaders or teachers to report ad hoc about potential public health events (with no structured visits of households). Because CEBS can be more flexible and typically does not require weekly household visits (which sometimes feature in IBS approaches), the population under surveillance can be broader and might better capture vulnerable populations and cross-border events.

While implementation of CEBS is less resource-intensive than CBS for IBS, CEBS can generate a large number of signals that require substantial resources for verification and assessment. CEBS is known to provide high sensitivity while generating many signals that can ultimately not be verified to represent events. To reduce the number of signals and workload, the implementation of a clear triage process is essential to deduplicate and check if the information could represent a potential acute public health event, before notifying the information as a signal; triage can, for example, be conducted by a CHW supervisor. For community EBS, clear event definitions tailored to context and a good triage can help to increase specificity and usefulness of the system. [Annex 3](#)  lists examples of community event definitions for EBS.

For more information on CBS for IBS and EBS, see the:

- [Africa CDC Event-based surveillance framework](#) 
- [Red Cross Red Crescent Community-based surveillance resource site](#) 
- [Integrated disease surveillance and response in the WHO Africa Region – Booklet One: Introduction Section – Annex E – Guide for establishing community-based surveillance and response](#) 

### 5.1.2.3 Combining sources of data

The aim of any EWAR system will be to identify acute public health events, which may be best achieved through use of a combination of complementary reporting sources under IBS and EBS strategies. The choice of sources can be highly context-specific and will depend on sociodemographic characteristics of the population; the functionality of the available surveillance system; the priority hazards; and the resources available to verify signals, assess events and respond to alerts (see Box 2 for examples).

Additionally, information from different sources will need to be linked for interpretation. The same event or case might be reported from different sources, thus de-duplication is crucial. However, systems based on EBS and IBS information also offer the possibility to make use of the complementing information. For example, an outbreak of Disease X might be reported as a single case in IBS data from health facilities, but as a cluster of 15 ill people with similar symptoms in a village through CEBS. The data need to be brought together and interpreted jointly to unleash the full potential of the EWAR system.



#### Box 2. Examples of combining sources for EWAR in an emergency

##### **Context A: Natural hazard in a fragile and conflict-affected situation**

A drought combined with violent clashes over access to water is causing an emergency in Country X, which is already affected by civil war. There is limited state infrastructure, and religion plays a big role in people's lives. Even prior to the drought, local faith-based organizations and a limited number of international NGOs were providing medical care. A multisectoral response to the emergency is underway and EWAR is implemented to ensure further public health risks are identified and acted on rapidly. Sources identified to report to the EWAR system included:

- all laboratories (n=2) and health facilities (OPD n=37, IPD n=6) reporting to the IBS system (exhaustive health-facility based IBS);
- selected local religious leaders were asked to report any information of potential events of public health concern brought to their attention through the EBS system; and
- contact was made with under-represented groups, including a small population of non-majority faith people living on the outskirts of the main population centre, and with a nomadic group grazing herds in the area, to report any information of potential events of public health concern through EBS systems.

##### **Context B: Natural disaster in a middle-income country**

A tsunami hits a small island state and is causing an emergency in Country Y. The health infrastructure was good prior to the emergency and CHWs formed an important part of the country's public health strategy. Following the tsunami, laboratories and inpatient facilities are nonfunctional. A multisectoral response to the emergency is underway and EWAR is implemented to ensure further public health risks are identified and acted on rapidly. Sources were identified to report to the EWAR system, and included:

- outpatient facilities, which had been quickly re-established with very basic services, and reported according to syndromic case definitions to the IBS system (exhaustive outpatient health facility-based IBS);
- CHWs, already employed and trained prior to the emergency, conducted weekly mortality surveillance and reported deaths to the IBS system; and
- all partners represented at the Health Cluster meetings were asked to call a hotline for EBS in case a public health event came to their attention.

### 5.1.3 What should be reported?

EWAR should be able to detect all public health events. Acute public health events can be caused by a variety of infectious and noninfectious **public health hazards**; that is, any biological, chemical, physical or radionuclear agents/sources with potential to cause adverse health effects in an exposed population (1, 11).

The selection of hazards covered by EWAR is guided by the specific epidemiological profile of the country, the area and population affected by an emergency. Typically, the selection must consider the:

- **agent** – infectious or non-infectious disease profile and other potential hazards in the county
- **host** – risk factors of the population, including levels of immunity to agents identified
- **environment** – precipitating factors (e.g., displacement, overcrowding, access to water).

Moreover, prioritization should consider the following hazards.

- **anticipated infectious hazards based on the epidemiological profile of the country** – for example, sporadic outbreaks and seasonal epidemics, common diseases triggered by breakdown of public health systems in emergencies, and diseases exacerbated by the mass gatherings of populations;
- **infectious hazards that may not be part of the historical epidemiological profile of a country but require a form of early detection** – for example, emerging and re-emerging diseases, agents of bioterrorism; and
- **non-infectious hazards requiring close monitoring present in the country** – for example, radionuclear releases, chemical spills, non-infectious food contamination, localized floods.

Guidance on the identification of priority epidemic-prone diseases and environmental hazards through a risk assessment is provided in [Module 3](#) . Guidance on how to translate selected priority hazards into well worded case definitions and event definitions can be found in [Module 6](#)  and [7](#) , respectively. Additional guidance on data quality and checks for the effectiveness of the system is presented in [Module 14](#) .

### 5.1.4 When should data be reported?

**EBS data are typically reported immediately.** All EBS information undergoes a rapid triage as close to the reporting level as possible to check if it is non-duplicative information that could represent a potential public health event (see [Module 7](#) ). After a positive triage, the information is immediately reported as a signal.

**IBS data is reported at a set frequency,** including:

- immediate/same day reporting of disease/conditions where one case requires immediate notification and response (e.g., Ebola virus disease or AFP); and
- scheduled (typically weekly) reporting of other diseases/conditions for monitoring trends.

### 5.1.5 Where should data be reported to?

To ensure the Early Warning component of the EWAR system can fulfil its function to rapidly and reliably detect potential public health events, it is important to define responsibilities and timelines for reporting and feedback. A list of key activities/flow chart can help to ensure reporting lines and feedback channels are clear. Ensure that everyone in the surveillance system understands where the data comes from and where it they need to be sent.

In addition to reporting lines, feedback channels should be established. There should be the possibility to provide bi-directional feedback – from the reporting sites to the highest level of the EWAR system and vice versa. Feedback channels to reporting sites should include feedback on data quality, as well as on disease trends and response taken on the information provided. This helps to ensure data providers are informed about current disease trends; data quality challenges; event verifications/potential signals requiring close monitoring; current public health events; and response actions that may directly/indirectly affect their work/communities. Inputs from reporting sites about challenges encountered during data collection and reporting can provide valuable information that aids the interpretation of the data.

Ultimately communication between all levels of the EWAR system results in potential increased efficiency to detect true events. See [Module 15](#) for more information on bi-directional communication and dissemination of surveillance data.

### 5.1.6 How should data be reported?

For IBS and EBS reporting, mechanisms need to be defined to ensure the data is transferred in a format that is consistent and easy to analyse.

For IBS, the reporting format should ideally be based on the routine surveillance infrastructure that was in place prior to the emergency. The EWAR function should be built into the existing electronic surveillance system wherever possible (see [Module 9](#)). All reporting sites should ideally use the same reporting software (or be able to synchronize their systems with the standard reporting software and report to it) to allow for easy analysis of the data by time, place and person (see [Module 10](#)).

Minimum requirements for the reporting software include the possibility to:

- add new or emerging priority diseases and conditions
- add new variables for existing diseases/conditions (if specific reportable risk factors emerge)
- report either on a weekly basis or immediately for individual high-risk hazards
- report aggregate or case-based data
- roll out to all reporting sites, with a trained focal point at each site
- scale-up use, with identified capacity to train additional staff to handle the software.

In places where the surveillance software that was in place prior to the outbreak is nonfunctional or does not fulfil minimum requirements, temporary solutions for EWAR reporting should be sought (e.g., EWARS-in-a-box) and rolled out at speed. The decision about the reporting lines and reporting infrastructure lies with the national public health authorities.

In some settings, reporting may need to occur through both a (pre-existing) national surveillance system and a dedicated EWAR surveillance system. In such cases, to reduce the workload and data discrepancies related to double notification into two different systems, solutions to integrate the EWAR data into the national surveillance data should be sought. In addition, especially in the case of multiple recipients of the data, there need to be clear lines of responsibility for who should be analysing the data, and conduct verification, risk assessment and response.

For EBS, the reporting format can be more flexible. Incorporating a function into the IBS reporting system that allows immediate reporting of events can be helpful. Additionally, or instead, it is possible to use other simple mechanisms such as phones, email or radio for reporting. In all cases, it is important to maintain records of communications to avoid loss of information, which may easily occur via less formal/flexible mechanisms. Several tools exist that allow the integration of EBS and IBS functions into one digital solution. A selection of those tools is described in [Module 9](#) .

### 5.1.7 What criteria/thresholds for reporting will be applied?

The reason to establish IBS and EBS is to provide an Early Warning of potential acute public health events. Criteria on what constitutes a potential event/signal must be predefined to trigger verification and subsequent steps, without overly burdening the system.

In **IBS systems** a signal is generated when a disease specific **alert threshold** is crossed. Thresholds for each disease/condition need to be decided at implementation of the surveillance system. Thresholds are determined based upon context, disease epidemiology (e.g., seasonality), immunity in the population, environment risk factors present and control strategies (e.g., diseases targeted for elimination/eradication). They may include:

- fixed-value thresholds (e.g., five cases within a one-week period);
- trend thresholds (e.g., significant increase in the number of cases reported compared to the same week in previous year(s), compared for seasonal conditions or compared to weeks prior); and
- single/one case alert thresholds (e.g., immediate reporting requirements for high-risk epidemic prone diseases).

Within **EBS systems**, all reported information undergoes a rapid triage (1). During the triage process, the information is checked that it is non-duplicative (*filtering*, i.e., not been reported previously/elsewhere through other systems) and could potentially indicate an acute public health event (*selection*). For more information on triage see [Module 7](#) .

When the alert threshold is crossed or triage is positive, a signal is generated. Box 3 outlines examples of signals, as well as examples of information that did not meet predefined criteria. With the generation of a signal the Alert component of EWAR starts.



**Box 3.**  
**Examples of  
signals and of  
information  
that does not  
represent a  
signal**

**Examples of signals:**

- Example 1: The IBS system detects seven cases of acute bloody diarrhoea within one week. The alert threshold for acute bloody diarrhoea was set to five cases per week.
- Example 2: The IBS system detects one case of potential viral haemorrhagic fever (VHF). The alert threshold for VHF is one case.
- Example 3: The EBS system detects a cluster of three unexplained deaths in a village at the centre of the emergency. The triage indicates the information has not been reported elsewhere and a cluster of deaths can potentially indicate an acute public health event.

**Examples of information that does not represent a signal:**

- Example 4: The IBS system detects 20 cases of malaria within one week. The alert threshold for malaria is based on the number of reported cases from previous years in the same season and is 32 cases for the week in question. The alert threshold is not passed; therefore, the information is reported to the EWAR system, but no signal is generated.
- Example 5: The EBS system detects five severely injured cases from a road accident of two cars. The triage indicates the information has not been reported before, but injuries by road traffic accident do not constitute a potential acute public health event. The information does not become a signal.

## 5.2 Management of signals, events and alerts

The management of signals, events and alerts refers to the second step of the EWAR process. Signals produced by EBS and IBS are now verified and if they constitute an event, the risk assessment and characterization steps are initiated (Fig. 4). A summary of the steps involved in managing signals is shown in Table 9. Details are described in [Module 8](#).

Fig. 4. The Alert component of EWAR

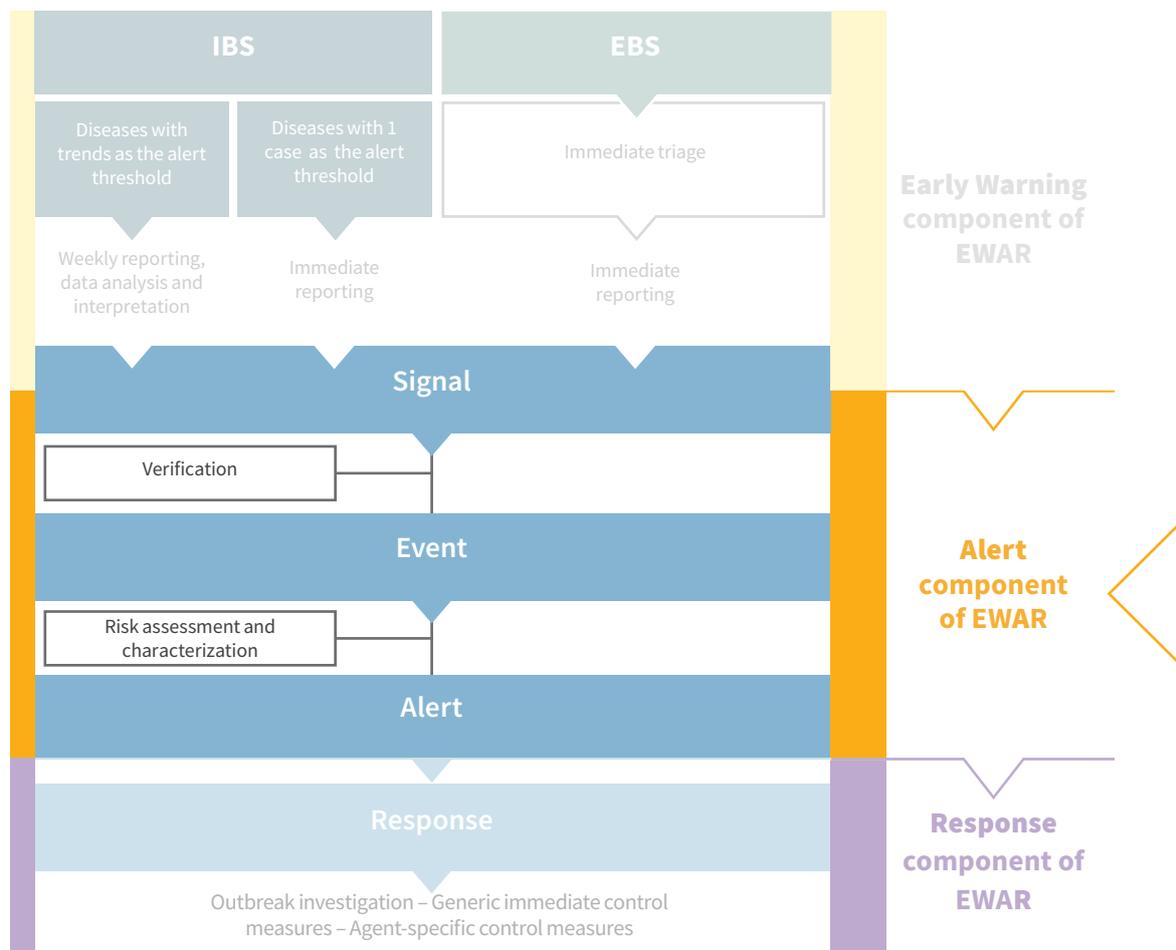




Table 9. Workflow for managing signals, events and alerts (11)

<b>Verification</b>	<p>Verification refers to the pro-active cross-checking of the validity of the signals collected by EWAR, by contacting the original source, additional sources or by performing field investigation. Verification requires that hoaxes, false rumours and artefacts are eliminated from further consideration.</p> <p>A standardized verification process must be in place to confirm whether a signal generated by IBS or EBS is genuine and qualifies as an event. As a result of verification, signals can a) be discarded; b) require further monitoring; or c) be verified. Verified signals become events that require risk assessment and characterization.</p>
<b>Risk assessment</b>	<p>Risk assessment is the systematic process for gathering, assessing and documenting information to assign a level of risk to human health to an event. This step requires a brief description of the event in terms of hazard, exposure and context. This can include the formation of a RRT to conduct field visits and collect laboratory samples. More often, a simple risk assessment is conducted as close to the reporting level as possible, without external human resources, to ensure it is done as quickly as possible and draws on local knowledge and expertise. In addition, risk assessment may be done at a higher geographical level, supported by the EWAR implementation team, if a phenomenon appears to be occurring across several reporting sites.</p> <p>The risk assessment might happen as part of, or in parallel with, an outbreak investigation (see <a href="#">Module 12</a> .</p>
<b>Risk characterization</b>	<p>The outcome of the risk assessment is the assignment of a level of risk to the event, according to a risk matrix and based on the likelihood of worsening outbreak or public health emergency occurring and the resulting public health consequences.</p> <p>The process of verification and risk assessment and characterization can be cyclical; new information can result in an imminent need to respond that previously was not apparent.</p>
<b>Outcome</b>	<p>The final step is a decision on what actions are needed based on the results of the risk assessment and risk characterization. The outcome of a risk assessment and characterization can be that: a) the event is closed if it does not require any (additional) action; b) the event needs further monitoring to decide if an action is needed; or c) the event requires a response. If the outcome of the risk assessment and characterization of the event is that a public health action is needed, this constitutes an alert.</p>

Regardless of whether a signal is generated from an IBS or EBS source, it should be documented in a central **log of signals, events and alerts**, as well as managed in a consistent and predictable way. The log includes information of all signals, whether they could be verified, all events, the outcome of risk assessments and the type of response, if applicable. Standards for the content of the alert log are described in [Module 8](#) .

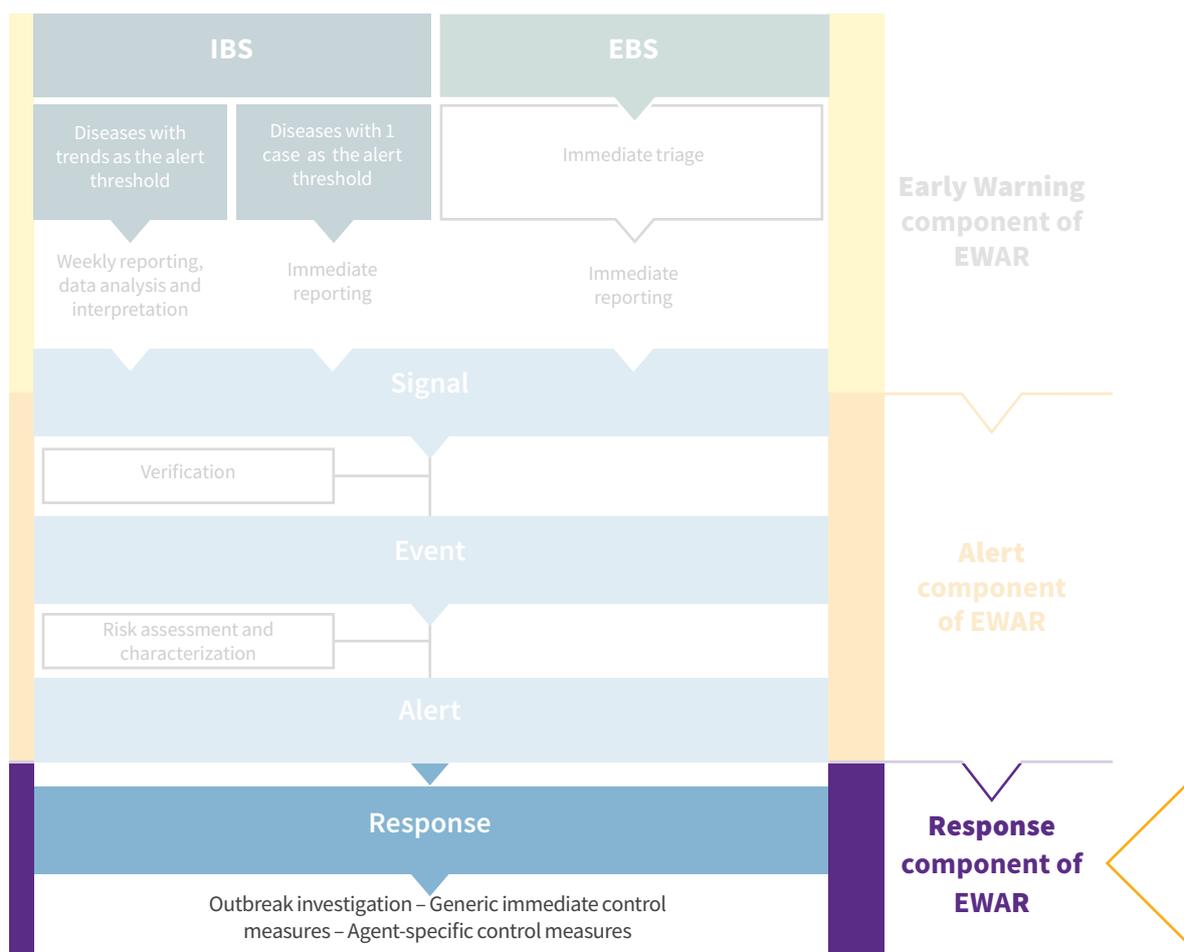
The log should be detailed enough to allow meaningful monitoring and evaluation of the system; for example, the proportion of signals that could be verified to be events and the proportion of events that were confirmed to be alerts (see [Module 14](#) .

During early phase of an emergency

## 5.3 Response to outbreaks and public health emergencies

Without systems in place for a prompt Response, Early Warning and Alert functions are of little use in an emergency. Facilitating a prompt Response is therefore a key priority for EWAR (Fig. 5). During a Response (see [Module 11](#)), the EWAR system is involved in triggering an outbreak investigation, supporting passive and active case-finding, and providing surveillance data to guide and monitor the outbreak and control measures.

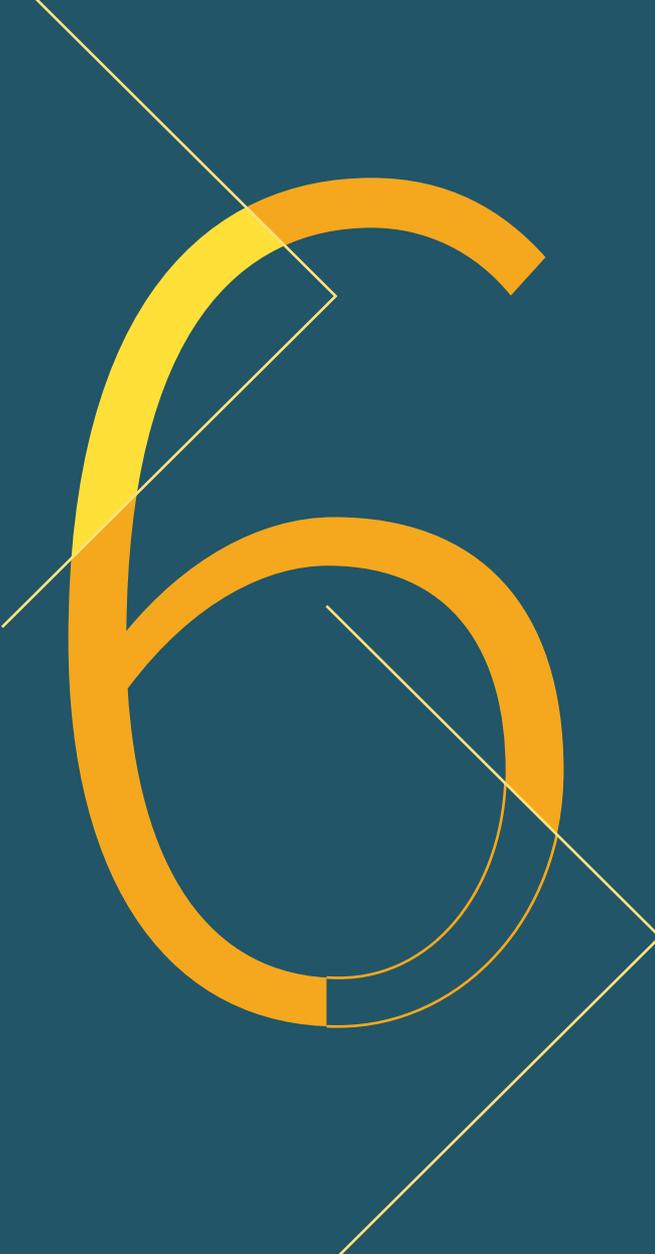
Fig. 5. The Response component of EWAR



Response refers to any public health action that is initiated based on the risk assessment of confirmed alerts. It should be initiated as early as possible to prevent the expansion of the outbreak or public health emergency, reduce morbidity and mortality and mitigate the impact on health service provision. It consists of four overlapping areas.

- (1) Outbreak investigation:** where the aim is to develop hypotheses to answer three key questions (see [Module 12](#) for detailed steps).
- a. What agent is causing the outbreak or public health emergency?
  - b. Which populations are at-risk?
  - c. What control measures are needed to control the outbreak or public health emergency, and to reduce morbidity and mortality?
- (2) Supporting passive and active case-finding:** During an outbreak, the goal is to detect cases in the community as quickly as possible to facilitate case management and to reduce community transmission. EWAR can play a role in supporting both passive and active case-finding.
- (3) Providing surveillance data to guide and monitor the outbreak and control measures.**
- (4) Implementation of control measures,** including the following.
- a. **Immediately implement generic control measures** upon receiving a confirmed alert (e.g., identifying and addressing unsafe and inadequate water for a disease prone to waterborne transmission).
  - b. Following strong suspicion of a specific agent or laboratory confirmation, **implement disease-specific control measures**, especially among high-risk groups (i.e., susceptible groups are protected by measles vaccination).

[Module 11](#) describes the roles of EWAR in response to outbreaks and public health emergencies in greater detail.



# Indicator-based surveillance (IBS) for EWAR

>	<b>6</b>	Indicator-based surveillance (IBS) for EWAR	→
>	<b>6.1</b>	Agree on a strategy	→
>	<b>6.2</b>	Who should be reporting?	→
>	<b>6.3</b>	What should be reported and how?	→
>	<b>6.4</b>	Define alert thresholds	→
>	<b>6.5</b>	Frequency of reporting	→
≡	<b>Contents</b>		

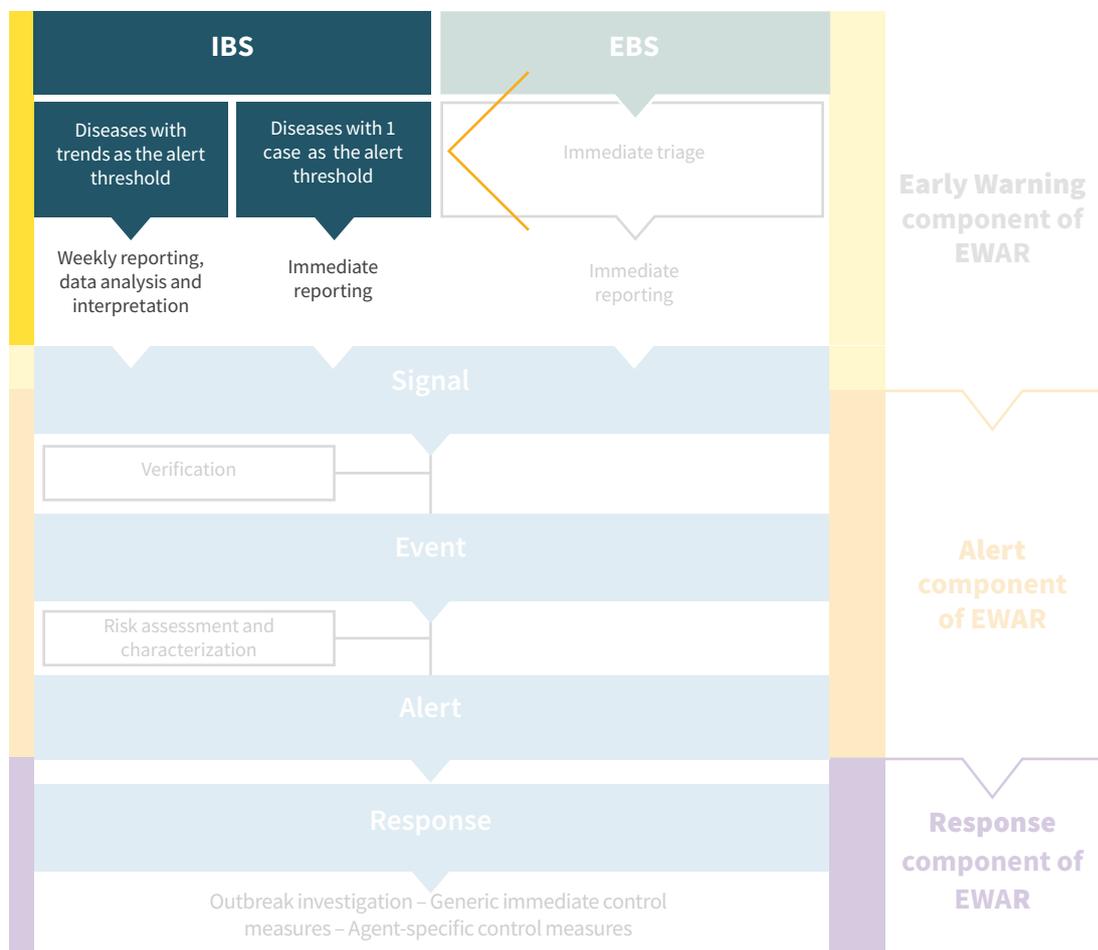
# 6. Indicator-based surveillance (IBS) for EWAR

During early phase of an emergency

IBS is the systematic collection, monitoring, analysis and interpretation of structured data (indicators) produced by health facilities or well identified other sources (such as CHWs and CHVs). Regardless of the reporting source, reporting is always based on case definitions of selected priority diseases or conditions (1). IBS forms one of the core components of Early Warning for public health hazards, working together with EBS (Fig. 6).

“IBS is the systematic collection, monitoring, analysis and interpretation of structured data (indicators) produced by health facilities or well identified other sources.”

Fig. 6. IBS function of the Early Warning component



Module 5  provides an overview of IBS as part of the EWAR surveillance architecture, as well as how IBS and EBS systems interlink. In this module, we provide further detail on IBS and outline practical steps and key principles (Box 4) for implementing/strengthening IBS systems in an emergency. This includes developing an agreed IBS strategy with partners and the community that defines the following.

1. Data sources – who should be reporting?
2. What should be reported? This includes:
  - a. selecting priority diseases and conditions
  - b. developing or reviewing and amending case definitions
  - c. defining the format of the data, reporting lines and reporting mechanisms
  - d. strengthening data collection and reporting
  - e. ensuring data protection.
3. Define the frequency of reporting.
4. Define alert thresholds.



**Box 4.**  
**Principles of IBS implementation as part of EWAR in emergencies**

- Focus only on a small set of 8 to 12 priority diseases or conditions as per country disease profile and context, which carry either a high risk of serious morbidity and mortality and/or are epidemic-prone. Limit to public health hazards for which a public health response can substantially mitigate epidemic spread/impact.
- Base the timing of reporting (weekly vs immediately) for each disease and condition on the assigned risk level – most diseases and conditions should require weekly (not daily) reporting to avoid overwhelming the IBS system.
- Ensure the system remains simple and flexible to respond to changing epidemiological and situational context.
- Ensure data analysis and interpretation are undertaken at the local level as much as possible. If not possible, it should be done with stakeholders as close to field level as possible to ensure context-appropriate conclusions are drawn and prompt action triggered.
- Establish multidirectional feedback loops, including everyone from data collection to analysis and response, to facilitate understanding of challenges, gaps and actions, and to ensure efficiency of response. Multidirectional communication should also include actors who may not be directly implicated in the reporting process, but who are important to strengthening the surveillance system.
- Community engagement is often key to establishing trust in the healthcare and surveillance system; this is also true for IBS systems for EWAR in emergencies.



# 6.1 Agree on a strategy

Broader considerations for the overall surveillance strategy are laid out in [Module 5](#). IBS and EBS strategies should be aligned and should complement each other. When formulating an IBS strategy, each component of the IBS system requires a clear description of who should be reporting which diseases and conditions, at what frequency and to where (Table 10).



Table 10. Questions and factors to consider when deciding on the strategy for IBS

Questions	Factors to consider	Example	Where to find further information
<b>Who should be reporting?</b>	IBS sources and reporting sites	All OPDs run by government, faith-based, NGO or private sector in the affected area (exhaustive network). Additionally, a CBS system with CHWs/CHVs in two less serviced areas that report three specific priority conditions.	<ul style="list-style-type: none"> <li>• Overview of potential sources and coverage of the surveillance system – <a href="#">Module 5</a></li> <li>• Common IBS sources – <a href="#">Module 6</a></li> </ul>
<b>What should be reported?</b>	Priority diseases and conditions, case definitions and standards for reporting	<p>OPDs report cases of 10 priority diseases and conditions as aggregate data, stratified by sex and age group (&lt;5 years and ≥5 years), based on syndromic case definitions.</p> <p>CHWs/CHVs report three priority conditions based on community-case definitions.</p>	<ul style="list-style-type: none"> <li>• General considerations for priority hazards and minimum standards for reporting – <a href="#">Module 5</a></li> <li>• Priority diseases – <a href="#">Modules 3</a> and <a href="#">6</a></li> <li>• Case definitions and strengthening data collection and reporting – <a href="#">Module 6</a></li> </ul>
<b>When should it be reported?</b>	Frequency of reporting for each disease/condition	<p>OPD: Routine reporting once per week. Immediate reporting for diseases with a one-case alert threshold.</p> <p>CHWs/CHVs: Weekly reporting of three conditions.</p>	<ul style="list-style-type: none"> <li>• Frequency of reporting – <a href="#">Module 5</a></li> <li>• Alert thresholds and signals – <a href="#">Module 6</a></li> </ul>

During early phase of an emergency

Questions	Factors to consider	Example	Where to find further information
<b>Where should the reports go?</b>	Information flow for disease reporting and responsibilities to take action based on the reports	CHWs/CHVs report to defined OPDs. OPDs report to the local level surveillance units. The local level unit transmits the information to the federal level and national level. The local level conducts verification, risk assessment and response if needed.	<ul style="list-style-type: none"> <li>Reporting lines and feedback loops – <a href="#">Module 5</a></li> <li>Communication and dissemination – <a href="#">Module 15</a></li> </ul>
<b>How should it be reported?</b>	Mechanisms for reporting and standard formats	CHWs/CHVs report on paper to OPDs. At OPD level, reports are captured and transmitted digitally to the local public health authority using a reporting tool that was implemented and used prior to the emergency. A standard form is used for weekly aggregate reporting; another form for weekly aggregate reporting by OPDs; and immediate reporting by OPDs of individual cases for diseases with one-case alert thresholds.	<ul style="list-style-type: none"> <li>Reporting mechanisms and SOPs – <a href="#">Modules 5</a> and <a href="#">8</a></li> <li>Digital tools – <a href="#">Module 9</a></li> </ul>



## 6.2 Who should be reporting?

All sources in the IBS system should be reporting IBS data to the next level in the surveillance system (usually local level emergency operations centre) using defined mechanisms and timelines. A list of sources that may contribute to IBS can be found in [Module 5](#).

A usual source for IBS data is a predetermined network of health facilities (e.g., health posts, health centres, hospitals). Ideally, included health facility sites should:

- be located as close as possible to the affected populations
- have good coverage of the affected populations, including specifically vulnerable populations
- have sufficient personnel, equipment and reliable telecommunications for routine reporting
- include all governmental, private, NGO, faith-based and other facilities in the affected area.

In certain settings, CHWs additionally contribute to IBS. The decision to initiate CBS for IBS in an emergency context needs careful consideration. Already existing structures of CBS for IBS

(pre-emergency) should be integrated and not duplicated. Characteristics of CBS networks for IBS and aspects to consider when planning CBS networks are outlined in [Module 5](#) . CBS is particularly valuable in situations where health facility surveillance may be less effective, for example:

- where coverage of the affected population by health facilities is poor;
- in the context of an outbreak of a disease which is stigmatizing for affected persons;
- for diseases where affected persons are less likely to present to health facilities, either due to perceived mildness, high treatment costs, or perceived lack of effective treatment; and
- where informal and traditional practitioners provide a substantial proportion of care.



## 6.3 What should be reported and how?

The overall aim of the Early Warning function of the EWAR system is to detect public health hazards rapidly. Hence, it is necessary to prioritize epidemic diseases and other public health hazards based on their likelihood and potential for high impact. Typically, infectious diseases (e.g., measles) are included in IBS; however, in some systems non-infectious conditions (e.g., lead poisoning) can also be included for reporting, according to the setting.

### 6.3.1 Select priority diseases and conditions

A maximum of **8 to 12 diseases and health conditions** should be monitored through IBS. The list should be developed and revised regularly with a risk assessment to reflect the epidemiological context (e.g., overcrowding caused by rapid population influx into the emergency-affected area) and any new or re-emerging diseases (see [Module 3](#) ).

A typical example list of potential diseases and conditions to be covered through IBS may include, for example:

- AFP (suspected poliomyelitis)
- acute haemorrhagic fever syndrome (Ebola, Lassa fever, yellow fever)
- acute jaundice syndrome (suspected hepatitis A/E)
- severe acute respiratory infection (suspected MERS/influenza/COVID-19 outbreak)
- AWD (suspected cholera)
- bloody diarrhoea/dysentery (suspected shigellosis)
- malaria (suspected and/or confirmed)
- dengue-like illness
- measles (suspected and/or confirmed)
- suspected meningitis and/or encephalitis.

There may be additional conditions and incidents that require reporting and action; however, the EWAR system should be limited to acute public health hazards to avoid overwhelming the system. EWAR focuses on epidemic-prone diseases which require immediate action to prevent outbreaks and acute public health emergencies. IBS as a component of EWAR in emergencies is not well placed to measure the prevalence of critically important but non-epidemic conditions, including noncommunicable diseases, chronic infectious diseases (e.g., HIV, tuberculosis), acute malnutrition or sexual violence and assault. Moreover, while mortality data collected at the health facility level can be used to calculate CFRs and trends for specific diseases and conditions, it is not useful to estimate all-cause mortality. Measurement of these conditions and indicators through IBS for EWAR risks undercounting persons affected and providing misleading estimations. Appropriate channels should be identified for other conditions and incidents that require documentation and action outside the EWAR system. Table 11 outlines further rationale and potential alternative surveillance measurement systems.



Table 11. Conditions and indicators that should not be included into the IBS for EWAR system

Condition/ indicator	Rationale for exclusion from EWAR	Potential alternative surveillance mechanisms
<b>Noncommunicable diseases, chronic infectious diseases (e.g., HIV, tuberculosis, chronic hepatitis)</b>	<ul style="list-style-type: none"> <li>• EWAR is not suited for detecting such a condition.</li> <li>• Passive reporting of chronic conditions does not reflect prevalence.</li> </ul>	There could be additional dedicated/integrated IBS information systems based at health facilities that treat and manage noncommunicable diseases and chronic infectious diseases (36).
<b>All-cause mortality</b>	<ul style="list-style-type: none"> <li>• Health-facility based data capture only a fraction of the true mortality in a population, where individuals often die in the community.</li> <li>• EWAR is not designed to collect reliable numerator and denominator data, nor to calculate population-level mortality rates, making the mortality data inaccurate.</li> <li>• CBS can be useful for collected all-cause mortality at community level where most deaths occur; however, it requires systematic collection of both the numerator (deaths) and denominator (population size) on a routine basis, and substantial technical and logistical resources – not a standard feature of EWAR (37).</li> </ul>	In emergencies, the most accurate sources are from retrospective mortality surveys, and may be complemented by prospective community-based mortality surveillance using CBS (37, 38) – further guidance is available from the Global Health Cluster

Condition/indicator	Rationale for exclusion from EWAR	Potential alternative surveillance mechanisms
<b>Malnutrition surveillance</b>	<ul style="list-style-type: none"> <li>Malnutrition cases are usually referred directly to nutrition treatment centres (e.g., Stabilization Centre or Outpatient Therapeutic Feeding Programme); therefore typically falling outside of EWAR health facility networks.</li> <li>Prevalence and incidence cannot be calculated using passive and incomplete reporting of malnutrition to health facilities in the EWAR network.</li> </ul>	Dedicated nutrition surveillance systems should be established where possible and where the resources exist (39).

### 6.3.2 Construct case definitions

Every disease and condition prioritized for IBS in EWAR must have an associated case definition. A case definition is a set of standard criteria that must be fulfilled to classify a person as a case of a particular disease or health condition for the purposes of surveillance and outbreak investigation. Definitions must be clear, appropriate, need to be consistently applied, and should be listed in surveillance reports to aid interpretation.

For EWAR, IBS case definitions are mostly syndromic, based on signs and symptoms that are easy to detect and do not necessarily need laboratory testing or advanced diagnostics (see example in Box 5). The advantage of syndromic case definition is that the classification can be made rapidly (without waiting for test results), and may be applied by any peripheral health facility, including facilities with limited diagnostic equipment. [Annex 4](#) lists commonly used syndromic case definitions.



**Box 5.**  
**Example of syndromic case definition**

**Acute jaundice syndrome:**

**Case definition for health facilities:** A person with acute onset of jaundice (yellowing of whites of eyes or skin or dark urine) AND severe illness with or without fever AND the absence of any known precipitating factors.

**Simplified community case definition:** A person with yellow eyes.

**Outbreak case definition:** A person with acute jaundice and fever and is resident of Camp X since at least 30 October 2021.

If the IBS system includes reporting from CHWs/CHVs, they are reporting according to what are known as community case definitions. Community case definitions are simplified versions of syndromic case definitions that make it possible for non-medically trained people to decide if someone is a case or not (see example in Box 5). Community case definitions can be context specific, depending on the community’s understanding and description of the disease or condition. [Annex 2](#) lists commonly used community case definitions.

Where available, case definitions issued by the national public health authorities (or equivalent) should be used for reporting from health facilities. Where these are not available, the [WHO Outbreak Toolkit](#) provides a repository of definitions for select diseases (as well as templates of line lists and data dictionary). In the event a new and emerging disease is detected and included under EWAR

IBS systems, new case definitions may need to be developed based on any available information on the epidemiology, clinical presentation and laboratory findings to date. WHO regularly suggests case definitions on emerging diseases. Case definitions are designed for surveillance purposes only. They are not used as diagnostic criteria for treatment and do not provide any indication of treatment provision. However, they may be used to refer suspected cases to care.

Case definitions should be reviewed periodically and adjusted as more information of a local disease or condition becomes available, adjusting sensitivity and specificity to overcome any observed challenges in the application of the definitions – based both on feedback received at reporting sites and in response to detected outbreaks. Definitions need to hold a balance between sensitivity and specificity. Ideally, a case definition will include all true cases (high sensitivity) and exclude non-cases (high specificity). Usually there is a trade-off between sensitivity and specificity – the more specific a case definition is, the higher the chance some true cases will be missed. As case definitions applied in EWAR typically do not include laboratory confirmation, they tend to be more sensitive and better placed to detect diseases and conditions faster. However, with syndromic case definitions, false positives are to be expected (low specificity), and are usually tolerated for the sake of early detection of outbreaks.

Case definitions may also be adjusted before, during and after outbreaks (see also [Module 12](#) ). For example, a syndromic case definition is used prior to the detection of an outbreak for early warning monitoring to ensure potential cases are picked up with high sensitivity. In outbreak investigations, case definitions are supplemented by time, place and person information in order to identify cases that belong to the outbreak in question (see example in Box 5) (2). These may also differentiate between suspected cases (often based on signs and symptoms), probable cases (often suspected cases with an epidemiological link to a confirmed case) or confirmed cases (often suspected cases with laboratory confirmation criteria). For diseases where it is imperative that every case is detected, a highly sensitive alert definition or community case definition may also be included. As the outbreak is ending, the case definition may be changed again to remove time, place, person and laboratory criteria in order to be more sensitive to ensure detecting the last potentially circulating cases.

### 6.3.3 Define the format of the data

For each disease/condition and reporting site, define the exact details that need to be reported for each case. For some settings and diseases/conditions, case-based reporting to allow for thorough analysis of time, place and person is warranted (see [Module 10](#) ). For others, aggregate data (with/without stratification) will be sufficient to capture an outbreak and will save resources (Table 12).



Table 12. Aggregate vs case-based reporting of IBS data

	Aggregate reporting	Case-based reporting
<b>What is it?</b>	Cases are not reported individually but in quantitative batches	Individual cases are reported
<b>When is it used?</b>	Often in outpatient health facilities where a large flow of patients is seen	Often used in inpatient facilities where details about the case's clinical presentation are more readily available
<b>What does it look like?</b>	Can include the total number of cases seen at a health facility in the reporting period only, or  More granular reporting of specific groups (e.g., number of cases stratified by sex and broad age group)	The minimum time, place, person information per case, e.g., unique case identifier, health facility identifiers, demographics, date of symptom onset, date of reporting, epidemiological case definition and disease outcome (recovered/dead)  Collated in a line list/spreadsheet/database format
<b>What are advantages and disadvantages?</b>	Saves time and resources and allows tracking overall trends and comparisons over time  Does not allow for detailed analysis of the data nor for retrospective verification	Enables detailed analysis of disease data by time, place and person in order to inform the response during outbreaks or targeted control efforts for prioritized conditions (e.g., Polio)  Allows for the retrospective verification of data  More resource intensive

Depending on the chosen format, and the context and capacities of reporting sites, an appropriate tool/mechanism should be selected and documented in SOPs. This may include, for example, standardized paper-based tools (e.g., case report forms, weekly aggregate tallies), digital tools or a combination of these across different levels and sites. [Modules 5](#) and [8](#) provide further details on reporting mechanisms, standard formats and SOPs, and [Module 9](#) reviews digital tools.

The same SOPs should additionally document the flow of information (reporting lines and feedback loops), and who is responsible for each step in the data collection, management, analysis and dissemination processes. [Module 5](#) provides further details on reporting lines and feedback loops, and [Module 15](#) outlines considerations for communication and dissemination.

### 6.3.4 Strengthen data collection and reporting quality

Several techniques exist to ensure the numbers of cases counted with IBS represent the true number of new cases identified at each reporting site as accurately and validly as possible. This may include training reporting sites to conduct the following.

- **Zero reporting:** All reporting sites should be trained and capacitated to perform zero reporting (the mandatory reporting of 0 cases if none is seen). Zero reporting avoids misinterpretation of missing numbers, while also allowing the identification of nonresponsive or “silent” health facilities.
- **Reporting of only new (incident) cases and avoiding double counting:**
  - If a patient returns to a health facility for a repeat visit for the same disease or health condition that has already been reported, they should not be reported again in EWAR.
  - Similarly, standard procedures should be put in place to prevent double counting of the same disease event in the same patient and same facility when they are referred between departments (e.g., a patient is diagnosed in OPD, sent to the laboratory for confirmation and admitted to the IPD for treatment following confirmation).
  - Conversely, if a case presents with two reportable health conditions (e.g., malaria and AWD), and if both are new diagnoses that have not previously been reported, then both new conditions should be reported. Aggregate counts reported to EWAR do not represent the total number of patients in a facility, rather the number of cases of diseases/conditions present.

In addition, considerations must be given to the **place of residence** and **cross-border populations** during the collection, analysis and interpretation of EWAR data. EWAR systems typically record reporting site/place of consultation, which may be distant from the cases’ places of residence at onset/usual residence/place of exposure. During an outbreak, when information on a case is being recorded in a line list, additional geographic data may be included to enable more accurate representation of the extent of the outbreak.

Regarding cross-border populations, when the affected population is living at the border between countries or autonomously managed regions within a federation of states, it is important to set up cross-border collaboration for information sharing and outbreak verification procedures, if feasible and acceptable.

Further information on monitoring and evaluation standards, including for data quality, can be found in [Module 14](#) .

## 6.4 Define alert thresholds

Not every case reported under an IBS system represents a signal/public health hazard in itself. Alongside the case definition, each disease or health condition prioritized in EWAR must be assigned an **alert threshold** – a predefined number of cases (or proportion, rate, trend) that, when reached/crossed, generates a signal (2, 13). Alert thresholds can broadly be categorized into three types: fixed values, moving average and historical trends (Table 13).



Table 13. Types of alert thresholds

<b>Fixed values</b>	<p>For diseases in populations with no historic surveillance data, the threshold is set at an absolute value, which when exceeded will generate a signal. The threshold may differ in different settings, depending on population size, population immunity to the disease and the epidemic disease profile.</p> <p>For several diseases, this threshold is a single case, which should prompt immediate reporting of a signal – often referred to as a one-case alert threshold.</p>
<b>Moving average</b>	<p>When data from the past weeks is available, a moving average can be calculated to evaluate the average change in counts of cases over time. For example, a baseline value may be calculated from the average number of cases reported in the previous three weeks in a specified reporting site/population, and the alert threshold set at twice the baseline value.</p>
<b>Historical trends</b>	<p>For diseases that are endemic and/or fluctuations in incidence may be predicted (e.g., due to seasonal changes), the threshold can be set as a calculated value, based on a greater than expected increase in the number of cases over a given time interval. The expected number of cases may be based upon observed rates (e.g., average number of cases reported in the same week in the past three years) or modelled to account for other parameters.</p>

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Some diseases have a defined **epidemic threshold**, which is the specific number of cases, according to the disease/syndrome and the population at-risk, used to trigger an urgent response (13). Some diseases and conditions already represent a potential public health hazard when the first case appears because they may spread rapidly (e.g., Ebola virus disease or poliomyelitis). A single reported case of such a disease or condition can signal a potential public health hazard. Additionally, there may be diseases and conditions that are required to be reported daily by local/national health regulations for programmatic and disease control reasons (e.g., diseases targeted for eradication/elimination requiring an immediate response). The selection of diseases and conditions with one-case alert thresholds should be based on a risk assessment (see [Module 3](#) ).

Moving average and historic trend alert thresholds are highly dependent on context and need to be adapted to available data, disease profile and local context. If there are no local historical data available (e.g., for a newly displaced population), fixed alert thresholds may be established, based upon observations elsewhere adapted to the local context, with expert input.

For all types of alert thresholds, methods used and set values should be periodically reviewed and adjusted, both as information about the disease profile of the local population becomes available, and based upon feedback from the verification process (e.g., if systems are generating many non-valid signals).

*The epidemiological data analysis for the early warning alert and response network (EWARN) in humanitarian emergencies: a quick reference handbook* provides additional information on calculating thresholds, and Table 14 lists examples of alert thresholds for diseases and systems commonly included in EWARN.

Table 14. Examples of alert thresholds (2, 13)

Disease/syndrome	Alert threshold
<b>Measles, acute haemorrhagic fever, AFP, neonatal tetanus, typhus, plague, cholera</b>	Single case
<b>AWD</b>	5 cases in ≥5 year age group in one location in one week
<b>Bloody diarrhoea, acute jaundice</b>	≥5 cases in one location in one day or 2x weekly moving average
<b>Confirmed malaria</b>	Median of number of confirmed cases during the same period in the past five years
<b>Suspected bacterial meningitis</b>	one case in an overcrowded camp setting ≥30 000 population: three suspected cases per week <30 000 population: two suspected cases per week or an increased incidence compared to previous non-epidemic years

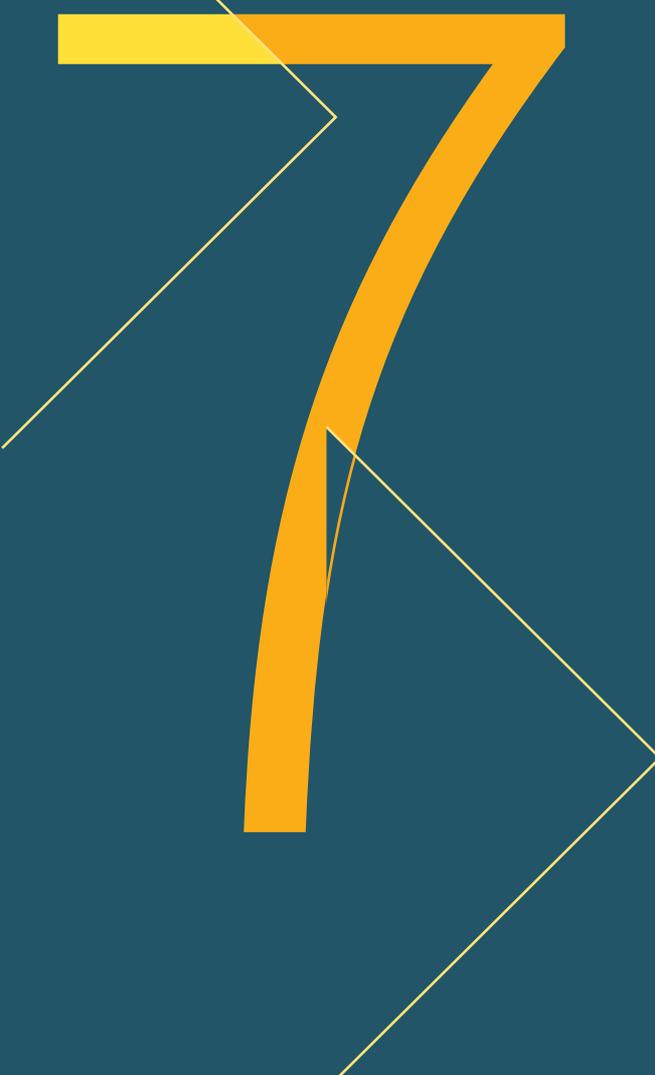
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## 6.5 Frequency of reporting

Most commonly, IBS data collected under EWAR in emergencies are reported on a weekly basis. This should follow an epidemiological week, as defined by the national public health authorities (commonly Monday to Sunday but may vary by country). This should be complemented by an immediate reporting of diseases/conditions with a one-case alert threshold.

Monthly reporting is not feasible for EWAR, as it will lead to delays in detecting signals of potential outbreaks. Routine daily IBS reporting for all EWAR diseases and conditions is also not recommended, as it places an overwhelming burden on staff and can easily overwhelm a system. However, in an outbreak, all facilities may switch to daily reporting of the outbreak disease using standardized reporting tools/line lists (see [Module 12](#) )

Frequent analysis of the transmitted surveillance data is needed to identify when a disease/condition has crossed the alert threshold and signals a potential public health hazard. All signals that are detected are notified as signals to the EWAR system and represent the start of the signal, event and alert management system that follows the same structure for all incoming signals (see [Module 8](#) )



# Event-based surveillance (EBS) for EWAR

- > **7** Core functions for early warning, alert and response →
- > **7.1** Agree on a strategy →
- > **7.2** Who should be reporting? →
- > **7.3** What should be reported and how? →
- > **7.4** Triage of EBS information →
- > **7.5** Frequency of reporting →

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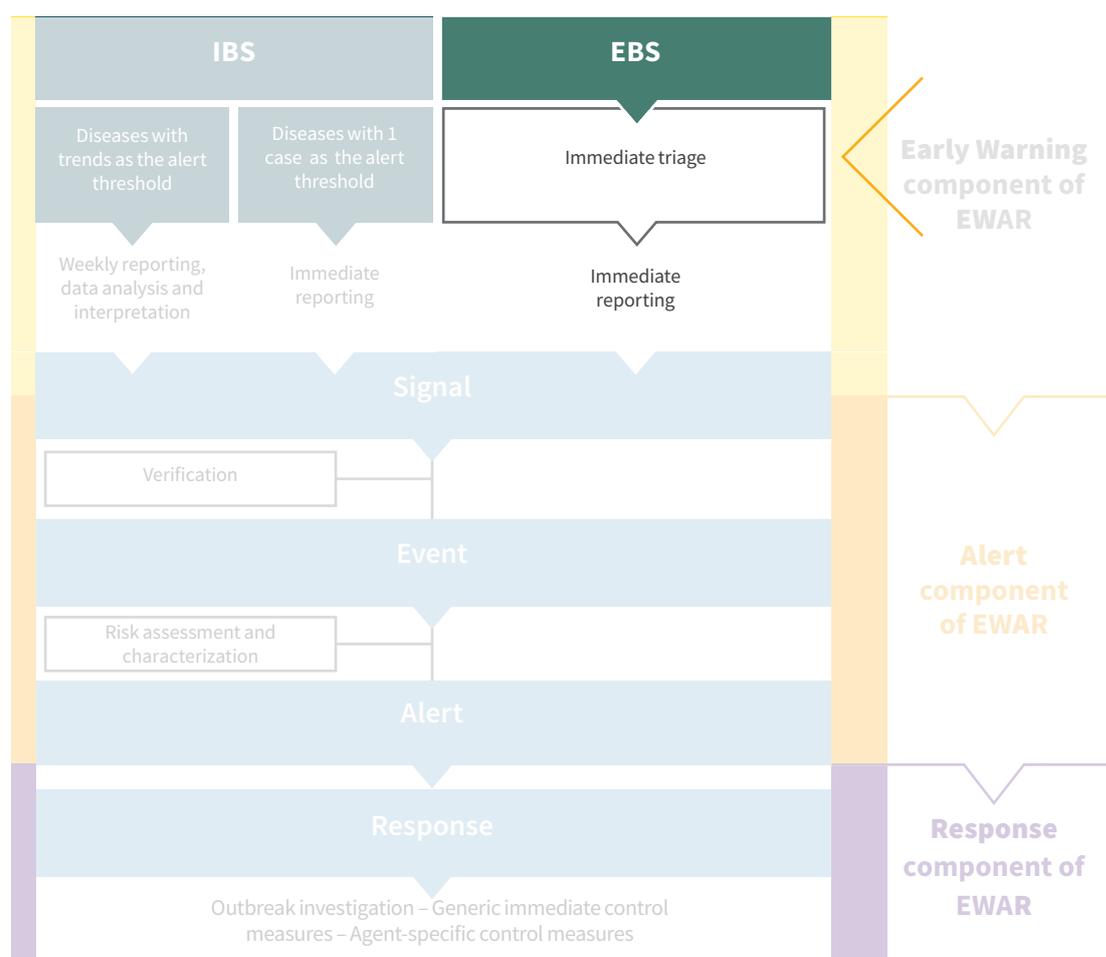
# 7. Event-based surveillance (EBS) for EWAR

EBS is the organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding potential public health hazards, which may represent an acute risk to human health. EBS can include health facilities, communities or other stakeholders reporting events that may represent a public health hazard. EBS is not based on case definitions and may detect potential public health hazards faster, can reach beyond health facilities, and can detect diseases that are not explicitly covered in your IBS system (1).

“EBS is the organized collection, monitoring, assessment and interpretation of mainly unstructured ad hoc information regarding potential public health hazards, which may represent an acute risk to human health.”

EBS is one of the core components of Early Warning for public health hazards, working together with IBS to detect potential public health events (Fig. 7). A key strength is that it can be implemented rapidly at the onset of an emergency, while IBS may take longer to be established. At the start of the emergency, especially in a situation where IBS is patchy and not fully functioning, initiating EBS reporting from health facilities and key community representatives can be a feasible and meaningful option to start surveillance for EWAR purposes, while other surveillance activities are progressively scaled-up.

Fig. 7. EBS function of the Early Warning component



Module 5  provides an overview of EBS as part of the EWAR surveillance architecture, as well as how IBS and EBS systems interlink. In this module, we provide further detail on EBS and outline practical steps and key principles (Box 6) for implementing/strengthening EBS in an emergency. This includes developing an agreed EBS strategy with partners and the community that defines the following:

1. Who should be reporting?
2. What should be reported?
  - a. Set event definitions
  - b. Define the format of the data
3. Triage mechanisms
4. Reporting tools and reporting mechanisms
5. Reporting frequency – ensure immediate reporting.



**Box 6.**  
**Principles of EBS implementation as part of EWAR in emergencies**

- Complement the IBS system and draw on the existing reporting structure and resources of IBS.
- Ensure systems are geared toward rapidly detecting public health hazards, including diseases and conditions not included in IBS.
- Implement EBS system as quickly as possible – a simple reporting mechanism (e.g., a hotline in all health facilities and key community locations) can be highly effective for rapidly detecting outbreaks while other EBS and IBS activities are scaled-up.
- Align with and draw upon existing networks and reporting lines as much as possible (e.g., health facilities, community networks, community health workers, teachers' unions).
- Adapt event definitions to local context and expertise of the reporting sites.
- Establish standard workflows to immediately triage information generated by EBS, and to immediately report and manage signals.

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## 7.1 Agree on a strategy

There are many possible strategies for the establishment of EBS in emergencies. The most appropriate strategy largely depends on the needs, context and available resources. Strategic decisions must consider the sources of data to include, the definitions of events and reporting lines. These decisions have important implications for the sensitivity and specificity of the system, and the volume of work and resources that will be required.

The decision on the EBS approach to start with is critical. Based on the context, it may be feasible to start with community and health facilities and progressively include media scanning and a hotline, depending on the available resources.

The strategy for EBS and IBS need to be aligned and should complement each other. Broader considerations for the overall surveillance strategy are laid out in [Module 5](#) .

The strategy should be clearly defined and agreed upon by key stakeholders and sectors prior to implementation. Each component of the EBS system requires a clear description of who should be reporting, at what frequency and to where (see Table 15).





Table 15. Questions and factors to consider when deciding on the strategy for EBS

Questions to consider	Factors to consider	Example	Where to find further information
<b>Who should be reporting?</b>	EBS sources and reporting sites	All outpatient and inpatient health facilities (run by government, faith-based, NGO or private sector) and women's group representatives in the affected area.	<ul style="list-style-type: none"> <li>• Overview of potential sources and coverage of the surveillance system – <a href="#">Module 5</a> ↗</li> <li>• Common EBS sources – <a href="#">Module 7</a> ↗</li> </ul>
<b>What should be reported?</b>	Event definitions	<p>Outpatient and inpatient health facilities report “any event that could represent a potential public health hazard”.</p> <p>Women's group representatives report “3 or more severe cases with similar symptoms or deaths that occur in the same village within one week”.</p>	<ul style="list-style-type: none"> <li>• General considerations for priority hazards and minimum standards for reporting – <a href="#">Module 5</a> ↗</li> <li>• Event definitions and additional considerations for data reporting in EBS systems – <a href="#">Module 7</a> ↗</li> </ul>
<b>When should it be reported?</b>	Frequency of reporting	Immediate reporting	<ul style="list-style-type: none"> <li>• Frequency of reporting – <a href="#">Module 5</a> ↗</li> <li>• Immediate reporting and signals – <a href="#">Module 8</a> ↗</li> </ul>
<b>Where should the reports go?</b>	Information flow for event reporting and who is responsible for actions based on the reports	All reports go to the local level surveillance unit. The local level conducts triage, verification, risk assessment and response, if needed, and reports accordingly to the next surveillance level.	<ul style="list-style-type: none"> <li>• Reporting lines and feedback loops – <a href="#">Module 5</a> ↗</li> <li>• Communication and dissemination channels – <a href="#">Module 15</a> ↗</li> </ul>
<b>How should it be reported?</b>	Mechanisms for reporting and standard formats	Reporting should be by the quickest, most efficient means that still enables the inclusion of all critical information. In this example, EBS reports are transmitted by text message.	<ul style="list-style-type: none"> <li>• Reporting mechanisms and SOPs – <a href="#">Modules 5</a> ↗ and <a href="#">8</a> ↗</li> <li>• Digital tools – <a href="#">Module 9</a> ↗</li> </ul>
<b>What feedback mechanisms should be installed?</b>	Communication and feedback loops between all levels of the EWAR system	A weekly epidemic bulletin reports trends seen, alerts confirmed and actions taken. Additionally, a monthly meeting between all levels of the surveillance and alert management system allows for communication and bi-directional feedback.	<ul style="list-style-type: none"> <li>• Reporting mechanisms and SOPs – <a href="#">Module 5</a> ↗</li> <li>• Communication and dissemination channels – <a href="#">Module 15</a> ↗</li> </ul>

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### 7.1.1 Community engagement

EBS in EWAR is often based to some extent on the reporting of signals and events in the community by community members – be it through public hotlines or in their capacity as community informants, CHWs and CHVs, traditional healers or religious leaders. It is key to establish community consultations from the outset and facilitate continuous dialogue to decide on an appropriate strategy and to ensure the EBS system is efficient, accepted and beneficial for the community under surveillance.

Community engagement should be tailored to context and can vary in scale and scope. It should not only be sought for the initial development of the EBS strategy as part of EWAR, but recommended throughout the emergency, as community trust and motivation are crucial to the success of any EBS system. Additionally, continuous community engagement allows for modification and adaptation of the strategy as community outlook and situations change.

Additionally, the systematic reporting of signals and events from communities requires a feedback loop to inform communities about actions taken based on the reported information (see [Module 15](#)). Community meetings also provide opportunities to exchange and listen and open a channel of communication to contextualize other surveillance system information (e.g., IBS data from health facilities).



## 7.2 Who should be reporting?

The sources and partners reporting into an EBS network should be broader than the network for IBS reporting. Reporting sites can be predefined (e.g., health facilities to report any unusual events) or reporting can be open to anyone (e.g., hotlines); reporting does not require medical expertise. A list of sources that might contribute to EBS can be found in [Module 5](#). A wide network of potential informants should be considered in the implementation and upscaling of EBS activities in an emergency-affected community, including, for example:

- established professional networks (e.g., health workers, pharmacies, laboratories, volunteers, government and nongovernmental organizations, teachers, religious leaders);
- animal health and environment sectors;
- traditional healers or traditional birth attendants, especially where traditional healthcare providers provide a substantial proportion of care or health facilities are scarce;
- media sources (e.g., newspapers, radio, social media and other internet-based sources); and
- the general public.

However, too many information sources can lead to a large number of signals that may overwhelm the capacity of the EWAR team. The number and type of sources need to be a balance between the ability of the system to detect a true and meaningful signal and the effort needed to maintain the system of triage, verification and risk assessment, and to mount an appropriate response to the information received. When selecting potential sources for the EBS system, the following considerations might be helpful.

- **Sensitivity and validity:** Are the sources of information able to identify events of public health concern?
  - Health workers are likely able to identify events of public health concern; signals derived from health workers usually have a good specificity and often indicate potential acute public health events. However, health workers have access to persons under care but not necessarily to the community. A system based on healthcare facilities alone is potentially not very sensitive as it might miss events in the community, and signals may be delayed due to inherent delays in the care pathway.
  - Community members may be able to report signals of potential public health events at community level early but might lack capacity to judge what constitutes an event of public health concern without appropriate guidance. A system based at community-level might be very sensitive, but the specificity of the reported signals may be limited.
- **Coverage:** Do sources have access to persons outside typical surveillance settings (i.e., healthcare facilities) and without too much duplication in coverage? Do sources have access to specific vulnerable groups?
- **Sustainability:** How easily can the source be established and maintained without impacting other EWAR and response activities?
- **Resource implications:** How much time and resources (e.g., people, money, equipment) will be required to ensure the source is able to provide useful surveillance information?

## 7.3 What should be reported and how?

The selection of potential events to be reported under EBS should be based on the local context. EBS may be leveraged to detect a range of public health events, including those not detected by IBS (35). Signals/ events reported under EBS may include potential public health hazards that:

- overlap prioritized diseases under IBS but include less restrictive criteria (more sensitivity);
- are not among prioritized diseases under IBS (e.g., new and emerging or re-emerging diseases);
- include a large proportion of cases that are mild, or that aim to detect early stages of illness before patients seek care at health facility level;
- occur in areas where the health systems and IBS systems are weak;
- occur among communities with limited access to healthcare providers (e.g., because of distance, cost, security, ethnic differences);
- are prone to under-reporting at health facility level because of stigma, perceived high treatment costs or perceived limited benefits to clinical treatment;
- are non-infectious (e.g., poisoning); and
- relate to environmental conditions or animal health events.

It is important to consider a One Health approach in the selection of events for reporting. Close collaboration with animal and environmental sectors can provide valuable early warning about zoonotic disease outbreaks and other public health hazards. This may include, for example:

- bird die-offs as an early warning sign for a possible West Nile virus outbreak or highly pathogenic avian influenza;
- livestock die-offs as an early warning sign for a possible Rift Valley fever outbreak; and/or
- fish die-offs as an early warning sign of potential hazardous substances in water supplies (e.g., algal blooms, sewage contamination, excessive chemical/fertilizer run off, release of toxic compounds).

### 7.3.1 Event definitions

Event definitions define the information that should be reported in an EBS system. These definitions must be adapted to the context; hence the wording used in their descriptions must be understood by the local sources who are requested to report.

Unlike IBS, where the disease or condition is well defined, events captured by EBS can vary greatly. Most often, a broad definition that covers any public health event is included in the list of event definitions. Examples include the following:

- a single case of a rare, unusual or severe disease or condition
- unusual or unexpected cluster of diseases or deaths in a community
- diseases or conditions that affect many people (more than would normally be expected)
- environmental hazards such as a chemical spill
- a cluster of deaths or diseases in animals (e.g., livestock, bird or fish die-offs)
- information about a new or unusual disease or condition
- a cluster of patients that do not respond to regular treatment.

Similar to case definitions, it is important to balance the sensitivity and specificity of event definitions. Defining more specific event definitions will result in fewer false signals (examples in Box 7). Less specific event definitions will capture a broader range of signals and are more sensitive; however, they may include a substantial number of false signals that all need to be verified and require more resources.



**Box 7.**  
**Examples of**  
**specific and**  
**sensitive event**  
**definitions**

**Specific event definitions**

- At least five cases of severely sick persons (cannot walk anymore) with similar complaints in the same village within two weeks
- At least two animals of the same species dying of unexplained causes in the same village within four weeks

**Sensitive event definitions**

- Any public health event that could represent a threat to human health
- A cluster of cases in the community
- Unusual death of any kind
- A rumour about an unusual disease or condition



The sensitivity and specificity of signals will also depend on the experience and expertise of staff/communities at the reporting sites. As medical personnel typically have more training and experience in identifying what could constitute a potential public health event of concern, using a broad event definition at health facility level might generate more relevant signals than using the same definition among non-medical individuals. For non-medical personnel, a more specific event definition can be beneficial to avoid an overload of the system with signals for non-relevant or small-scale outbreaks and events (e.g., notification of mild diarrhoeal diseases among children or chronic conditions). Event definitions should be tailored to local context and the expertise of the reporting source to maximize the potential of EBS for EWAR in detecting both loosely defined health hazards and specific high-risk events (examples in Box 8).



**Box 8.**  
**Example of**  
**event definitions**  
**tailored to**  
**reporting sites**

Health facilities report broad events and severe and unusual cases to EBS:

- any public health event that could represent a threat to human health
- a single case of a rare or severe disease (e.g., haemorrhagic fever)
- a cluster of patients that do not respond to regular treatment.

Community representatives report clusters of severely sick community members to EBS:

- at least three cases of severely sick adults (cannot walk anymore) with similar symptoms from the same village within one week.

[Annex 3](#) lists additional examples of community event definitions applied in emergencies.

### 7.3.2 Define the format of the data

Unlike IBS, EBS relies mainly on unstructured ad hoc reports of suspected acute public health events by individuals or institutions (1). While a wide variety of sources, tools and mechanisms may be used to report potential events, the analysis and management of EBS signals should be conducted in a structured manner. Systems should aim to transmit and collate all information needed for verification of the event from reporting sources, which may include:

- source of report
- location
- nature of the hazard (e.g., infectious, chemical, radionuclear) and description
- date of event
- date of onset of symptoms
- number of case(s)/death(s)
- signs and symptoms
- number of people potentially exposed/affected.

The reporting of signals/events in EBS should always prioritize speed over completeness of data. Some of the information may not be available immediately but that should not delay notification. An incomplete report by a community member that is sent within hours about a signal that represents a potential public health threat is of more value than a complete report that took the community member a week to compile.

### 7.3.3 Reporting tools and mechanism for EBS signals

As with IBS, ensuring reliable, simple and structured methods of communication from reporting sources to surveillance site is essential.

- The mechanism of reporting (e.g., phone, text messages, radio, email) should be reliable, simple and cost free for persons reporting.
- Predefined reporting channels should be established; they will vary depending on context and the existing public health system.
- Dedicated EWAR software or applications (e.g., EWARS-in-a-box) facilitate reporting of EBS signals (see [Module 9](#) .
- Ideally only one or two centralized reporting mechanisms should be identified and used (e.g., EWARS-in-a-box for health facilities and similar structures, and a text message system for all community-based sites) to avoid overwhelming the EWAR system with multiple different data formats and to streamline the health information system and database structure.

**Fully electronic EWAR:** Reporting for EBS by health workers should preferably be done through the same channels as for IBS, through an immediate reporting feature of the tablet/mobile phone application. EWARS-in-a-box, for instance, facilitates collection of both weekly IBS data transmission and ad hoc event reports from EBS. However, this is only accessible to devices integrated into the electronic EWAR. It should be assumed that community members do not have access to mobile phones to make reports. Therefore, any established EBS source (e.g., health facilities and CHW networks) should be facilitated to relay potential signals from community members who visit those health facilities.

**Hotline:** Establishing a toll-free hotline to call (or text) can facilitate receiving EBS signals/events from community members and NGOs, which may include anonymous reporting if necessary. The type of hotline and who can make reports (e.g., the public, NGOs, health facilities) will depend on the context and the EBS strategy. The hotline should ideally be monitored 24 hours a day, seven days a week, with dedicated mobile phone(s). A hotline usually generates a lot of discarded signals and benefits should carefully be weighed against costs and resources needed for verification and assessment. A public hotline usually additionally requires community engagement to promote hotline usage. Attention should be paid to the training of people answering calls/messages to ensure sufficient information is collected for verification and to ensure that people calling feel their information is being followed up. Moreover, consider whether the hotline is intended only to receive information, or also to give advice and/or refer caller to emergency/support services, and that the community is well informed of what they can expect of it.

**Text messages:** Increasingly, EBS reporting systems are receiving reports via text messages using short messaging services or instant messaging (SMS/IM). If text message reporting is to be established in parallel to a phone hotline, using the same phone number as the voice hotline number is preferable.

**Email:** If the internet is reliable, email may be suitable for reporting signals/events. Establishing dedicated email accounts to receive both IBS and EBS reports is recommended. This account should not be limited/linked to an individual, but securely accessible only to an assigned EBS officer/group of officers, where access is transferable in case of staff changes. If EBS reports are to be communicated by email, it is important that an EBS officer checks and responds to messages several times a day. As with all elements of the EBS implementation and operations, SOPs should clearly define who is responsible for monitoring EBS email accounts, the frequency of account monitoring, and procedures of reviewing, responding to and archiving emails.

**Radio:** Some isolated locations without internet or mobile phone connection may require reporting by HF/VHF/UHF radio. If radio-based reporting is used and messages are received by a centralized radio operator, it is important that there is a mechanism in place to make sure the notifications are rapidly passed onto the EBS officer.

Further information on available tools can be found in [Module 9](#). Considerations for the communication of the reported data to stakeholders and the public can be found in [Module 15](#).



## 7.4 Triage of EBS information

A triage process/step aims to filter out information that does not constitute a signal to prevent overwhelming the system. Triage should be conducted as close to the reporting source as possible. Depending on the source of the information, triage may be conducted by different people, such as a CHW supervisor for CEBS, a health facility surveillance focal point for health facility-based EBS, and a phone operator for EBS systems based on phone hotlines.

Any information that is obtained in an EBS system for EWAR should undergo a rapid triage to answer two questions (34):

### 1. Is the reported information new information (not a duplicate)?

- A duplicate is information about a signal or event that matches previously reported information in time, place and person affected. Only when all four parameters (event/agent, time, place and person) match the previous report, is the information confirmed to be duplicative.
- Depending on the administrative level at which the triage is conducted, only limited information on other reports might be available (e.g., a CHW supervisor might only have access to information that was reported by the CHWs who are under his/her supervision). Thus, further checks for duplication might be required during the verification process.

### 2. Could the reported information constitute a potential acute public health event; namely, does it meet the event definition?

The following outcomes are possible:

- Question 1 = no, the information was reported before and represents a duplicate – no further action is needed; the information and the outcome should be documented.
- Question 1 = yes, the information is new – Question 2 needs to be answered.
- Question 2 = no, the information could not constitute a potential acute public health event – no further action is needed; the information and the outcome should be documented.
- Question 2 = yes, the information could constitute a potential acute public health event – the information and the outcome should be documented, and the signal needs to be reported immediately to the appropriate EBS reporting channels.



**Box 9.**  
**Example of**  
**triage of EBS**  
**information**

- A CEBS system is running in Area A and CHWs are requested to report clusters of deaths (more than two unexplained deaths in one village in one week).
- A CHW reports a cluster of three deaths in one village due to a car accident to their supervisor.
- The supervisor checks triage Question 1 (Is this new information?) and finds no indication it has been reported before.
- The supervisor therefore proceeds to Question 2 (Could this constitute a potential acute public health event?) and decides that it does not meet the event definition because the cause of the death is known (car accident), and it does not constitute a potential acute public health event.
- The information and the outcome of triage are documented.

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## 7.5 Frequency of reporting

In an EBS system, all information should be reported immediately to the next level to initiate triage. Information can be submitted at any time and reports should be processed in near real-time as possible (seven days a week) to facilitate rapid detection and response to a public health event.

After a positive triage, the information constitutes a signal and should be reported immediately.

Weekly or monthly reporting is too infrequent for the purpose of immediate detection, triage and verification of signals.

Once a signal has been detected as part of EBS activities, it should be managed according to a predefined workflow and set of SOPs (see [Module 8](#) )



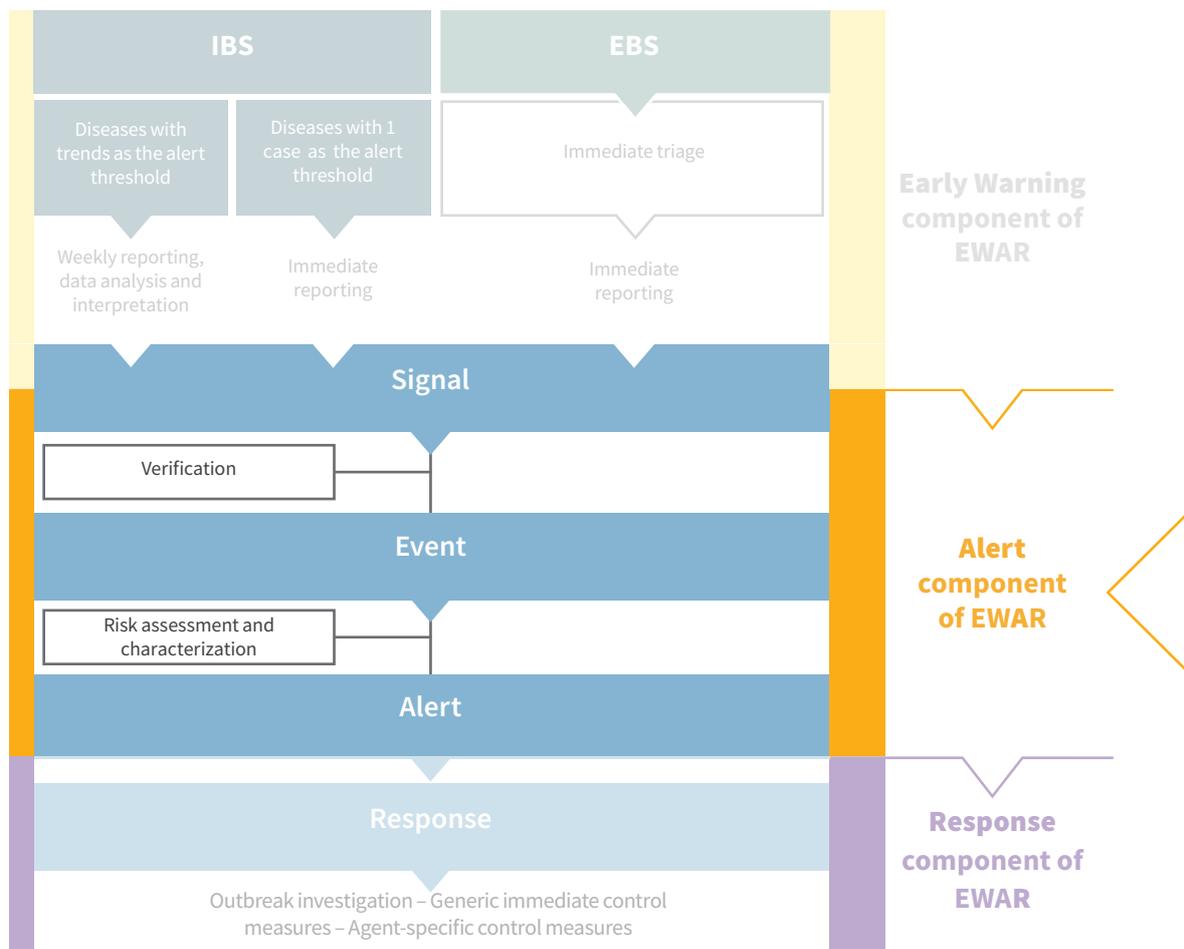
# Management of signals, events and alerts

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# 8. Management of signals, events and alerts

The management of signals, events and alerts is part of the ALERT function of the EWAR system and requires a defined process of detection, verification, and risk assessment and characterization (Fig. 8). This chapter explains how EWAR should be used in an emergency to manage signals, events and alerts that are detected by IBS and EBS. It describes the key steps that are required to determine if a response is needed, and the type and scale of the response required.

Fig. 8. Management of signals, events and alerts in the EWAR process



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An effective EWAR system often generates a large amount of surveillance data., The volume of information, signals and subsequent verification and risk assessment steps may differ greatly depending on the EWAR system and sensitivity of signal detection (see examples in Box 10). A common mistake is to omit the investment into a systematic and adequate alert management capacity. Systems with inadequate capacity may fail to differentiate the true signals from false signals, which may slow down/overburden public health responses and risk staff becoming overwhelmed/demotivated, and therefore they could miss events.



**Box 10.**  
**Examples of signal and alert volumes during EWAR in previous emergencies**

**Ebola virus disease, the Democratic Republic of the Congo, two year period (41)**

- There was a mean of 280 signals per day (from active case-finding, health facilities and community).
- Each new signal had to be investigated individually.
- 15.8% (30,728/195,601) of all signals were verified as suspect cases needing referral, isolation, testing and case management.
- <3% (804/30,728) were confirmed or probable Ebola virus disease cases.

**Refugee crisis, Cox's Bazaar, Bangladesh, one year period (26)**

- ~100 signals were reported per week (most discarded as false because of data entry mistakes, not meeting case definitions or no cluster identified).

**Cyclone Winston, Fiji, one year period (25)**

- 325 signals were reported over the year produced through IBS (from healthcare workers only).
- 88% of all signals were verified as alerts (286/325).



## 8.1 Signal-Event-Alert definitions and workflow

**A Signal** is the initial detection of a potential public health event either by IBS or EBS (Table 16) (1). Signals may consist of information/reports of cases or deaths (individual or aggregated), potential exposure of human beings to biological, chemical or radionuclear agents, or occurrence of natural or man-made disasters.



Table 16. Characteristics and examples of IBS and EBS signals

<b>IBS</b>	<ul style="list-style-type: none"> <li>• Signals are generated when a predefined alert threshold for the number of cases is crossed.</li> <li>• As notifications are based on case definitions applied by trained reporting sites, signals tend to be more specific than EBS and may result more often in verified events, alerts and responses.</li> <li>• Diseases with one-case alert thresholds are reported immediately when one suspected case is notified because of their high transmissibility and potential impact (e.g., a single case of a suspected VHF).</li> <li>• Other diseases and conditions are reported at a set frequency (typically weekly). Weekly data are compared against disease-specific alert thresholds. When the threshold is crossed, a signal is produced (e.g., exceeded alert threshold for acute jaundice syndrome).</li> <li>• See <a href="#">Module 6</a>  for further details.</li> </ul>
<b>EBS</b>	<ul style="list-style-type: none"> <li>• Information reported under EBS is based on (sometimes very broad) event definitions, which tend to be less specific and more sensitive than IBS, capturing a wider variety of potential public health hazards (e.g., a cluster of adults severely sick with similar symptoms is reported).</li> <li>• Reported information is subject to triage to confirm it is non-duplicative and constitutes a potential acute public health event. After positive triage, the information constitutes a signal and should be reported immediately.</li> <li>• All reported signals trigger verification, and risk assessment and characterization steps, where needed.</li> <li>• See <a href="#">Module 7</a>  for further details.</li> </ul>

Regardless of the source, all signals are managed according to a standardized workflow (Fig. 9). All signals first undergo a **verification** process.

Overall, only a small proportion of the signals will be verified. An **Event** refers to a signal that has been verified (1). Events need **risk assessment and characterization** to decide if a response is needed.

Even fewer events will require follow-up. To determine the level of follow-up required, a risk assessment is conducted. An **Alert** refers to a signal that has been i) verified to be an event; ii) risk assessed; and iii) requires an intervention (an investigation, response or communication with partners or the public) (1).

These steps should ideally occur at the local level. As a result of the following advantages, conducting alert management at the local level is more likely to be efficient and accurate as trained staff are well placed to understand the local context and procedures needed to gather information.

- Decentralizing alert management helps to ensure the rapid follow-up and processing of all signals.
- Local-level staff are able to quickly find the source of the signal, get more information to verify the signal, and can better understand the epidemiological and sociocultural context in which it occurred. This is essential to be able to ask the right questions and to obtain accurate information.

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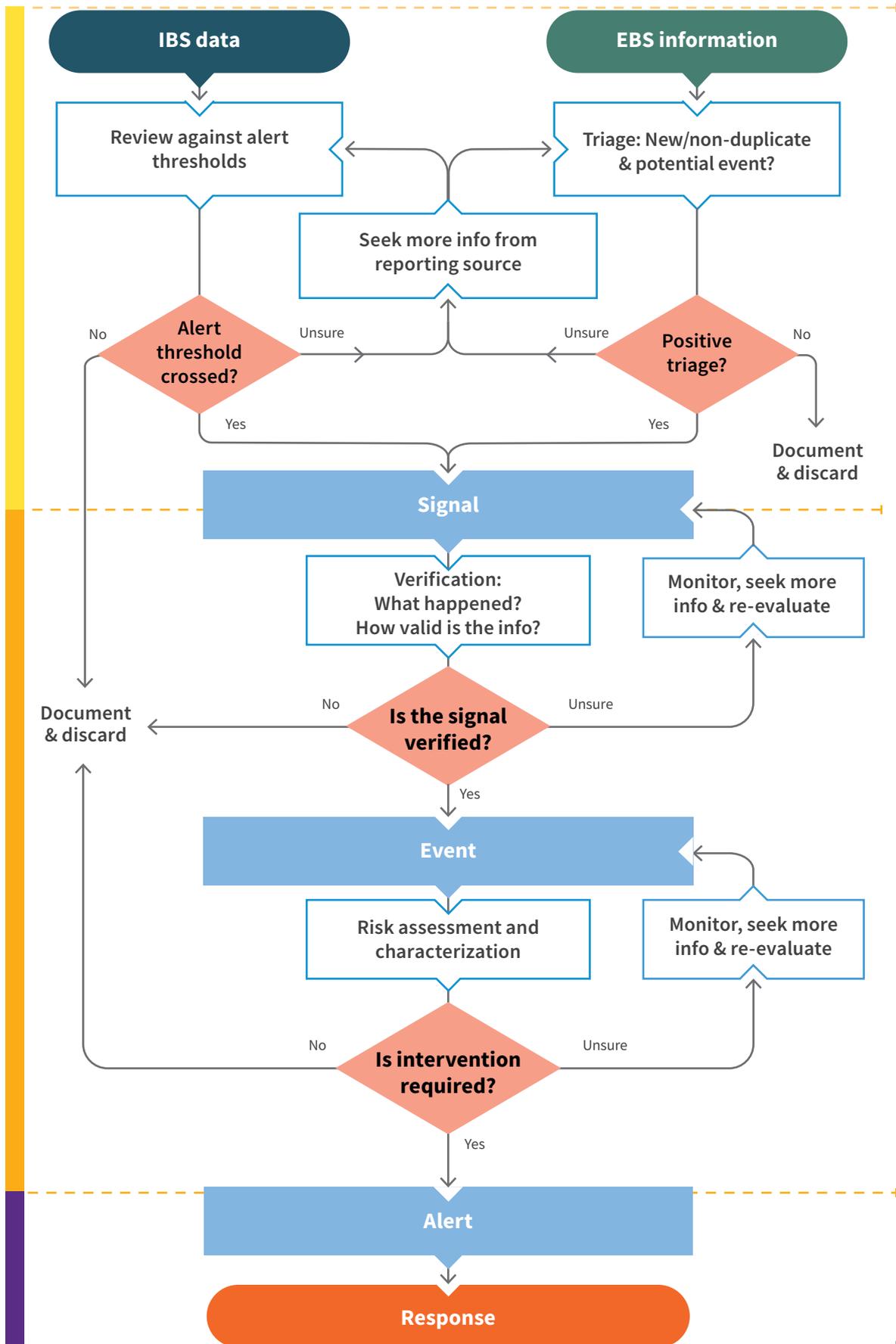


- In an effective system, many signals will be verified as false and will best be handled at the local level without escalation. In particular, EBS information can be quickly triaged “in” or “out” without ever becoming a signal.
- If verified at the local level, there is an option to perform the next step (risk assessment) at the same level or escalate to the next level in the system if additional support is needed.

During the implementation of the alert management function, the following considerations should be reviewed.

- For each step in the workflow, SOPs should describe what is done, who is involved, and their respective roles and responsibilities.
- Staff at the local level may need the training to be able to verify signals and conduct risk assessments.
- Key performance indicators should be defined for regular monitoring of the alert management function (see [Module 14](#) )
- Staff at higher levels in the system should be able to access information on alerts and monitor performance; however, they should only become directly involved if additional expertise or support is required. Likewise, staff at the district level should be able to communicate with other districts to see if similar signals are being detected across districts. (Where issues are detected they should be communicated to higher levels.)
- Sharing of information in alert management should respect data protection standards and confidentiality (see [Module 9](#)  paragraph 10.3).

Fig. 9. Workflow for the management of signals, events and alerts



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## 8.2 Create a log of signals, events and alerts

All signals, regardless of the source, should be systematically documented in a **signal log** and managed in the same, standardized manner. This is done immediately, as signals are reported. Note that the triage of EBS information occurs before the logging of signals (see [Module 7](#) ) . The signal log should be used to do the following:

- record all signals, events and alerts in one place;
- monitor the progress of verification, risk assessment and characterization, and the response for each signal;
- identify diseases causing most alerts over time and geographical area for situational analyses; and
- monitor the performance of the EWAR system in terms of timeliness and completeness of signal management, and the usefulness and validity of data sources (see [Module 14](#) ) .

Responsibility for updating the log and ensuring all signals are being followed should be kept as local as possible (e.g., district level EWAR unit). Surveillance officers are typically responsible for updating the signal log and ensuring that all signals are being followed up according to a standardized procedure.

A signal log should be accessible/kept at all geographical levels and should be reviewed daily to ensure that follow-up actions have been undertaken. Ideally, the transmission of information of new signals and updates to the log should be automated between different levels of surveillance (e.g., using a shared, access-protected online database/spreadsheet). If it is not, it should at least follow a standardized and time-bounded sequence (e.g., daily updates to the higher levels).

Table 17 outlines the minimum information that should be included in a signal log. The initial data is obtained during the verification process; however, it may be incomplete when the signal is first received. The log should be updated as new information becomes available, as steps are completed and as decisions are made.

The signal log should be regularly analysed, and a summary of information on the number of signals, events and alerts detected, and of the actions taken, should be shared in the weekly epidemiological report (see [Module 10](#) ) .

The signal log and associated tools should not be shared widely, but only among staff working on alert management.

Table 17. Recommended signal log variables

Category	Variables
<b>Identification</b>	<ul style="list-style-type: none"> <li>• Unique identifier</li> </ul>
<b>Origin of signal</b>	<ul style="list-style-type: none"> <li>• Date of reporting</li> <li>• Source (e.g., laboratory, health facility, community health worker)</li> <li>• Type (IBS one-case alert, IBS alert threshold crossed, EBS)</li> <li>• Location (block/neighbourhood/village, district, province)</li> <li>• Contact information of the person reporting (telephone number, address)</li> </ul>
<b>Nature of signal</b>	<ul style="list-style-type: none"> <li>• Suspected event or disease from the point of view of the person reporting (e.g., measles, cholera, animal die-off; signs and symptoms; is it ongoing?)</li> <li>• Number of suspected cases (by age and sex)</li> <li>• Number of suspected deaths (by age and sex)</li> <li>• Date of symptom onset for the index case (or only case)</li> <li>• Date of symptom onset for the last reported suspected case</li> <li>• Suspected exposures from the point of view of the person reporting</li> <li>• Similar signals in the past</li> <li>• Other information</li> </ul>
<b>Actions taken</b>	<ul style="list-style-type: none"> <li>• Verification of signal: <ul style="list-style-type: none"> <li>• start date of verification process</li> <li>• outcome (verified, further monitoring required, discarded)</li> <li>• if verified or discarded, why was this decision taken? (e.g., discarded because irrelevant information collected)</li> <li>• if further monitoring is required, anticipated date of new verification</li> <li>• if discarded: actions and documentation stop here</li> <li>• end date of verification process</li> </ul> </li> <li>• Risk assessment of event: <ul style="list-style-type: none"> <li>• yes/no</li> <li>• if no, why was risk assessment not conducted?</li> <li>• start date of the risk assessment process</li> <li>• risk characterization</li> <li>• end date of the risk assessment process</li> </ul> </li> <li>• Response to alert: <ul style="list-style-type: none"> <li>• yes/no</li> <li>• if no, why was the response not conducted?</li> <li>• start date of response</li> <li>• the type of response (e.g., health promotion, vaccination campaign)</li> <li>• institutions/partners involved in the response</li> <li>• end date of response</li> </ul> </li> </ul>
<b>Outstanding actions</b>	<ul style="list-style-type: none"> <li>• Any outstanding actions?</li> <li>• Alert closed? yes/no</li> </ul>

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## 8.3 Verification

**Verification** refers to the proactive assessment of the validity of the signals collected by EWAR, performed by contacting the primary source or involving additional sources or performing field investigations (1). Verification requires that hoaxes, false rumours and artefacts are eliminated from further consideration.

All signals collected by EWAR require verification. This should occur as quickly as possible and ideally within 24 hours of reporting. If a signal is deemed urgent (e.g., one case of suspected VHF), it should be prioritized over other signals and verified immediately. Verification can be done by phone or by a visit to the person who reported.

It is important to follow a structured process to verify signals. Verification aims to answer the questions “What happened?” and “How valid is the information?”

### Verification Question 1: What happened?

Use the signal log to review information about the **origin and nature of the signal** and establish a basic epidemiological (person, time and place) description. Does this description suggest a potential event?

### Verification Question 2: How valid is the information?

Based on the information collected, several questions are asked to determine the **validity of a signal**. Not all the questions need to be answered, but the more questions that can be answered “yes”, the stronger the validity of a signal.

- **Source:** Is the information considered accurate and true (not a hoax/false rumour)? And is the source considered knowledgeable about health (e.g., health facilities, public health authorities, community health workers)?
- **Triangulation:** Has the signal been reported by multiple independent sources (e.g., residents, news media, healthcare workers)?
- **Epidemiology:** Does the signal description include details on person, time and place? (e.g., six people are sick and two died three days after ending a local celebration in Community X).
- **Clinical details:** Is the clinical presentation of the cases described in a credible way? (e.g., a cluster of seven people admitted to hospital with atypical pneumonia, of whom two have died)?
- **Consistency:** Has a similar signal been reported previously (and was it verified as an event)? (e.g., did it have a similar presentation, affecting a similar population and geographical area, over the same period).
- **Spread:** Has a similar signal been reported in a neighbouring area?

By answering these questions, the verification process aims to classify signals as:

- true/valid/verified – classified as an **event** and proceed to risk assessment and characterization;
- false/invalid – **document and discard** the signal; or
- undetermined – when there is insufficient information to verify/discard a signal, **monitor and seek more information** from reporting sources and **re-evaluate** the signal as soon as possible (the information continues to be classified as a signal during this process).

Note that there may be other similar signals being monitored simultaneously in neighbouring areas. Independently, each signal may not meet the verification criteria; however, together they may be considered an important trend that warrants further assessment.

Verified signals become events that require risk assessment and characterization.

## 8.4 Conduct a risk assessment

A **risk assessment** is a systematic process for gathering, assessing and documenting information to assign a level of risk to human health to an event (1, 11). Risk assessment includes three components: hazard assessment, exposure assessment and context assessment. The risk assessment informs the decisions taken to manage and reduce the negative consequences of acute public health events. Risk assessment is a continuous process from the detection of the signal to the alert response.

### 8.4.1 When is it done?

All events require a risk assessment. Risk assessment should ideally be carried out within 48 hours of a signal being verified as an event. They should be done quickly (total duration one hour) in order to gain a rapid understanding of the level of risk of the event.

Risk assessments are iterative. The level of risk may change over time and across the geographical area, meaning that it may need to be repeated at a later stage as new information becomes available (e.g., new cases, new areas affected).

A risk assessment may involve one or several phases, including the following.

1. Initially designate the level of risk to a new event, in terms of potential impact and likelihood, and raise an alert accordingly.
2. Once the alert is raised and more epidemiological information is received, conduct an in-depth outbreak or public health investigation of the alert to better characterize the agent, populations at-risk, and ongoing morbidity and mortality (see [Module 12](#) .

3. Assess an ongoing outbreak or acute public health event, which will include repeating in-depth risk assessments, taking into consideration any evolution in the epidemiology, response capacity and context (7). Note that this type of risk assessment falls outside the scope of EWAR and is not covered here.

## 8.4.2 Who does it?

Risk assessment should be carried out by trained staff at the district level with knowledge, access and collaborative relationships with healthcare facilities and communities. It may be supported by the EWAR implementation team, given that similar public health events may be occurring across a larger geographical area.

This may involve reaching out to healthcare facilities close to the event, local health authorities, other local partners and animal health authorities in order to obtain more information on the context surrounding the event (see also [Module 12 paragraph 12.3.5.4](#)  Integrated Outbreak Analytics (IOA)).

## 8.4.3 How is it done?

A risk assessment involves the description of three components: hazard, exposure and context assessments using several key questions (Table 18). These questions are oriented toward communicable disease outbreaks but can be modified for other acute public health events (see Table 3 and Table 4 of the [Rapid Risk assessment of public health events](#) ).

Completing a risk assessment is not always a sequential process. Hazard, exposure and context are often assessed at the same time and there is usually overlap in the information required to assess each component.

The outcome of these three components is used to identify the event as an alert, and to further characterize the overall level of risk that a verified event poses to public health.

Table 18. Components of risk assessment (11)

Components and example	Key information	Key questions	Example
<p><b>Hazard assessment</b></p> <p>Identification of the anticipated hazard (or several potential hazards) causing the event (e.g., measles), the characteristics of a public health hazard and health effects.</p>	<ul style="list-style-type: none"> <li>Laboratory confirmation</li> <li>Clinical and epidemiological information, or</li> <li>Listing of possible causes based on clinical and epidemiological features</li> </ul>	<ul style="list-style-type: none"> <li>Do laboratory test results confirm a specific cause or are they consistent with a particular type of hazard? If confirmation has been attempted but was not successful, is a newly emerging disease suspected?</li> <li>Is a high level of severe morbidity or mortality anticipated?</li> <li>Does the suspected disease have a high potential for rapid transmission?</li> <li>Is there suspected transmission within a healthcare setting (i.e., nosocomial transmission)?</li> </ul>	<p>Cluster of five children with fever and rash – suspected measles. A sample taken from one child tests positive for measles, no further cases or deaths known yet.</p>
<p><b>Exposure assessment</b></p> <p>Evaluation of the exposure of individuals and populations to the possible hazards.</p>	<ul style="list-style-type: none"> <li># of people likely already exposed</li> <li># exposed likely susceptible</li> <li>Likelihood of the population at-risk being exposed</li> <li>Likely path of transmission</li> <li>Likelihood of continuing exposure (e.g., through poor water, poor sanitation, overcrowded living conditions and/or ongoing rainy season)</li> </ul>	<ul style="list-style-type: none"> <li>Is clustering of cases with similar signs and symptoms observed at this point in time?</li> <li>Are there similar events happening simultaneously in different geographical areas (including in surrounding areas/countries), perhaps demonstrating spatial expansion?</li> <li>If the event is due to a non-human source (e.g., animal disease or chemical spill), does this have known or potential consequences for human health?</li> </ul>	<p>The five affected children came from four different families and have in total nine siblings (aged &lt;5 years). An additional 35 children from neighbouring households might potentially have been exposed. Measles vaccination coverage was 35% in &lt;5-year-olds in a recent survey. The last measles outbreak occurred seven years ago.</p>

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Components and example	Key information	Key questions	Example
<p><b>Context assessment</b></p> <p>Evaluation of the context which may affect either the transmission potential or overall impact of the event</p>	<ul style="list-style-type: none"> <li>• Vulnerable groups</li> <li>• Vaccination coverage and dates of previous outbreaks (if applicable)</li> <li>• Environment (e.g., climate, vegetation, land use) and impact on water and sanitation or vector habitats</li> <li>• Population size</li> <li>• Health and nutritional status of the population</li> <li>• Local cultural practices and beliefs</li> <li>• Gender roles and responsibilities that may affect exposure</li> <li>• Infrastructure (healthcare access, healthcare services available, expanded programme on immunization (EPI) coverage)</li> <li>• Context (e.g., ongoing civil conflict, refugee camp, displacement)</li> </ul>	<ul style="list-style-type: none"> <li>• How efficient is the surveillance system (can it detect all cases?)?</li> <li>• Is the affected community susceptible (e.g., low immunization coverage for this agent) or vulnerable (e.g., poor nutritional status or poor access to healthcare)?</li> <li>• Is this occurring in a displaced population?</li> <li>• Is there the response capacity to control the event? Are response systems currently overwhelmed?</li> </ul>	<p>The event is occurring in a crowded refugee camp, 40 000 population, with 25% of children &lt;5 years. Severe acute malnutrition: &lt;0.5% of children &lt;5 years. Good access to healthcare in the camp and EPI vaccination is available.</p>

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## 8.5 Risk characterization

**Risk characterization** is the assignment of a level of risk to an event, according to the combination of its likelihood of occurring and the scale of the resulting public health consequences. Once the risk assessment team has carried out the descriptions of the hazard, exposure and context, a level of risk is assigned **to the anticipated consequences of the outbreak or public health emergency**.

The process is based on the consensus of the team. This involves asking a series of questions relating to the risk of high impact, further spread and overwhelmed response capacity. In addition, social, technical, economic, environmental, ethical, and policy and political information should be sought while characterizing the potential impact/consequences. These essential considerations are known by the acronym STEEEP and align with the IOA approach (11,42) (see also [Module 12 paragraph 12.3.5.4](#) ) Integrated Outbreak Analytics (IOA)).

- What is the risk of impact on human health?
- What is the risk of the event spreading to neighbouring areas?
- What is the risk of disruption to normal activities?
- What is the risk of having insufficient capacity to respond?

Each of these questions is then graded using a **risk matrix** (Fig. 10) based upon a combined qualitative estimate of the following.

- Likelihood: What is the level of likelihood that the event has high impact, spread, disruption to normal activities and consequences for the capacity to respond?
- Potential impact/consequences: What is the level of consequences in terms of impact, spread, disruption to normal activities and consequences for the capacity to respond? (Example is in Box 11.)



### Box 11. Example of using the risk matrix

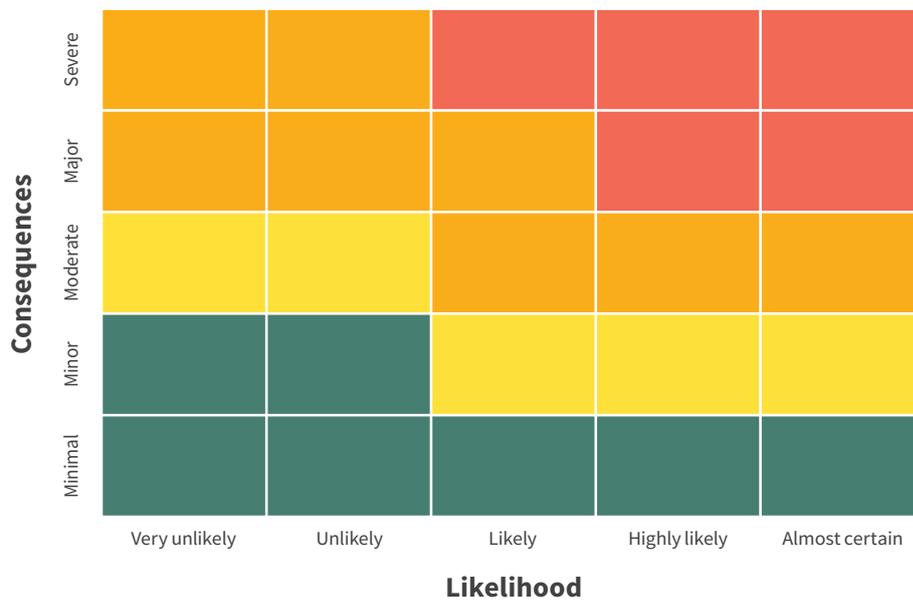
There is a cluster of five measles cases (one of them laboratory confirmed) in a crowded refugee camp with a high proportion of children aged <5 years, low vaccination coverage and considerable time since the last measles outbreak. Depending on the specific context, the likelihood of a measles outbreak could be rated as very likely and the consequences as major, thus putting the level of risk at “very high risk” in the camp. The level of risk might be lower at the national level if the vaccination coverage in the general population is high enough to prevent outbreaks.

For EWAR, not all events can, or should, be judged as “high” or “very high” risk. The assignment should be done carefully – balancing risk with consequences for the response. Upwards of 100 signals per week are transmitted in many EWARNS, and assigning severe risk to half of these would overwhelm response capacity. There may also be important secondary social, political and economic consequences, and the perception of risk can destabilize an already fragile situation. For example, in 1994, a plague outbreak

(197 cases, 54 deaths) was declared in Surat, India. Fear amongst the population caused half a million persons to flee their homes within a one week period, caused the exodus of health professionals, and had severe impacts on trade and the economy (43).

The overall level of risk combines the likelihood and consequences of each risk question asked (see example in Box 12). It should consider the potential type of response needed (e.g., case management), the scale of the response needed and the level of resources needed to do so. For instance, if the event is occurring at the district level, the ability for the district RRT to respond rapidly and have sufficient human and material resources to do so, should be considered.

Fig. 10. Risk matrix of the likelihood and consequences of the acute public health event



**Likelihood:**

<b>Almost certain</b>	Is expected to occur in most circumstances (e.g., probability $\geq 95\%$ )
<b>Highly likely</b>	Will probably occur in most circumstances (e.g., probability 70–94%)
<b>Likely</b>	Will occur some of the time (e.g., probability 30–69%)
<b>Unlikely</b>	Could occur some of the time (e.g., probability 5–29%)
<b>Very unlikely</b>	Could occur under exceptional circumstances (e.g., probability $< 5\%$ )

**Consequences**

<b>Minimal</b>	Limited impact and disruption to activity for population; routine response adequate, no additional control measures to be implemented
<b>Minor</b>	Minor impact and disruption; minimal control measures required
<b>Moderate</b>	Moderate impact and disruption for large population or at-risk group; additional control measures required
<b>Major</b>	Major impact and disruption for small population or at-risk group; large amount of additional control measures required with significant resources needed
<b>Severe</b>	Major impact and disruption for large population or at-risk group; large amount of additional control measures required at scale, with significant resources needed

During early phase of an emergency

## Actions (level of support required according to the overall risk level):

<b>Low risk</b>	Managed with standard intervention protocols by the local health facility
<b>Medium risk</b>	Specific and/or additional surveillance or control measures required (e.g., enhanced surveillance, hygiene promotion response)
<b>High risk</b>	Specific and/or additional support and coordination are needed to implement necessary additional control measures
<b>Very high risk</b>	An immediate response is required, including rapid implementation of additional control measures, urgent and additional support, and coordination



### Box 12. Example of a risk assessment

You are a district EWAR officer. A CHW has contacted the EWAR hotline to share information on an acute public health event. You work with your district team to discuss the situation with a community representative and a CHW, and think about the potential impact, risk of further spread and capacity for response.

- Over the last three days, there have been four adult deaths associated with AWD in two adjacent households.
- The population at-risk is a community that has been recently displaced, is living in makeshift and dense tented households, is prone to poor hygiene and sanitation, and to a lack of safe water.
- This population is dynamic and the settlement has doubled in size in the past month.
- There are a few health facilities in the area that serve the host population.
- Humanitarian access to the area is possible.
- Cholera is suspected. It is endemic in the host population, but the displaced population affected has not had a cholera outbreak in the past five years, nor have there been any vaccination campaigns.

**Risk assessment:** The team decides the grading is as follows for each risk question:

- **Potentially major impact is likely:** Multiple AWD deaths among adults is a potential signal for cholera; several deaths highlight the severe vulnerability of the population and it appears very likely that more deaths could occur.
- **Further spread is highly likely and would impact neighbouring settlements:** The expanding displaced population is highly susceptible to infection given the poor status of water, sanitation and hygiene conditions, and the presumed lack of immunity to cholera.
- **Current capacity is low and would likely be overwhelmed:** Disease control would require surge support and significant resources that would outstrip the capacity of the local health facilities and partners present (e.g., WASH, case management and potentially vaccination).

Taking these risk questions together, the team suspects a cholera outbreak in a very susceptible and vulnerable population, and assigns an **overall level of risk assigned is “high-risk”**. The entire risk assessment process took a few hours to arrive at a conclusion.



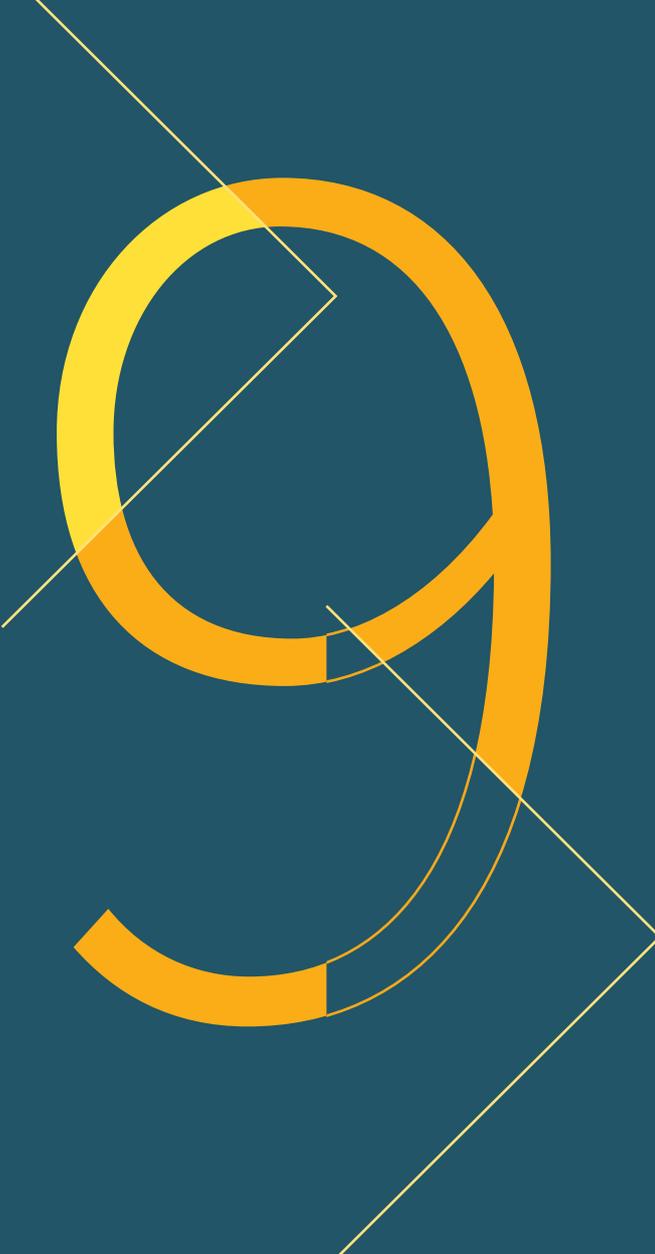
## 8.6 What happens after an alert is raised?

An alert often leads to a more in-depth outbreak or public health investigation, and control measures may be appropriate (see [Modules 11](#) and [12](#)).

In the weekly epidemiological report, the number of events (and the timeliness of their verification within 24 hours) should be reported as a metric. Additional details on the outcome, location and status of each alert (e.g., a measles outbreak in Camp 7 with an ongoing vaccination campaign) should be communicated (see [Module 10](#)).

Feedback should be given to the communities affected by the alert through a community feedback mechanism with local leaders or the equivalent. Risk communication and community engagement strategies should be undertaken to mitigate fear and encourage health-seeking behaviour.

In addition to the response, a risk communication strategy will be needed to address the public as well as health professionals and politicians (see [Module 15](#)).



# Electronic EWAR tools

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  - **9.2** Minimum standards and desirable standards for electronic EWAR tools →
  - **9.3** Current fully electronic EWAR tools and their features →
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# 9. Electronic EWAR tools

This chapter describes the use of digital/electronic EWAR tools, and the challenges faced when setting up fully or partly electronic EWAR tools. Electronic EWAR has proven to be feasible in many contexts, including the use of EWARS-in-a-box in Northern Nigeria (2016) and Cox’s Bazaar, Bangladesh (2017), an electronic disease early warning system (eDEWS) in Yemen (2019) and Go.Data across countries/institutions for outbreaks of diseases such as Ebola, COVID-19, measles, dengue and diphtheria (22, 26, 44–46).

“A successful electronic EWAR tool should move the EWAR cycle closer to real-time and efficient surveillance, from data collection to dissemination phases.”

A successful electronic EWAR tool should move the EWAR cycle closer to real-time and efficient surveillance, from data collection to dissemination phases. It will get the right information into the right hands as quickly as possible, enabling surveillance officers, contact tracers and epidemiologists to focus on their tasks and to produce results that inform the decisions of managers and policy-makers on preparedness, early warning and response to public health threats. Therefore, a measure of the effectiveness of an electronic EWAR tool is the time delay between the reporting of signals and public health actions based upon that data.

## 9.1 When and how to use electronic EWAR tools?

A **fully electronic EWARS** consists of digital data collection by the persons reporting surveillance data, digital data management, trend analysis and semi-automated epidemiological analysis.

A **partly electronic EWARS** can support one or more of the following functions in the cycle of data collection, management and analysis for EWAR:

- data collection for surveillance and data management
- alert generation and management
- data analysis and visualization

- line listing during outbreaks
- contact tracing, data management, and visualization of chains of transmission
- geographic information systems (GIS)
- mobile data collection.

Planners should be aware of several considerations for electronic EWAR when choosing to rapidly develop or improve EWAR in a given emergency (Table 19). The main challenges concern ensuring user support, maintaining mobile connectivity in remote settings and medium- to longer-term maintenance of the electronic system over time (i.e., sustainability).



Table 19. Considerations for developing a fully electronic EWAR tool

Domain	Considerations/Advantages	Challenges
<b>Resources</b>	<ul style="list-style-type: none"> <li>• Can be set up “out-of-the-box”, complete with tools, software and training materials</li> <li>• “Bring Your Own Device/BYOD”: can use devices already available on-site (e.g., smartphones, laptops, server box)</li> <li>• Can be more environmentally sound, as it avoids the use of paper</li> </ul>	<ul style="list-style-type: none"> <li>• Requires significant financial resources to set up and maintain</li> <li>• Needs specialist human resources to configure and maintain</li> <li>• Smartphones/tablets are prone to breakage and theft; therefore a plan and resources are required to protect, repair or replace devices and mitigate risks to data collectors</li> </ul>
<b>Configuration and flexibility</b>	<ul style="list-style-type: none"> <li>• Emphasizes simplicity and standardization in workflows – from data collection to creation of reports.</li> <li>• Should prioritize “configuration” of a standardized and generic system over development and customization from the ground up</li> <li>• Facilitates addition and removal of diseases and associated definitions in a changing context (e.g., integration of a new outbreak case definitions)</li> <li>• Facilitates the inclusion of all possible reporting sites (e.g., community, health facilities, call centres and media monitoring) and expansion to new sites</li> </ul>	<ul style="list-style-type: none"> <li>• Interoperability with existing routine surveillance systems (e.g., DHIS-2 based) is challenging and time-consuming to implement immediately or may be unavailable</li> </ul>



Domain	Considerations/Advantages	Challenges
<b>Data collection</b>	<ul style="list-style-type: none"> <li>• Potential for improved data quality at the point of data collection through built-in data validation measures (e.g., flagging duplicates, out-of-range values, incomplete forms)</li> <li>• Potential for improved timeliness and coverage, as person pick-up of paper records, double data entry and email reporting become unnecessary/considerably reduced</li> </ul>	<ul style="list-style-type: none"> <li>• Heavily dependent on familiarity of health workers with smartphones/tablets and digital interfaces</li> <li>• Requires repeated training in data entry and validation to ensure high-quality data collection</li> </ul>
<b>Data management and transmission</b>	<ul style="list-style-type: none"> <li>• Efficient for data management as there is no need for separate data entry, compilation and cleaning</li> <li>• Can either use cellular or internet data for transmitting signals or support offline data collection and syncing data when the reporter is in a location with a network connection</li> </ul>	<ul style="list-style-type: none"> <li>• Data management capacity (e.g., where data is aggregated at a district office) may be weak and may require substantial training and reinforcement</li> <li>• Consistent and stable cellular/internet connectivity and electricity may be a problem in remote locations, interfering with timely data transmission</li> <li>• Requires stable and reliable offline and backup systems</li> </ul>
<b>Analysis</b>	<ul style="list-style-type: none"> <li>• Basic analyses and visualization can be fully/semi-automated</li> <li>• Provides automated outbreak detection through the setup of alert thresholds</li> <li>• Processes of verification, investigation and risk assessment can be managed and documented within the application</li> <li>• Can allow for consistent key performance indicator monitoring (including automatically calculated metrics) across contexts and disease, and across data collection, management and analysis functions</li> </ul>	<ul style="list-style-type: none"> <li>• There are risks of relying too heavily on automated analysis – automated outbreak detection and analyses are useful but should be supported by human-centred processes, based on epidemiological principles and expertise, to provide an appropriate public health-based and context-based interpretation</li> </ul>
<b>Data sharing, dissemination of reports and feedback to users</b>	<ul style="list-style-type: none"> <li>• Facilitates two-way information flow between stakeholders, including feedback to the user</li> <li>• Communication outputs can be (partially) automated (e.g., outline, graphs and tables for situation reports)</li> </ul>	<ul style="list-style-type: none"> <li>• Digitizing data at the point of data collection brings issues of data security and risk in crisis contexts, wherein sensitive personal and location data may be exposed when login information is indiscriminately shared</li> </ul>

## 9.2 Minimum standards and desirable standards for electronic EWAR tools

If the main challenges described above can be addressed, planners can use the following checklist to ensure the minimum standards required to support a fully electronic EWAR tool in an emergency (Table 20). Desirable standards should be considered once the minimum standards are met.

Table 20. Minimum and desirable standards for fully electronic EWAR tools (22, 25, 26, 45, 47, 48)

Domain	Minimum standard	Desirable standards
<b>Simplicity of use</b>	<ul style="list-style-type: none"> <li>• Minimal time for configuration</li> <li>• User friendly: simple interface appropriate for persons who have limited previous experience with electronic data collection</li> <li>• Training materials available in multiple languages</li> <li>• Process of verification, investigation and risk assessment managed and documented within the application</li> <li>• Runs with existing operating system standards and hardware configurations (i.e., can run on locally available smartphones and computers)</li> </ul>	<ul style="list-style-type: none"> <li>• Flexible configuration by surveillance personnel (e.g., add a new case definition)</li> </ul>

Domain	Minimum standard	Desirable standards
<b>Flexibility of the system</b>	<ul style="list-style-type: none"> <li>Allows for offline data collection</li> <li>Flexibility to add multiple languages to the interface</li> <li>Integrates the input of laboratory surveillance data</li> </ul>	<ul style="list-style-type: none"> <li>Inter-operability with existing national surveillance systems</li> <li>Integrates reference metadata from other systems, e.g., location files/trees, facility lists and option sets for categorical variables</li> </ul>
<b>Security</b>	<ul style="list-style-type: none"> <li>Administrative function to manage login information</li> <li>Granular roles and permissions to limit user access to specified actions/portals</li> <li>Encryption of any identifying data (e.g., including names and locations)</li> </ul>	<ul style="list-style-type: none"> <li>Option for cloud storage in-country</li> <li>Data encryption both at rest and in transit</li> <li>Embedded security features such as multi-factor authentication or captcha</li> </ul>
<b>Technical support</b>	<ul style="list-style-type: none"> <li>Technical support available either from internally trained staff or outsourcing agreements</li> </ul>	<ul style="list-style-type: none"> <li>A strong community of practice that can assist with problems</li> </ul>
<b>Analysis</b>	<ul style="list-style-type: none"> <li>Basic analyses and visualization can be achieved within the software</li> </ul>	<ul style="list-style-type: none"> <li>Use of aberration detection functions, in addition to alert thresholds</li> </ul>

## 9.3 Current fully electronic EWAR tools and their features

More fully electronic EWAR tools are available than any other time before. EWAR electronic tools should provide the core functions (e.g., data collection, management, analysis and visualization) – the minimum standards of EWAR, but can vary in their additional functions.

Table 21 provides some examples of fully electronic EWAR applications, according to their specific functions. While not an exhaustive list, these tools have been used recently in crises. All listed tools allow for the reporting surveillance data, digital data management, trend analysis and semi-automated epidemiological analysis.

Table 21. Examples of fully electronic EWAR tools (as of March 2022)

Tool	Responsible for software	Full EWAR*	Outbreak detection	Contact tracing	Examples of use
<b><u>EWARS-in-a-box</u></b> 	WHO	✓	✓		Cox's Bazar (26), Northern Nigeria (22), South Sudan (49)
<b><u>Electronic Disease Early Warning System (eDEWS)</u></b> 	WHO Regional Office for the Eastern Mediterranean	✓	✓		Liberia, Pakistan, Somalia, Yemen (45)
<b><u>District Health Information Software version 2 (DHIS2)</u></b> 	University of Oslo	✓	✓	✓	Rwanda (50), United Republic of Tanzania (51), Uganda (52)
<b><u>Go.Data</u></b> 	WHO	✓	✓	✓	65 countries and >115 institutions, including: <a href="#">Argentina</a>  ; <a href="#">Bangladesh</a>  ; <a href="#">Uganda</a>  ; <a href="#">Gabon</a>  ; <a href="#">Guatemala</a>  ; Malta; South Africa (Free State Province); <a href="#">Switzerland (Canton Vaud)</a>  ; <a href="#">Ukraine</a>  . More details available in the <a href="#">Go.Data annual report</a>  .
<b><u>Surveillance Outbreak Response Management and Analysis System (SORMAS®)</u></b> 	Helmholtz-Zentrum für Infektionsforschung (HZI)	✓	✓	✓	Northern Nigeria (47), Ghana

\* Full EWAR includes data collection and management, outbreak detection, analysis/visualization, verification, investigation and risk assessment of alerts, and dissemination.

All the listed tools are open-source or open-access, as opposed to commercial products. Note, for open-source software, there exists no legally binding contracts supporting users. Implementers often rely on a broad community of users (often working on a voluntary basis). Therefore, many organizations may require additional human resources to launch these tools.

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In addition to the listed tools, other electronic tools may be used broadly for surveillance (e.g., KoBoCollect, Open Data Kit (ODK)-based tools, Epidemic Intelligence from Open Sources (EIOS)), and data visualizations and dissemination through the creation of reports and dashboards (e.g., Microsoft PowerBI, Tableau, Qlik, Zoho, Esri ArcGIS, R).

More information on these fully electronic EWAR tools and other specialized tools that can provide additional functions (e.g., for contact tracing, GIS) can be found in the following:

- [UK Public Health Rapid Response Team Data Collection, Management and Analysis Tool Finder](#)  – an online wizard created to support decision-makers (Ministry of Health, NGOs) to find the most appropriate electronic tools for outbreak response, based on their needs and technical requirements; and
- [WHO Digital Health Atlas](#)  – a global technology registry platform that aims to strengthen the value and impact of digital health investments, improve coordination, and facilitate institutionalization and scale.

## 9.4 Ensuring a rapid implementation of electronic EWAR

The alert function should be set up immediately and may rely on the telephone (e.g., a hotline on a dedicated mobile phone), dedicated text messages or internal software-based reporting between reporters and the system, until a tool is selected. Once a tool has been chosen, all data that were collected should be transferred. Apply the following key principles for preparation and training to guide rapid and successful implementation. These follow the nine [Principles for Digital Development](#) .

- **Design for scale:** Scale affects all resource requirements (e.g., hardware, servers, bandwidth) for the implementation of an electronic tool. In relatively small areas (e.g., a set of camps) with adequate technical and human resource support, training can take place very rapidly. However, scale-up of training can take more than two weeks in a large geographic area (45).
- **Design with the user and understand the existing ecosystem:** Training should assume limited previous experience with smartphones or tablets for data collection, and an emphasis on complete and error-free data collection.
- **Include technical expertise for configuration and data management:** At least one information technology specialist who is familiar with the EWAR tool and the software should be recruited to configure, troubleshoot and maintain the system. A data manager should be recruited to verify daily or weekly aggregation of data, data cleaning and automation of analyses.
- **Be data-driven – ensure sufficient technical expertise for surveillance:** An electronic EWARS cannot replace technical expertise in surveillance best practices and functions. An epidemiologist may be best placed to lead discussions of weekly analyses and interpretation.

# 10

## Data analysis

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# 10. Data analysis

EWAR will produce large volumes of data, with 9 to 12 diseases and public health hazards under surveillance. Therefore, an effective EWAR is dependent on timely and systematic data analysis, interpretation and dissemination.

- **Analysis** focuses on uncovering patterns in person, time and place that can give clues to the source and determinants of transmission.
- **Interpretation** focuses on why the disease patterns have occurred, and what this implies for current interventions. To aid interpretation, any available quantitative and qualitative data on behavioural practices, preventative measures, and social and community dynamics should be analysed in an integrated way.

A systematic analysis involves a reproducible analysis plan and a consistent presentation of results in a weekly report. This enables stakeholders to quickly compare the findings from week-to-week, inform decision-making, and ultimately drive the public health response. This module describes data management, analysis and interpretation of weekly trends in IBS and EBS, and performance indicators for EWAR.

Other types of data analysis and interpretation occur within the context of EWAR but are not addressed in detail in this module.

- During an outbreak or public health investigation, line list data on cases may be collected and analysed within an electronic EWARS (a paper-based EWARS may require an additional line list tool to be used). Analysis of data from an outbreak investigation is covered in [Module 12](#) .
- Data analysis and interpretation for the health facility catchment area takes place (Box 13).



## Box 13. Data analysis in the health facility

Wherever time and resources allow, healthcare staff should carry out data analysis to monitor trends in their own catchment area. This may include, for example:

- visualization of weekly counts of diseases for visual comparison;
- detection of a tally of signals; and
- during an outbreak, creation of a line list of suspected cases and calculating in-patient mortality ratios – weekly CFRs can be assessed, and an unusually large CFR investigated to assess potential issues with case management or health-seeking behaviour.

See the [Section 3 of the Technical guidelines for integrated disease surveillance and response in the African Region](#)  for more information.



# 10.1 Guiding principles for data management and analysis

An epidemiologist (or Data Management Lead) should develop a data management and analysis plan, which defines how data are cleaned and which statistical analyses, graphs, tables and maps are necessary for a concise weekly report. These guiding principles will be helpful to organize this process.

- Ensure that data management and data cleaning are done consistently before attempting analyses.
- Ensure that all analyses are closely linked with the primary objective of EWAR; that is, to support the early detection and rapid response to outbreaks and acute public health events. For example, to:
  - detect potential outbreaks using alert thresholds and spatial clusters (of disease and unexplained deaths); and,
  - monitor and improve the timeliness and completeness of reporting sites.
- Data not included in the analysis plan should not be collected. For example, detailed analyses of potential risk factors for each disease, aside from age and sex, may not be needed to achieve the main objective of the detection of outbreaks and public health emergencies.
- Once the analysis plan is established, the analysis should be consistently conducted at the same time each week.
- Ensure interpretation is undertaken as it forms a critical part of the translation of analyses into actions. Without good interpretation, indicators alone will carry very little meaning for most stakeholders. Interpretation should not be done from afar. It should incorporate the knowledge of local disease epidemiology and context and the insights of the EWAR implementation team and health staff who work at the level of the response.





## 10.2 Developing and conducting the analysis plan

Box 14 outlines a weekly analysis plan. [Section 3 of the Technical guidelines for integrated disease surveillance and response in the African Region](#)  describes its development in-depth.



**Box 14.**  
**Weekly analysis plan for EWAR (13)**

- Define the unit of time and the frequency of analysis.
- Define the geographical unit of surveillance.
- Conduct data cleaning.
- Calculate the coverage, completeness and timeliness of reporting sites.
- Calculate weekly case totals and denominators and cumulative totals.
- Visualize trends in cases over time.
- Calculate the number of alerts triggered and their outcomes.
- Visualize data by geographic area (e.g., camp, blocks, districts).
- Interpret the data considering the context and explanatory factors.

### 10.2.1 Step 1: Define the unit of time and the periodicity of analysis

Define the day when the epidemiological week starts, and when the surveillance period starts and ends (e.g., starting Sunday at 12:00 am and ending Saturday at 11:59 pm). To enable comparison with other surveillance data, use the epidemiological week, as defined by the Ministry of Health's routine surveillance system, or the ISO week date system. The surveillance period should correspond with the period of data collection.

For IBS data, the periodicity of analysis, interpretation and reporting depends on the epidemiological context. Usually, it is done weekly. One exception is at the start of a suspected outbreak where case counts rise quickly, and outbreaks expand spatially, so information is needed more frequently. Therefore, outbreak analysis, interpretation and reporting may be done daily (see [Module 12](#) .

For EBS data, analysis and interpretation (i.e., verification, interpretation and risk assessment) should be done immediately to trigger rapid public health actions (reporting can remain weekly). A weekly analysis of EBS data alone will not enable early warning rapidly enough. However, a weekly analysis of trends in CEBS (where unstructured reports of signals are produced rather than IBS) is appropriate if it is accompanied by the immediate verification, interpretation and risk assessment of signals.

## 10.2.2 Step 2: Define the geographical unit of surveillance

Analyses should be aggregated at the level of the entire EWAR coverage area, and always disaggregated for its sub-units (e.g., camps, districts, neighbourhoods, villages). If analysis is kept at the level of the EWAR, targeted public health actions cannot be undertaken.

Typically, the sub-units correspond to healthcare facility catchment areas or district-level catchment areas (which compile multiple healthcare facility catchment areas). In some countries, these sub-units can be different from their administrative units and may be referred to as health boundaries or specific surveillance reporting unit and catchment areas. Geographical delineation of such health boundaries should be carried out in close consultation with the local health authorities. Note that the reporting of performance indicators (e.g., timeliness and completeness of data reporting) should be assigned to the level of the reporting site to enable performance monitoring and improvement.

## 10.2.3 Step 3: Conduct IBS data compilation and cleaning

At the end of the surveillance period each week, after the data are sent from reporting sites to the EWAR, the data manager must either manually compile the data or check that they have been electronically compiled correctly. Each row in the database should represent an epidemiological week and a specific reporting site.

The data manager must then systematically clean the data to ensure their accuracy before any analysis is undertaken. The following steps can be completed.

- At the start, keep a separate data dictionary that documents the way variables are coded (e.g., ABD = “acute bloody diarrhoea”; sex = “1” for male and “2” for female).
- After the data are aggregated from all sites on a weekly basis, keep a backup of the database in XLSX or CSV format in a separate location (preferably a protected external hard drive or cloud storage to avoid data loss) before any data cleaning is done. Some digital tools offer the possibility to archive regular backups.
- Check for any late or double entries. For example, a reporting site might send both the current week’s entry and a previous week’s late entry that they had not already reported.
- Check for missing entries, and ensure that zero reporting is being followed (check for an entry of a “0” where no cases were reported in a given time period, instead of an ambiguous blank space). Blank spaces create confusion and may indicate zero cases or may indicate missing data. If there is a blank space instead of a zero, the data manager should contact the reporting site and explain the logic and practice of zero reporting.
- Run validity checks to ensure a reported value is within range of what would be expected. For example, a very high number of weekly suspected measles cases at a healthcare facility may exceed what would be expected for the given healthcare facility catchment area.

**Be proactive!** If there is any doubt, clarify with reporting sites by phone call, text message or a visit.

## 10.2.4 Step 4: Calculate the coverage, completeness and timeliness of reporting sites

To achieve the EWAR objective of the early detection of outbreaks and public health events, it is critical that reporting sites send complete data by a set deadline for the surveillance period, and that the surveillance covers nearly all the emergency-affected population. Weekly analysis should be accompanied by four performance indicators (Table 22). These indicators can be visualized for a simple representation of the performance of reporting sites. The total population with surveillance and the number of reporting sites should also be listed.



Table 22. Performance indicators on the coverage, completeness and timeliness of reporting sites

Indicator	Definition	Interpretation
<b>Surveillance coverage (%)</b>	Number of reporting sites that reported, divided by the total number of enrolled sites	While the range depends on the context, a low proportion indicates incomplete reporting among identified reporting sites.
<b>Population coverage (%)</b>	Population under surveillance, divided by the total population; OR Number of reporting sites with surveillance, divided by the total number of sites in catchment areas with and without surveillance	Relative to the stage of surveillance system implementation, a low proportion indicates poor population coverage and that certain communities (e.g., remote, insecure, without access to a healthcare facility) may be routinely excluded from surveillance.
<b>Completeness (%)</b>	Number of reporting sites producing a complete dataset with all variables completed (including zero reports), divided by the total number of enrolled sites	A relatively low proportion indicates poor quality reporting, and an opportunity to work with sites to fill in reports correctly, and to identify and overcome any challenges.
<b>Timeliness (%)</b>	Number of reporting sites reporting data at the specified deadline, divided by the total number of enrolled sites	A relatively low proportion indicates delayed reporting, and an opportunity to work with sites to improve their timeliness (appreciating the goals of early detection), and to identify and overcome any challenges.

EWAR staff should review these indicators to understand whether weekly reporting is adequate. Some sites may be silent (i.e., not sending reports) or consistently submit data after the deadline. Areas without a reporting site should be flagged for follow-up by the EWAR implementation team. The following questions can be asked of health facility staff to understand the causes of under-reporting and to find ways to help them to report correctly.

- Is there a staff member who is responsible for the data compilation? If not, are health facility staff generally too overwhelmed to participate in surveillance?
- If there is staff responsible for data compilation, what was the main reason for incomplete or late reporting (e.g., software failure, poor connectivity, limited human resources, limited time availability, surveillance is not perceived as a priority, didn't know about this surveillance, no payment received for this activity)?

See also [Module 14](#)  for more information on monitoring indicators.

## 10.2.5 Step 5: Calculate weekly case totals, denominators and key morbidity and mortality indicators

Compile the following data for the current epidemiological week. Where applicable, include cumulative totals starting from a meaningful date (e.g., the establishment of EWAR, the start of the calendar year). Cumulative totals may be useful for advocacy during a health response (e.g., the total number of cases of AWD and confirmed cholera during a cholera outbreak).

### 10.2.5.1 Number of cases by place of consultation (numerator)

The number of cases of each disease/syndrome is compiled on a weekly basis. To capture the change in the situation in the current reporting period, the weekly total should be compared to the previous week. Some sites may not be reporting consistently week-to-week at the start of implementation of EWAR.

### 10.2.5.2 Number of deaths due to diseases under surveillance (numerator)

Deaths due to a given disease recorded at health facilities are sourced from IBS data. Given this only represents a fraction of the total deaths (community mortality reporting is incomplete through EWAR), population-level mortality rates should not be calculated using this data.

### 10.2.5.3 Population denominators by place of consultation (denominator)

Population denominators concern the size and composition of the population at-risk. They are used to calculate incidence and to interpret trends. Numerators should be interpreted in relation to the population at-risk to monitor changes over time. Note that population sizes may shift in dynamic contexts. Used alone, the number of cases or consultations is not sufficient to evaluate the burden of disease in the population.

The population denominator can also be categorized by (a) persons under 5 years and 5 years and over, and (b) by sex/gender. These categories can be meaningful for early warning of outbreaks and public health emergencies. In addition, it is always useful to understand how different age-gender categories can be exposed differently and present with different risk factors (beyond traditional classifications such as infant/child/ adult) and adapt denominators accordingly.

The <5/≥5-year age disaggregation is useful for monitoring trends in diarrhoea as an increase in diarrhoea among persons ≥5 years may signal an emerging cholera outbreak (53). Other age categories will depend on their level of risk. The age group 15–49 years is generally used to define women of reproductive age. Children are generally defined as <18 years, and infants are <12 months.

Sex/gender disaggregation can help to derive hypotheses about exposure patterns (e.g., related to occupations, responsibility for caring for the sick), nutritional status, and access to health care and preventative care, including vaccination (note that additional data are needed to evaluate these hypotheses) (54). Moreover, for some diseases/syndromes, women/men may be at higher risk of severe outcomes (e.g., Hepatitis E among pregnant women) (30).

Box 15 lists common sources of population denominators in an emergency. Qualitative or convenience-based methods should not be used as these are often biased (e.g., persons in a food registration line are not indicative of the overall population or the demographics of the camp). Poor denominator data can lead to overestimating or underestimating morbidity. If pre-existing population estimates do not

capture the emergency-affected population, then rapid population estimation should be considered as part of setting up EWAR. Consider adding the emergency-affected host population if they are not being covered. See the Global Health Cluster’s guidance note [Estimation of population denominators for the humanitarian health sector](#)  for further detail on how to estimate population denominators in an emergency.



**Box 15.**  
**Potential sources of subnational population estimates in emergencies (55)**

- Emergency population estimation data from UNHCR or OCHA
- Registration, enumeration and structure counts used to establish services
- Large-scale household health and nutrition surveys that enumerate populations
- IOM’s Displacement Tracking Matrix (displacement only)
- Census data derived from CHW catchment areas or community-based surveillance
- Census data derived from community-based mass vaccination campaigns
- Data from food distribution from UN organizations and NGOs
- Structure counts from recent satellite imagery
- Weekly arrivals and departures
- Information on future influxes

**10.2.5.4 Key indicators for morbidity and mortality**

Indicators for EWAR should be kept simple and easily understandable by stakeholders who will read the weekly report. Key indicators for morbidity and mortality are outlined in Table 23 and the narrative below.



Table 23. Key indicators for morbidity and mortality

Indicator	Calculation*	Interpretation
<b>Incidence rate</b>	New cases of a specific disease/syndrome reported during a given time interval (e.g., one week), divided by the average population at-risk during that same time interval (e.g., midweek population), expressed per 10 <sup>n</sup> for easy interpretation.	Consider major changes in a population, as well as the absolute number of cases observed relative to other surveillance sites (e.g., very high incidence rates or large fluctuations may be expected in sites with very small populations).
<b>Proportional mortality</b>	Deaths caused by a specific disease/condition reported during a given time interval (e.g., one week), divided by total deaths from all causes reported in the same time interval, multiplied by 100.	Relative importance of a given disease/syndrome compared to other diseases/syndromes. Each cause is expressed as a percentage of all deaths, and the sum of the causes must add to 100%.

Indicator	Calculation*	Interpretation
<b>Simple/unadjusted case fatality ratio</b> ( $CFR_{unadjusted}$ )	Deaths due to a specific disease/syndrome reported during a given time interval (e.g., one week), divided by cases of the same disease/syndrome reported during the same time interval, multiplied by 100.	Percentage of known cases of a given disease/syndrome that result in death. CFR is heavily biased towards persons whose deaths are known to EWAR; typically, they are patients who die in healthcare facilities.
$CFR_{adjusted}$	Deaths due to a specific disease/syndrome reported during a given time interval (e.g., one week), divided by cases with an outcome (i.e., deaths + persons who have recovered) within the same time interval, multiplied by 100.	
<b>Inpatient mortality ratio</b>	Deaths among hospitalized cases of a disease/syndrome during a given time interval, divided by total hospitalized cases of the same disease/syndrome during the same time interval, multiplied by 100.	

\*All calculations are for a specific population over a specified time interval (typically one week in EWAR).

An **incidence rate** is the number of new cases of a specific disease during a given time period. In EWAR, the number of new cases reported is typically counted over one week, divided by the average population at-risk during that time period (midweek). Interpretation of weekly incidence requires consideration of changes in the denominator. For instance, a surge in RDT-positive malaria cases could either reflect an increase in malaria cases among a largely stable population or an influx of displaced persons into the area. Both instances indicate the need for intensified health services for the population; however, the former example suggests a potential outbreak requiring an urgent response.

**Proportionate (or proportional) mortality** describes the proportion of deaths attributable to different causes among a specified population and over a specified period. This may be useful to guide priority setting, especially when the population size is unknown or changing rapidly. Plotting proportional mortality over time (by week) during an emergency may provide insights into the relative burden of diseases/syndrome each week, and changes in these distributions over time, which signal, for example, a potential outbreak, seasonal change, impact of an intervention or change in surveillance. However, as proportionate mortality is not a rate (denominator is all deaths as opposed to the population in which they occurred), they are subject to several biases; for example, measurement biases concerning conditions prioritized for surveillance, or persons more prone to seeking health care, or cases that are relatively easier to diagnose and report.

**CFR** is the number of deaths due to specific disease/syndrome. While CFRs are a useful indicator for monitoring mortality trends for a specific disease over time in a given population, it is limited since a complete picture of the number of infections and true cases in the community is not known (56).

The **simple/unadjusted CFR** calculation is biased by delays in reporting cases and their outcomes (57). This calculation assumes that the likelihood of detecting cases and deaths remains consistent; however, we know that symptomatic cases are more likely to seek care and be detected by surveillance than asymptomatic or mildly symptomatic cases. This overestimates CFR. Another assumption is that by the day of reporting, we know the outcome for all reported cases (recovery or death). This underestimates CFR. The likelihood of detecting cases and deaths may change over time, and outcomes may never be known for some cases.

**Adjusted CFR** calculations focus on resolved cases for which the outcome is known at the time of reporting (56). For example, if there are two deaths due to acute jaundice syndrome among 271 cases this week, but we only know the outcomes for 253 patients (two deaths, 251 recovered) and lack information on the outcome for 18 patients, then the  $CFR_{adjusted} = (2 / (2 + 251)) * 100 = 0.8\%$ .

For health facility settings, the **inpatient mortality ratio** should be used instead to appropriately capture and describe the CFR as applied to healthcare facilities' deaths and cases only. This is more immediately interpretable as a measure of late access or lack of access to health care, problems with case management, or other underlying conditions among those affected.

### 10.2.6 Step 6: Visualize and assess trends in cases over time against thresholds

**Time-trend histograms or line charts** are a good communication tool to give a general sense of the magnitude of disease transmission (or relative stability) over time. The main objective of analysing trends over time is to continuously compare weekly case counts in order to detect any sudden or gradual increases over time – namely, signals. Certain modifications are particularly useful for EWAR.

- Incidence rates may be used instead of the case counts in order to account for changes in the population size, which may be masked by simple case counts. However, this must be balanced against realities where population estimates may be unreliable and may change often in emergency-affected populations.
- For an EWAR that has been running for several years, graphs of previous years or calculated X-year means can be overlaid for comparison. This can be particularly useful for seasonal diseases. Since the population sizes may have changed between years, incidence rates are preferred for these charts.

Fig. 11 illustrates the use of an alert threshold while monitoring disease trends in the population.

Assessments of trends should occur against predefined alert or epidemic thresholds (see [Module 6 paragraph 6.4](#) ). Thresholds help to identify trends that may constitute an abnormal increase and trigger signal management processes and immediate epidemic readiness/urgent response measures, where appropriate. Thresholds should account for expected seasonal increases wherever possible. Analyses of absolute case/death counts or incidence rate trends against alert and epidemic thresholds can include the following (58, 59):

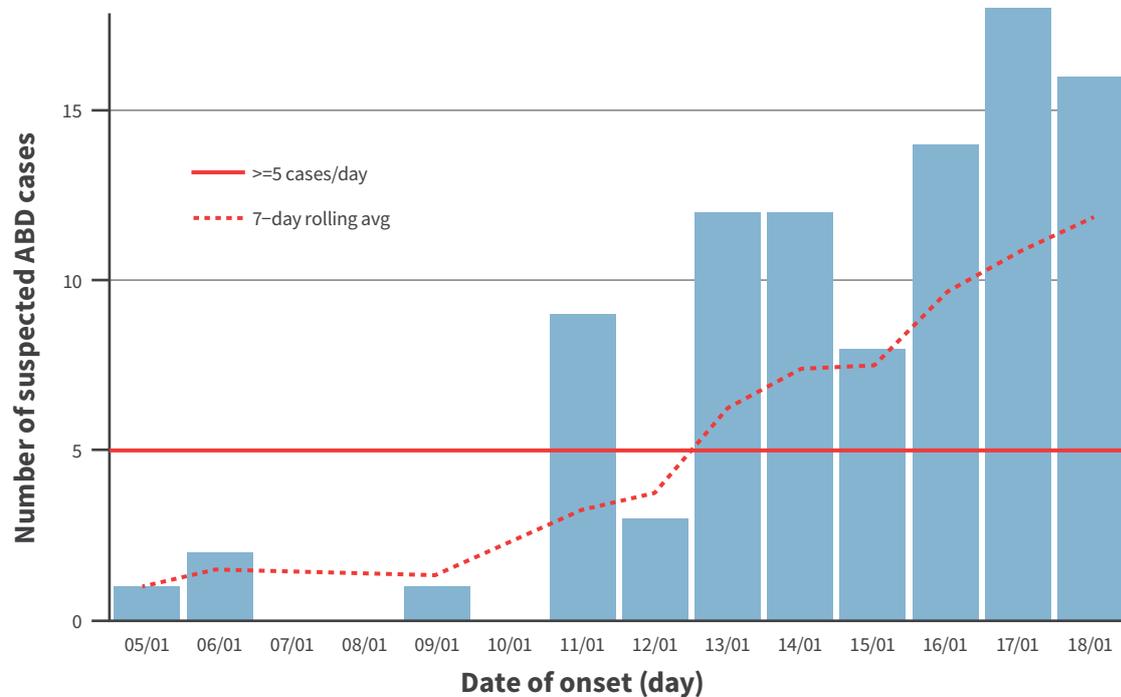
- a simple comparison against fixed value thresholds (e.g., visualized as a static threshold line on trend graphs or coloured flag/cell in tables);
- a moving average that compares the current week with the average of the past several weeks; or
- other statistical methods using historical data to generate context-specific thresholds.

If electronic EWAR is used, thresholds can be programmed to trigger an automated signal notification to the team for verification and action.

An **epidemic curve** is another type of trend graph, traditionally visualized as a histogram showing the number of cases/incidence rates by the date of onset of symptoms, or a proxy case-specific time variable (see [Module 12](#) ). Epidemic curves provide a useful complement to routine EWAR trend graphics during an outbreak to visualize in greater detail when the outbreak began, the slope in the rise and fall of cases, and the current and past stages of the outbreak. However, as EWAR data are typically collected as

aggregate cases by the date (day/week) of notification, this may preclude inclusion of epidemic curves in standard EWAR analyses.

Fig. 11. Examples of trend graphic – Reported cases of bloody diarrhoea reported in Nambutu, January 2018 and corresponding thresholds defined as  $\geq 5$  cases in one location in one day or double the daily average



During early phase of an emergency

### 10.2.7 Step 7: Assess weekly EWAR performance indicators

At the end of the surveillance period each week, the data manager should consult the alert log to review key EWAR alert management timeliness and completeness indicators (see [Module 14](#) ). This may include analysis and reporting of the proportion of new signals that have been verified, the number of new events raised to the risk assessment stage, and the proportion of those events that were risk assessed as alerts within 24 hours from notification, by the end of the reporting period. Remember that events can be produced by EBS (e.g., a rumour of a cluster of deaths in a household) or IBS (e.g., a surge in acute jaundice syndrome cases at a healthcare facility).

Showing the outcomes of the alert management process demonstrates the value of EWAR and the vigilance of reporting sites, and capacity of the EWAR team to rapidly follow up signals and events. Alerts can be summarized and mapped alongside the weekly assessment of trends. The outcomes of the alerts should also be listed in the weekly report, as well as the nature of the confirmed alerts (e.g., measles outbreak detected in Area 7, response has been initiated).

For example, during 2017, EWAR staff in Cox’s Bazaar refugee camp mapped measles cases by age group, which helped to rapidly communicate the need for targeted vaccination campaigns. Similar mapping of cases of acute jaundice syndrome and measles were reported rapidly in the week of detection to health facilities, who could then support case-finding and case management (26).

## 10.2.8 Step 8: Map the data by geographic area

Basic mapping of case counts, indicators and alerts provides a means of evaluating the frequency of cases by geographic site and identifying areas at higher risk. Mapping of: (a) indicators by administrative level or reporting site; and (b) individual cases in a small area can describe both the geographic extent of transmission and identify high-risk areas. Key questions to ask when considering data by geographic area include the following.

- Is the reporting consistent or stable over time?
- Does the frequency vary geographically?
- How did the variation change from the previous weeks to this week?

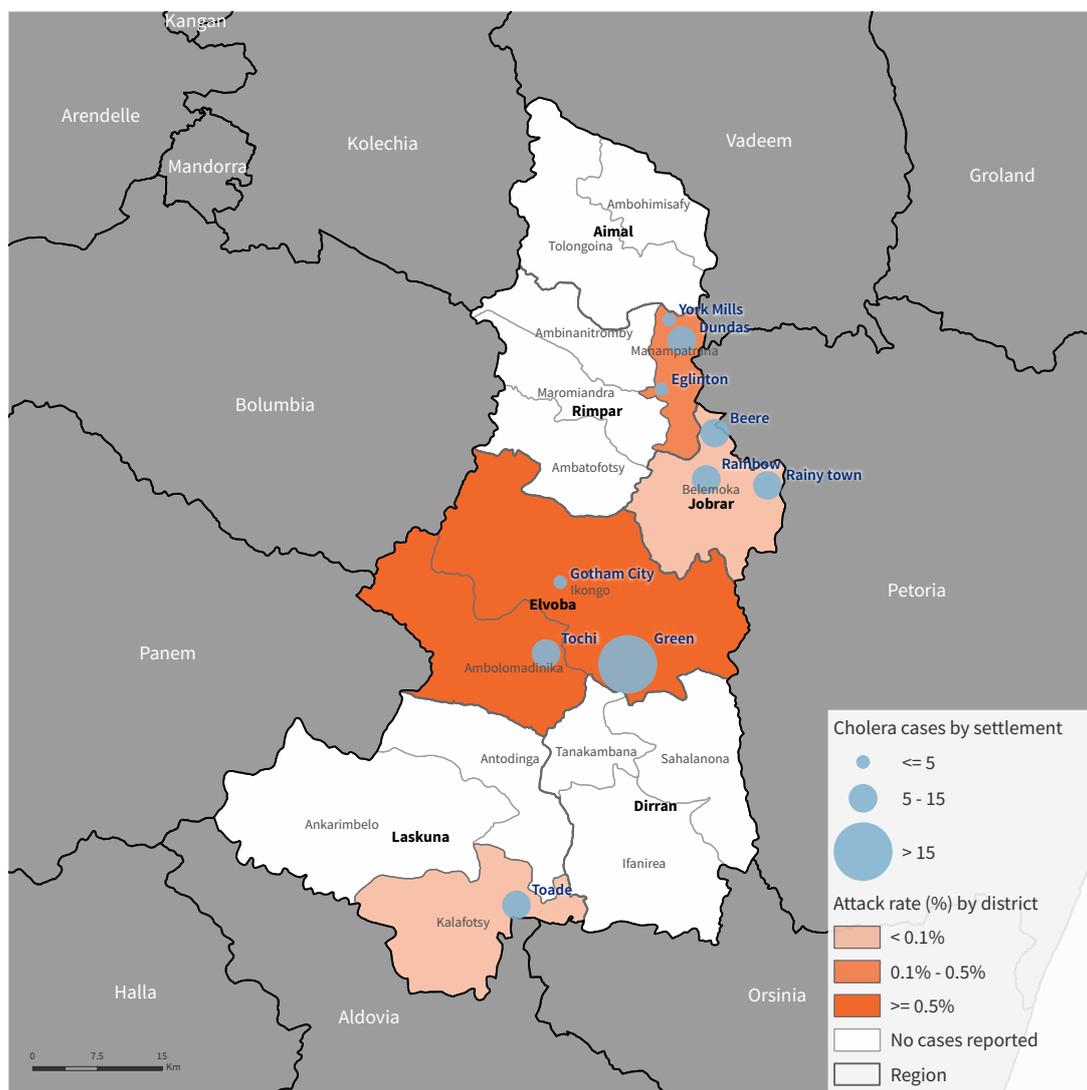
Key steps to consider when developing maps include the following (60).

1. Ensure the systematic collection of geocoded location data at a sufficient granular level. This may include:
  - locations of cases' residences – address, administrative level/division data (e.g., camp, suburb, village/city/town, district and province/state boundaries and/or GPS coordinates);
  - health facility or other reporting site details (as above); and/or
  - other relevant location data (e.g., places of potential exposure).
2. Choose a map type appropriate to the type of indicator, objectives and data available.
  - **Proportional symbol map** could be appropriate to show the distribution of cases and deaths. In this type of map the symbol's size varies in proportion to the quantity it represents.
    - The data can be represented at its exact location (e.g., GPS coordinates) or can be aggregated by administrative level or reporting unit. If the data are aggregated, the symbol should be placed in the centroid of the area.
    - Note that the collection of GPS information on cases and presentation of these data in maps can be highly sensitive as cases may be easily identified. Use of such maps, therefore, should be limited to situations when they will aid control efforts (e.g., for a ring vaccination effort where potential contacts need to be identified), and should not be disseminated widely or published publicly.
    - In this type of map, multiple variables can be displayed simultaneously. In addition, it is possible to overlap on other types of mapping layers, such as a choropleth map layer or satellite imagery.
  - A **choropleth map** is favoured to represent health indicators such as morbidity and mortality (e.g., incidence rate, proportional mortality) across a geographical area like administrative levels, camps or reporting units (see example in Fig. 12). Wherever possible, area-specific rates should be presented to account for difference in underlying population.
  - To follow indicators over time and location, **time series/timelapse maps** of the above-mentioned types can be used.
3. Clean and arrange the data in a format suitable for mapping (e.g., aggregating case counts by administrative level and day/week).

4. Access software to create maps.
  - Electronic EWAR systems have an inbuilt capacity to visualize counts or rates on maps.
  - This can also be done using additional software (e.g., ESRI ArcGIS, Google Earth, Quantum GIS, GRASS GIS or R). Guidance on using R to create basic maps is available in the Applied Epi [Epidemiologist R Handbook](#). Other resources to create maps are available for [ArcGIS](#), [QGIS](#) and [ArcGIS for GOARN partners](#).
  
5. Source-relevant GIS databases/map layers.
  - The EWAR team should align with national geographic data as officially approved by the national and local authorities. That includes agreeing on what geographical data (including administrative/geographical boundary map layers) to use to be in line with the surveillance reporting units (e.g., health boundaries).
  - Be aware of political sensitivities for disputed territories in the country and identify the best symbology to represent disputed areas and borders.
  - Other geographic variables and points of interest that might be associated with the causal agent (e.g., rivers, water sources, vector breeding sites, places of worship, schools) or provide refence (e.g., health facilities) should be geolocated and added. Satellite imageries can also be helpful, especially during a humanitarian or natural disaster crisis.
  - Additional geospatial data resources are available from the [Humanitarian Data Exchange](#).
  
6. Develop and interpret maps.
  - Thorough interpretation should accompany all maps. This may include highlighting higher risk areas (hotspots) and populations for targeted intervention based upon observed differences in burden between geographical areas, identifying potentially underserved areas, as well as providing local contextual insights into why any patterns may be observed.
  - Note that the apparent absence of cases on a section of the map may not represent the reality of transmission, but rather surveillance limitations (e.g., poor reporting), which should be followed up.

Note that mapping does not have to be complicated; it can be done using pen and paper. In the absence of software, internet connectivity, appropriate GIS databases, time or expertise or where greater granularity and details are needed, data can also be simply tabulated by administrative/geographic areas. See also [Module 12, paragraph 12.3.5.2](#) for further considerations on analyses by place during outbreak investigations.

Fig. 12. Example of a choropleth map – Number of cases and attack rate of cholera by settlement in January 2018, Nambutu



### 10.2.9 Step 9: Interpret the data thoughtfully

Data analysis must be used for evidence-based decision-making in a public health response. The epidemiologist should not only analyse the data but provide a thoughtful interpretation that is comprehensible, useful for public health actions and tailored to its specific audience (58).

In interpreting the findings, the principles of IOA should be used. IOA proposes that the analysis and interpretation go beyond time, place and person to incorporate contextual, political, economic and sociocultural factors that can explain the trends in indicators, risk factors and populations at-risk that are highlighted in the outbreak investigation (42, 61–66). Examples of using IOA for analysing and interpreting public health data can be found in the quarterly IOA Field Exchange (67, 68) and on the [IOA website](#) .

Presenting the weekly epidemiological analysis in a well organized report is the key step in communicating important findings to a wider audience, enabling the weekly comparison of key indicators and giving feedback to reporting sites. The recipients include:

- national public health authorities (or the equivalent), Ministry of Health and associated Ministries
- Health Cluster, WASH Cluster and other cluster partners, to engage multiple sectors
- national and international NGOs and CSOs
- WHO, UNICEF and other UN offices for international coordination and advocacy.

In linking well thought out analyses to weekly reporting to stakeholders, the following guiding principles should be considered.

- The report should be no longer than five pages, written in the country's official languages and translated into relevant languages as needed.
- Concise summary tables, graphs and maps should be used to ensure that the information is clear and understandable to non-technical staff.
- Findings should be interpreted. Interpretation should be kept to key bullet points that reflect: (a) the reporting performance of EWAR (e.g., areas or subpopulations that lack coverage); (b) the number of alerts triggered and verified; and (c) weekly trends in epidemic-prone diseases and conditions (see Box 16). These should be written in a way that is easily understood at coordination meetings.
- Aim to inform frontline health workers about the health problems at their facility and others in their region. In addition, showing how the data they are reporting are being used to trigger and inform control measures (e.g., vaccination campaigns) can be motivating.



**Box 16.**  
**Summarizing  
and interpreting  
data (11, 58)**

- Describe longitudinal disease trends (increasing, decreasing, stationary), any potential influence of seasonality (e.g., rainy/dry season) and any unusual/unexpected changes in trends.
- Describe spatial clustering by district and camp and identify possible risk factors that may be associated. Identify areas with the highest burden of the disease reported (based on the highest number of cases/deaths and incidence rates, but also the level of vulnerability of the population affected). Pay special attention to diseases with high CFRs in specific areas.
- For outbreaks, identify dates to signal the beginning and end of an outbreak to those partners involved in the response.
- Describe the population at-risk (e.g., demographics, geographic areas).
- Where available, provide local insights into any major trends/concerning patterns observed (e.g., context information, possible risk factors, previous outbreaks, vaccination coverage, seasonality, the situation in neighbouring areas, societal factors) that may influence trends.

Key elements and analyses to be presented in reports are listed in Table 24. [Module 15](#)  discusses communication and dissemination in detail.



Table 24. Key elements of an EWAR epidemiological bulletin

Element	Analysis
<b>Highlights</b>	<ul style="list-style-type: none"> <li>Review of key points from that week’s data and key public health actions undertaken as a result</li> </ul>
<b>Burden of disease</b>	<ul style="list-style-type: none"> <li>Numbers of cases and deaths by disease and week, compared to thresholds/previous weeks/cumulative</li> <li>Incidence rate trends</li> <li>Graphs of proportional morbidity and mortality</li> </ul>
<b>Person</b>	<ul style="list-style-type: none"> <li>Age</li> <li>Sex</li> <li>Any other relevant disaggregated information that can support interpretation and orientate response activities</li> </ul>
<b>Time</b>	<ul style="list-style-type: none"> <li>Incidence rate</li> <li>Case and death counts over time using histograms</li> </ul>
<b>Place</b>	<ul style="list-style-type: none"> <li>Maps of distribution of cases, indicators and alerts</li> </ul>
<b>EWAR components</b>	<ul style="list-style-type: none"> <li>Tabulate alerts</li> <li>Proportion of alerts verified</li> <li>Investigation and response actions taken</li> </ul>
<b>Surveillance system and performance</b>	<ul style="list-style-type: none"> <li>Population covered by surveillance (size and any changes, demarcation of the geographic area)</li> <li>Completeness of reporting (by site or district)</li> <li>Timeliness of reporting (by site or district)</li> </ul>
<b>Interpretation</b>	<ul style="list-style-type: none"> <li>Focus on the epidemiological situation, performance of EWAR, contextual factors (elements that can explain trends, including risk assessment STEEEP criteria) and comparison with the previous week or cumulative period.</li> </ul>

During early phase of an emergency





## 10.3 Data protection

Safeguards must be put in place to protect the data and confidentiality of individuals throughout data collection, transmission, management, storage, analysis, reporting and dissemination processes. This is the shared responsibility of all individuals and partners contributing to EWAR systems.

For most EWAR systems, only aggregate data (e.g., number of suspect cases by week) are needed by partners to understand trends in alert management. Nevertheless, for smaller populations, either rare conditions or where stratification (e.g., by age/sex/village/facility) is needed could make it possible to easily re-identify individuals. Caution must therefore be taken when sharing aggregate data in external forums/public reports. Where necessary, take steps (e.g., aggregating small counts to higher strata/areas) to prevent re-identification.

When the collection of individual patient records/line-listed data become necessary (e.g., during an outbreak investigation), individual names, locations (e.g., addresses, GPS coordinates), contact details, medical history and other personal details may be transmitted through surveillance systems. Additional precautions must be taken to protect this data from unauthorized access or use (see [Principles on Personal Data Protection and Privacy](#) ). This may include, but is not limited to:

- ensuring line lists and databases are access-controlled to only individuals directly involved in field investigations, with user-specific passwords and encryption;
- separating sensitive individual case data (e.g., names and contacts) into databases with additional security and access restrictions for a limited number of individuals using unique IDs to allow for re-identification of cases when needed (e.g., for data cleaning duplicate case records); and
- securely storing any physical/printed records (e.g., case investigation forms).

Ownership of all data and authorization of any third-party use of these data via prior agreement remains with local/national public health authorities or the Ministry of Health. Explicit written permission should be sought from these authorities before any sharing or use of data collected, and before developing information products/publications derived from analyses of these data (e.g., using a formal data sharing agreement); sometimes prior approval from an ethics review board might be warranted. Specific records extraction from databases/line lists and sharing should be limited to the intended use and to only those variables and records necessary to complete the agreed task(s) and product. For example, remove case names and other identifying information and exclude non-cases in the data export before sharing.

All users must give careful attention to protect individual case identities in data analyses presented, shared or published outside of the investigation team. All case descriptions and analyses (text, tables, charts, maps) should apply an appropriate level of aggregation to avoid cases being easily re-identified (e.g., map cases aggregated by administrative region rather than publishing spot maps). Where more granular data visualizations or descriptions are useful for targeting control measures (e.g., spot maps to support a ring vaccination effort, where potential contacts need to be identified), access to these analyses should be limited, and not included in routine EWAR reports and other information products that are shared with stakeholders or published in public forums.



# Response

- > **11** Response →
- > **11.1** Triggering an outbreak or public health investigation →
- > **11.2** Supporting passive and active case-finding →
- > **11.3** Providing surveillance data to guide the response and monitor control measures →
- > **11.4** Implementation of control measures →

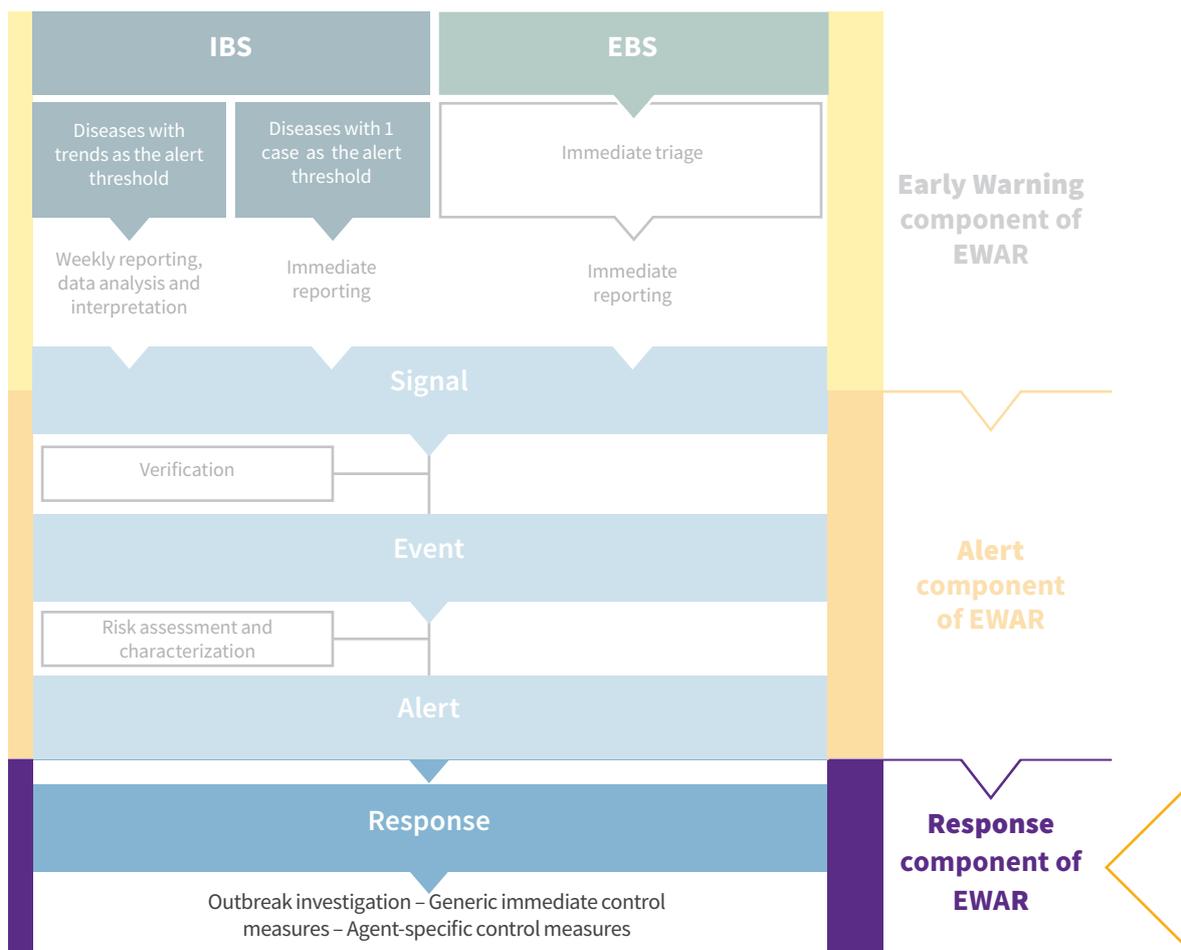
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# 11. Response

EWAR plays a critical role in enabling the early warning and alert functions for acute public health events that are required to facilitate a prompt investigation and response (Fig. 13). Response refers to any public health action that is initiated based on the risk assessment of an alert. It should be initiated as early as possible to prevent the expansion of the outbreak or public health emergency, reduce morbidity and mortality, and mitigate the impact on health service provision and affected communities' well-being. At the earliest stage of the outbreak or public health emergency, the national public health authorities (or equivalent) coordinate the investigation and response. The EWAR implementation team provides any necessary support needed to guide the investigation and response.

“Response refers to any public health action that is initiated based on the risk assessment of an alert.”

Fig. 13. The Response component of EWAR



During early phase of an emergency

This chapter describes the specific roles for EWAR in supporting the response, including:

- triggering an outbreak investigation
- supporting passive and active case-finding
- providing surveillance data to guide and monitor the outbreak and control measures.

The implementation of control measures, which involves the health and other sectors, is briefly described for context.

## 11.1 Triggering an outbreak or public health investigation

An alert could lead to an immediate response if the agent and population at-risk are known. For example, an alert to a trend of sharply increasing malaria cases highlights a need to review the availability and the use of prevention measures (e.g., long-lasting insecticide-treated bed nets, mass prophylactic drug administration). In other situations, an outbreak or public health investigation is needed to determine the agent, source of infection, modes of transmission and response required (see [Module 12](#) )

## 11.2 Supporting passive and active case-finding

During an outbreak or public health emergency, the goal is to detect cases in the community as quickly as possible to facilitate case management, to understand epidemiological dynamics and to reduce transmission. Existing IBS at the health facilities may be insufficient in detecting the cases. EWAR can play a major role in facilitating both passive and active case-finding (i.e., the systematic search for cases in communities at-risk during an outbreak or public health emergency). At a minimum, this includes the daily collection of line lists from reporting sites. Other methods are described in [Module 12](#) .



## 11.3 Providing surveillance data to guide the response and monitor control measures

The surveillance and response data checklist (Box 17) outlines key data and indicators sourced from EWAR, which may be used in addition to the line list from the outbreak or public health investigation.

As the outbreak expands temporally and geographically, an updated risk assessment may be needed and may be supported by national or regional public health institutes and WHO. This may require more EWAR data from the entire area under surveillance.

In addition, the [Epidemic analysis for response decision-making](#)  stepwise approach will inform decisions by systematically, logically and clearly organizing multisource information to optimize assessment. It can usefully be complemented by the IOA approach (see [Module 10 paragraph 10.2.9](#)  and [Module 12 paragraph 12.3.5.4](#) ).



### **Box 17.** **Surveillance and response data checklist**

The national public health authorities (or equivalent) and the EWAR implementation team should meet daily to review the EWAR data on:

1. Suspected cases
  - a. Crude and age-specific weekly attack rates
  - b. Histogram by date of reporting (cases by date of onset when available)
  - c. Any increases in incidence in affected areas
2. Suspected deaths
  - a. Community deaths and proportion of cases resulting in death
  - b. Inpatient deaths and proportion of hospitalized cases resulting in death
3. Hospitalized cases
4. New alerts (and proportion of alerts that were verified)
5. Mapping of affected (and newly affected) geographic areas
6. EBS signals to suggest additional clusters of cases in newly affected areas, community acceptance of response measures and other possible challenges (e.g., insecurity, concurrent emergency) (69).



# 11.4 Implementation of control measures

A comprehensive response strategy extends beyond EWAR and is informed by national, disease-specific response plans (e.g., national cholera plan) and the available resources.

EWAR plays a supportive role in providing data to monitor the effects of control measures on the outbreak. For instance, the national public health authorities (or equivalent) may ask for data to monitor the impact of a mass vaccination campaign for measles on case incidence over time. However, note that evaluation of the coverage of intervention measures (e.g., measuring coverage of a mass vaccination campaign), falls outside the scope of EWAR data.

Importantly, generic/agent-specific control measures implemented in response to a detected alert/emergency should be considered temporary (time-limited) and grounded in a risk-based approach, with clear scientific rationale/evidence to support a measure. Communities should be at the centre of the decision-making process, well informed about the evidence and involved in the collection and interpretation of contextual data (70, 71). Moreover, measures should be reviewed regularly to consider their effectiveness and adverse impacts on communities, and regularly adjusted in proportion to evolving risks and latest scientific evidence; repeat until such time as an agent is identified and generic measures can be replaced by more targeted, agent-specific control measures. Where measures continue beyond the end of an acute event, these should be incorporated into longer-term local/national prevention and control strategies and reviewed accordingly. To the greatest extent possible, control measures should target only individuals at-risk and avoid placing stigma or any kind of social-economic burden on affected communities and individuals.

## 11.4.1 Immediate and generic control measures

Immediate control measures are implemented as soon as the suspected route of transmission is identified, even before the agent is confirmed. For example, this may include the following.

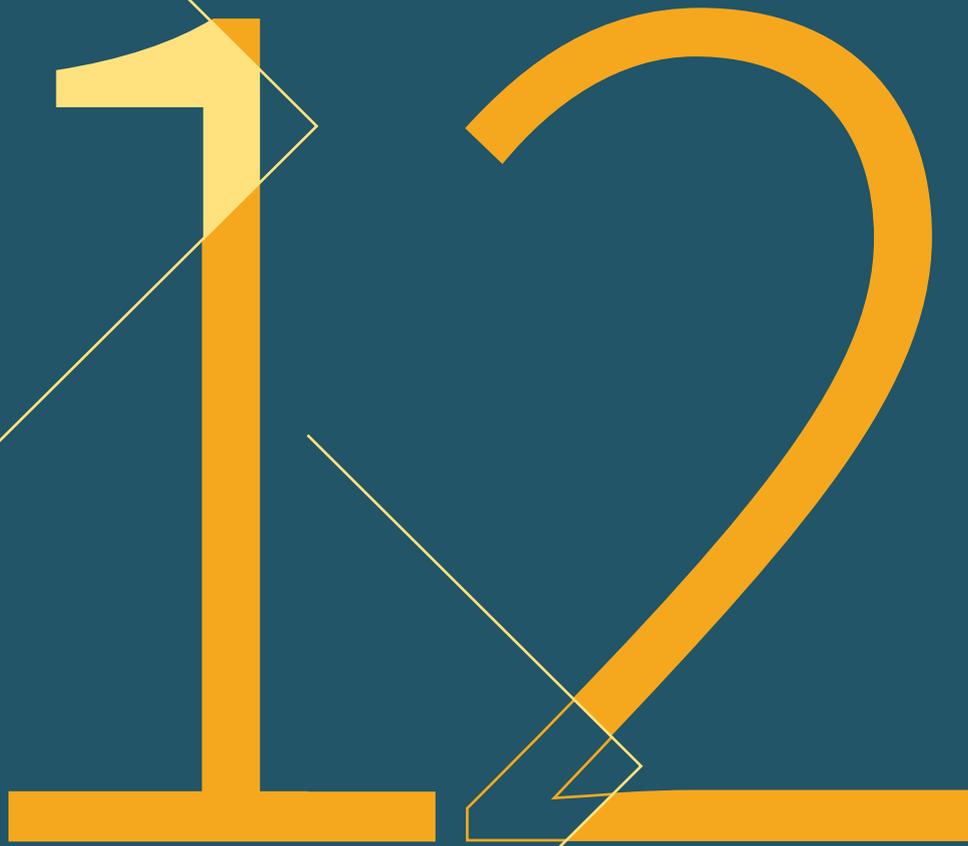
- Implement community engagement, consultation, and health and hygiene promotion.
- Reinforce infection prevention and control (IPC) in health facilities, including the reinforcement of standard/universal precautions, and use additional personal protective equipment (PPE) (e.g., masks, gloves, disinfecting materials).
- If water/foodborne transmission or an environmental agent is suspected, implement linking with relevant authorities to immediately investigate and sample suspected exposure sources and, where appropriate, implement precautionary preventative measures to prevent further exposure (e.g., household water treatment following detection of increased faecal coliforms in drinking water sources).

- If zoonotic outbreaks are suspected to be related, effect linkage with the animal health sector to investigate the situation in animal populations and implement standard precautions (see, for example, the [Livestock Emergency Guidelines and Standards](#) )
- If human-to-human transmission is suspected or where cause is unknown, implement precautions aimed to limit onward transmission and enable early detection/monitoring of potentially infected/exposed individuals (e.g., temporary isolation of cases, contact identification and follow-up, limiting case/contact interactions with specific high-risk settings, screening of individuals at points of control and points of entry).

## 11.4.2 Agent-specific control measures

When the agent is identified, specific control measures are introduced to prevent exposure, infection, disease and death. The points below are adapted from the [WHO Communicable disease control in emergencies field manual](#) . Further information on disease-specific control measures may be found in the [WHO Managing epidemics handbook](#)  and the [WHO Outbreak Toolkit](#) .

1. **Prevention of exposure:** The source of infection is contained to prevent the disease from spreading to other members of the community. Depending on the disease, this may involve:
  - prompt diagnosis and treatment of cases using standard protocols (e.g., cholera);
  - isolation and barrier nursing of cases (e.g., VHFs);
  - improvements in environmental and personal hygiene (e.g., shigellosis, cholera, hepatitis A, hepatitis E, typhoid);
  - control of the vector or animal population (e.g., dengue, Lassa fever, malaria, yellow fever);
  - safe disposal of sharp instruments (e.g., hepatitis B); and
  - health education, tailored to the specific agent and the needs of the community.
2. **Prevention of infection:** Susceptible groups are protected by vaccination (e.g., cholera, diphtheria, measles, meningitis, yellow fever), safe water (e.g., shigellosis, cholera, hepatitis A, hepatitis E, typhoid), adequate shelter (e.g., ARI), and improvements to sanitation (e.g., cholera, hepatitis A, hepatitis E).
3. **Prevention of disease after exposure:** High-risk groups are offered chemoprophylaxis (e.g., malaria prophylaxis for pregnant women during outbreaks) and better nutrition.
4. **Prevention of death:** Prompt diagnosis, management of cases and effective healthcare services foster prevention of death.



# Outbreak or public health investigation

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# 12. Outbreak or public health investigation

EWAR plays a critical role in enabling the early warning and alert functions for acute public health events that are required to facilitate a prompt investigation and response. At the earliest stage of the outbreak or public health emergency, the national public health authorities (or equivalent) coordinate the investigation and response. The EWAR implementation team provides any necessary support needed to guide the investigation and response.

Following the designation of an alert (i.e., a public health signal that has been verified to be an event, risk assessed and requires an intervention), an outbreak or public health investigation (hereafter outbreak investigation) and response are required. This chapter describes the role of EWAR in supporting the investigation, including the use of enhanced surveillance for active case-finding and contact tracing.



## 12.1 Aims of the investigation

An outbreak investigation differs from EWAR signal verification and event risk assessment and characterization processes, which determine if an event is occurring, the level of risk it may pose to human health and immediate response actions needed. Outbreak investigations aim to continue the process of characterizing the public health event. The aim is to answer three questions.

1. What agent is causing the outbreak or public health emergency?
2. Which populations are at-risk? What do the person, time and place aspects of the data demonstrate about populations at-risk?
3. What control measures are needed to control the outbreak or public health emergency to substantially reduce morbidity and mortality?

An outbreak investigation often includes the risk assessment of an acute public health event (see [Module 8 paragraph 8.4](#) )



## 12.2 Forming the investigation team

National public health authorities (or their equivalent) lead the outbreak investigation and include the EWAR implementation team. Initial preparations should include the following.

- Discussions are conducted with technical, communication and political partners about the occurrence of the investigation to ensure a coordinated and well supported effort.
- Appropriate technical staff for the investigation are organized, who may include (depending on the suspected disease):
  - team leader (frequently an epidemiologist)
  - epidemiologist (if not already the team leader)
  - laboratory technician
  - physician/clinician
  - health promotion specialist
  - other specialists (as appropriate): water and sanitation, vector control, animal health, anthropologist, data analyst
  - drivers
  - logistician.

In some investigations, a smaller team of experienced technical staff may be desired for expediency.

- Persons with a good knowledge of the local communities are consulted and included (e.g., CHWs, community leaders). These team members provide valuable insights for the interpretation of findings; help to describe the acute public health event from the community's perspective; and help to remain sensitive to community culture, beliefs and behaviours in the design, execution, analysis and interpretation of the investigation.
- An inventory of required medical and laboratory equipment to support specimen collection, transport and communication is developed.
- Discussions are conducted with security staff regarding any security concerns and mitigation plans prior to travel.



## 12.3 Steps in the outbreak investigation

The steps in the investigation of the outbreak follow a standard approach but are oriented toward rapid response (Box 18). The steps may not occur in this order, but several steps should be prioritized during an emergency. For example, the initial investigation, case investigations and line listing should be initiated without delay to determine the cause of the outbreak and who is at-risk (40). Implementation of generic control measures is also done as soon as possible, with discussions with the leaders of the communities to reduce excess morbidity and mortality among the already vulnerable population.



**Box 18.**  
**Steps in an outbreak investigation in the EWAR context**

1. Conduct initial investigation to confirm the existence of an outbreak and verify the diagnosis.
2. Implement immediate and generic control measures, if possible.
3. Develop a case definition for the outbreak.
4. Systemically find cases and contacts (if appropriate) and collect individual data using a standardized case investigation forms and a line list.
5. Conduct descriptive epidemiological analyses, describing time, place and person characteristics.
6. Develop hypotheses for the exposure, source and mode of transmission. Update the case definition, as appropriate.
7. Conduct further investigations to evaluate these hypotheses, including further laboratory investigations, environmental sampling and epidemiological studies to further define the agent and/or its mode of transmission, risk and the effectiveness of control measures.
8. Implement agent-specific control measures.
9. Develop public health messages with affected communities and the national public health authorities (or its equivalent) and other outbreak response actors.
10. Communicate the findings of the outbreak investigation more widely.

### 12.3.1 Step 1: Confirm the existence of an outbreak and verify the diagnosis

Under the EWAR alert management workflow (see [Module 8](#) ), this step may have been fully or partially completed during signal verification and risk assessment processes. These outputs should be reviewed by the investigation team to inform what further investigations are needed to establish the existence of an outbreak and identify the causative agent.

An **outbreak** or **epidemic** is the occurrence of more cases of a particular type of disease, chronic condition or injury than expected in a given area, or among a specific group of people, over a particular period of time (2). An important task of field investigators is to verify that a group of cases is indeed an outbreak. They might turn out to be true outbreaks with a common cause or sporadic and unrelated cases of the same disease, and others are unrelated cases of similar but unrelated diseases (4). Moreover, it is critical to ensure that the disease has been properly identified (since control measures are often disease-specific) and to rule out laboratory error as the basis for the increase in reported cases. Further investigations to confirm the existence of an outbreak and verify the diagnosis may include:

- reviewing all available epidemiological data;
- consulting healthcare workers attending to cases;
- engaging with CHWs who might know of cases;
- engaging with and consulting traditional practitioners who might have attended to cases;
- checking for any changes in the overall context (e.g., change in the environment, population, access to health care, policies);
- conducting initial animal health and environmental investigations (where appropriate); and
- based on a differential diagnosis from these investigations, undertake laboratory investigations to confirm the agent in all identified cases (or a representative subset).

“Moreover, it is critical to ensure that the disease has been properly identified (since control measures are often disease-specific) and to rule out laboratory error as the basis for the increase in reported cases.”

As part of these steps, it is important to develop an understanding the local profile of epidemic-prone and endemic diseases, the local population’s susceptibility to specific diseases (e.g., a cholera-naive displaced population entering a zone where cholera is endemic), seasonality and other population risk factors. This can narrow the list of potential diseases. Check if a communicable disease epidemic profile has been completed (see [Module 3](#) .

Visiting the referring health facility and/or cases to ascertain additional information will support the development of a differential diagnosis, and a case definition for the outbreak (see Step 3). Healthcare workers should conduct medical investigations for all suspected cases and list all signs and symptoms, medical history and treatments already undertaken. It may be appropriate to use a generic/disease-specific case investigation form to collect initial data to systematically describe potential syndromes common to suspected cases and potential sources of transmission (e.g., a household cluster, nosocomial transmission occurring in a hospital). Disease-specific case investigation forms for epidemic-prone diseases, generic case investigation forms (when no disease or agent is yet suspected), case definitions and other disease-specific guidance are available in the [WHO Outbreak Toolkit](#) .

In addition, it is critical to engage with affected communities, including community health workers, who may have observed cases outside healthcare facilities. In some instances, the population might have developed empirical knowledge of the disease (e.g., signs and symptoms, risk factors, local terminology) and have organized their own ways to deal with similar outbreaks. Furthermore, as main beneficiaries of the possible response to be set up, communities should be meaningfully engaged from the start of the outbreak investigation to ensure better acceptability of and adherence to response measures, to build awareness of the event and appropriate preventive/early health-seeking behaviours, as well as to limit possible adverse impacts.

Based on the suspected agent(s), collect clinical specimens, and arrange for safe and timely transport and testing at a laboratory with capacity to conduct relevant tests (see [WHO Guidelines for the collection of clinical specimens during field investigation of outbreaks](#) ) . Note that definitive laboratory confirmation may take several days or weeks. Suggestive/indicative diagnoses of some pathogens may be possible using RDTs available at the point of care or at the district or provincial health office (e.g., cholera, malaria). This should always be followed by definitive/confirmatory laboratory testing, based on current gold-standard methods as well as other appropriate laboratory investigations, to guide the description of the outbreak, the additional investigations and the response (e.g., genomic analyses, antimicrobial resistance testing). Attention must be given to linking the patient's identification numbers/information with the laboratory sample numbers and sending the patient's signs and symptoms to orient the laboratory and allow for analysis of linked epidemiological and laboratory data. Clinicians and patients must be informed of results, and results must be captured in the line list (see Step 4 below).

Where appropriate, undertake initial animal health and environmental investigations and sampling or reach out to get access to results of outbreak investigations from veterinary or environmental health investigators, and review records of routine testing (e.g., water quality monitoring) with the support of these sectors. This may support the confirmation of outbreak, inform which pathogens may need to be considered (which may not be routinely tested for at subnational level laboratories, e.g., Rift Valley fever virus testing), the early identification of exposure sources for immediate control, and the size of the population potentially exposed (see the WHO guide [Environmental health in emergencies and disasters and A tripartite guide to addressing zoonotic diseases in countries](#) ) .

### 12.3.2 Step 2: Implement immediate and generic control measures

As a potential pathogen or source becomes apparent through the investigation, it is critical to put in place immediate and generic control measures while waiting for laboratory confirmation. Immediate control measures are implemented as soon as the suspected routes of transmission are identified. This may happen before the agent is confirmed. Such measures may include the following.

- Implement community engagement and crafting and disseminating public health messages regarding the outbreak or public health emergency. A community feedback mechanism, such as a dialogue with community leaders, should be implemented to receive and respond to feedback about the investigation and the emerging outbreak (72). This will help to initiate the involvement of local populations in all aspects of decision-making and future response.
- Reinforce IPC measures in health facilities, including the use of universal precautions and PPE (e.g., masks, gloves, disinfecting materials).
- If the cause is unknown, isolate patients (or at least limit external contact with the community); identification/information and tracing of contacts of the patient(s) should be considered for containment. Isolation and quarantine should only occur after explicit discussion and consent from the affected communities.
- If waterborne transmission is suspected, apply household or community water treatment.
- If a zoonotic agent is suspected, initiate communication with the animal health sector to investigate animal populations (e.g., an H5N1 influenza outbreak linked with transmission from poultry flocks in the community) (73).
- If vector-borne transmission is suspected, initiate vector investigation and control strategies, and mobilize the community to take appropriate precautions (e.g., use bed nets).
- If an environmental agent is suspected, initiate a specialized investigation to identify the population at-risk and possible preventative and therapeutic measures (e.g., a lead poisoning outbreak associated with gold mining in Nigeria, where free chelation therapy was then made available at local hospitals) (31).

### 12.3.3 Step 3: Develop a case definition for the outbreak

As soon as a suspected outbreak has been confirmed, an outbreak case definition must be agreed upon to enable the rapid identification of cases. An outbreak case definition is either a new case definition (e.g., in case of an emerging disease where the pathogen remains undetermined) or can be a revision of an existing case definition used in surveillance. In contrast to surveillance case definitions, an outbreak case definition is more specific as it includes whether there is an epidemiological link to the current outbreak. The outbreak case definition is not meant to guide clinical decisions for an individual patient; it is for epidemiological purposes to define and count cases in a similar way over time. It should contain three key attributes with simple and clear wording that is easily understood:

- reference to person, place, time and clinical criteria
- reference to laboratory and/or epidemiological criteria applied to increase specificity
- classification of cases as a suspected case, probable case or confirmed case.

Outbreak case definitions can be revised and modified as new information becomes available. For example, at the beginning of an outbreak, a sensitive case definition may be used to ensure that all possible cases are identified, treated and less likely to contribute to community transmission. Once the cause of the outbreak is known, the outbreak case definition may be revised to become more specific. It is important to keep track of when case definitions are changed, and how they have changed, to interpret changes in the epidemic curve. Individual data pertaining to the case definition and the epidemiological classification should be collected to allow for retrospective review of cases.

The outbreak case definition may also be adapted to a simplified, community case definition for CHWs to support a broader and more sensitive community-based surveillance (see [Module 6 paragraph 6.3.2](#) ) .

Existing outbreak case definitions are typically available from the national public health authorities (or equivalent). Alternatively, outbreak case definitions for many epidemic-prone diseases are available from the [WHO Outbreak Toolkit](#)  .

Case investigation forms capture the information necessary to create the outbreak case definition. Table 25 describes key data elements in the case investigation form, and their relationship to the outbreak case definition (see also the [WHO Outbreak Toolkit: Data collection standards](#)  ). Box 19 provides an example of an outbreak case definition, highlighting key attributes.

Table 25. Key data elements of an outbreak case definition and case investigation. Adapted from the *WHO Outbreak Toolkit: initial generic case investigation form* .

Data elements in blue are recommended as core variables by the WHO Outbreak Toolkit Project.

Domain	Data elements	Examples of use in an outbreak case definition
<b>Person:</b> Describes key characteristics that cases may share in common	<ul style="list-style-type: none"> <li>• Unique identifier</li> <li>• First and last name</li> <li>• Age (may be estimated)</li> <li>• Date of birth</li> <li>• Sex at birth</li> <li>• Occupation (and health facility if health worker)</li> </ul>	<p>“children under the age of 5 years”</p> <p>“healthcare workers at clinic X”</p>
<b>Clinical criteria:</b> Simple clinical information directly related to the suspected diagnosis is initially collected. For an exhaustive list of signs and symptoms at presentation, see the <a href="#">initial generic case investigation form</a> 	<ul style="list-style-type: none"> <li>• <b>Inclusion criteria</b> may include symptoms and signs at presentation (e.g., fever) and underlying conditions and comorbidities (e.g., pregnancy, malnutrition, immunodeficiency, chronic disease)</li> <li>• <b>Exclusion criteria</b> may refer to characteristics which suggest a condition, comorbidity or pre-existing disease unrelated to the outbreak case definition</li> </ul>	<p>“shortness of breath and fever”</p> <p>“persons with no previous history of chronic cough or asthma”</p> <p>“menstrual haemorrhage” in women</p>
<b>Place:</b> Specific geographical location associated with the outbreak	<ul style="list-style-type: none"> <li>• Location of current residence (e.g., address, administrative level, camp and/or GPS coordinates)</li> <li>• Health facility location</li> </ul>	<p>“resident of Camp Y or District X”</p>
<b>Time:</b> Time period of events experienced by cases under investigation	<ul style="list-style-type: none"> <li>• Date of onset of the first signs or symptoms/illness onset</li> <li>• Date of presentation to health facility</li> <li>• Date of hospitalization</li> <li>• Date of disease outcome (recovery, death, defaulted/unknown)</li> </ul>	<p>“date of symptom onset between 4 May and 31 August 2018”</p>

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Domain	Data elements	Examples of use in an outbreak case definition
<b>Laboratory information:</b> Confirmatory testing, e.g., culture, serology, PCR, RDT, as applicable for a given disease or syndrome	<ul style="list-style-type: none"> <li>• Specimen collection date</li> <li>• Laboratory test type</li> <li>• Laboratory result</li> </ul>	“culture positive for <i>Vibrio cholerae</i> ”  “PCR positive for <i>Neisseria meningitidis</i> serogroup B”
<b>Exposure history:</b> Types and dates of potential exposures applicable for a given disease or syndrome	<ul style="list-style-type: none"> <li>• Contact with person(s) presenting with similar illness/symptoms</li> <li>• Participation in mass gathering events</li> <li>• Travel outside of residential areas</li> <li>• Visit to a traditional healer</li> <li>• Contact with or ingestion of sick or dead animals</li> <li>• Other exposure as relevant</li> </ul>	“household contact of a confirmed case of COVID-19”



**Box 19.**  
**Outbreak case definition for a confirmed diphtheria outbreak among Rohingya refugees, Bangladesh (74)**

**Suspected case:** Camp resident living in areas of Ukhia or Teknaf with an illness of upper respiratory tract with pharyngitis, nasopharyngitis, tonsillitis or laryngitis; and adherent pseudomembrane of the pharynx, tonsils, larynx and/or nose with symptom onset since 8 November 2017.

**Confirmed case:** a suspected case with:

- positive polymerase chain reaction (PCR) result for toxin gene; or
- epidemiological link (i.e., intimate respiratory or physical contact within the 14 days prior to onset of sore throat) with a laboratory-confirmed case.

Once defined, the outbreak case definitions should be disseminated widely to all partners through inclusion of definitions in SOPs, case investigation forms and weekly epidemiological reports. In addition, the outbreak case definition may be disseminated in a letter/other communication to health workers and during training – alerting them to the existence of an outbreak, providing guidance on case presentations and instructions for case reporting and management mechanisms (see [Module 6 paragraph 6.3.2](#) for more details on case definitions).

### 12.3.4 Step 4: Systematically find cases and contacts

#### 12.3.4.1 Enhance surveillance through passive and active case-finding

Cases detected through IBS, EBS early warning signals and initial outbreak investigation steps may represent only a small proportion of the total number of cases in the community. Outbreak investigators

must therefore enhance surveillance activities through passive and active case-finding to determine the true magnitude and geographical scope of the outbreak and populations affected.

**Passive case-finding** describes the voluntary presentation of patients to health practitioners and facilities after developing signs or symptoms of a disease or other public health event and subsequent detection and reporting by the health professionals; there is no active search for cases. Actions to enhance passive case-finding may include the following.

- Notify local health practitioners and facilities (e.g., clinics, hospitals, laboratories, traditional healers) in the affected and neighbouring areas to raise awareness of the occurrence of an outbreak; raise their index of suspicion; share outbreak case definitions and case reporting tools; and inform of actions necessary to report and manage cases and to prevent exposure.
- Enhance surveillance through existing EWAR sites, which may include, for example:
  - increasing the frequency of reporting from weekly to daily;
  - introducing case line listing in addition to aggregate reporting at EWAR sites; or change from aggregate reporting to case line lists for cases; and/or
  - prompting additional investigations and sample collection from all (or a subset of cases) that meet the suspected outbreak case definition (i.e., establishing sentinel surveillance).
- Alert the public directly, through local and social media and community consultations, to raise awareness, prompt more suspected cases to present to health facilities, and to take precautionary measures to prevent exposure.

As the goal is to detect cases in the community as quickly as possible to facilitate case management and to reduce community transmission, passive surveillance at health facilities may be insufficient. This may be because health facilities are underused (e.g., due to insufficient human resources and stocks); they may not cover all affected communities (accessibility challenges); infected persons may delay or avoid seeking timely care from health facilities; and/or health facilities may not effectively detect and report cases due to a variety of reasons.

During an outbreak, enhanced passive surveillance activities should be complemented by active surveillance wherever possible and appropriate. **Active case-finding** describes the systematic search for cases in communities or groups who are considered as having been exposed during an outbreak. Active case-finding is commonly performed through CBS. A pre-existing network of CHWs/CHVs or other existing community-based networks (e.g., via the national Red Cross society, polio vaccinators, outreach workers) are rapidly trained in the outbreak case definitions (or a simplified community case definition); they are also familiarized with methods to systematically conduct household visits and/or rumour surveillance in a small area where persons are thought to be at risk of infection. The main aim is to detect suspected cases in the community that have not yet presented to health facilities and, where appropriate, refer cases to care. These cases can be reported through health facility-based IBS, or directly to EWAR through EBS of suspected clusters. The risk of double-counting cases should be minimized by checking for duplicate reports from multiple sources. CBS can be “activated” or scaled-up during outbreaks. General training on active case-finding and reporting is done in the preparedness phase; it is activated and aligned with the outbreak case definition when a suspected outbreak is declared.

**Systematically contacting health facilities, traditional practitioners, schools, workplaces and other sites** are other forms of active case-finding. Calling/visiting health facilities provides an opportunity to reinforce passive IBS systems and training; to detect outbreak cases that may have otherwise been missed through **rapid record reviews** or rounds (e.g., to find cases admitted to non-

outbreak wards, due to other conditions, or that presented prior to the declaration); and to investigate/prevent potential nosocomial transmission.

Cases at community and health facility levels may also be identified during **contact tracing** activities.

The strategy for case-finding should be agreed upon rapidly at the onset of an outbreak. Other methods for active case-finding and the factors to take into consideration when deciding on the case-finding strategy are shown in Table 26. Regardless of the methods used, passive case-finding should continue to be reinforced during an outbreak to support the detection of new suspected cases.



Table 26. Comparison of methods for active case-finding

Method	Rationale	Challenges	Use case examples
<b>Health facility-based.</b> To consider where access to health care is reasonably high (e.g., in camp-based settings, settings with high levels of health-seeking behaviour).			
<b>Daily phone calls</b> to health facilities across the geographical areas covered by EWAR	To increase the vigilance and adherence by health workers	Time and labour-intensive  Relies on availability of phones and network in health facilities	At the start of a cholera outbreak to prospectively assess whether any cases have occurred in areas not yet known to be affected
<b>Rapid retrospective review</b> of patient registers in health facilities in areas known or suspected to be affected	To identify patients who have met the outbreak case definitions but have not been detected by surveillance	Time and labour-intensive  Registers may not contain sufficient information to identify suspected cases	At the start of an EVD outbreak to retrospectively assess whether any cases have occurred in areas not yet known to be affected
<b>Daily collection of data</b> from new treatment centres set up for case management	To identify cases managed in treatment units (e.g., during EVD outbreaks)	Need to assure reporting practices (both the type of data and methods/channels of reporting) are harmonized with the surveillance system	For all diseases with dedicated treatment units: cholera, EVD, hepatitis E, yellow fever, diphtheria
<b>Systematic screening</b> of patients presenting to existing health facilities	To comprehensively identify suspected cases presenting to facility for referral for treatment  To prevent nosocomial transmission	Risk of double counting for health facilities and treatment units (requires good referral)  Logistically intensive for health workers and structures	Cholera, EVD, hepatitis E, plague, yellow fever, COVID-19



Method	Rationale	Challenges	Use case examples
<b>Community-based.</b> To consider where access to health facilities is poor due to a lack of health facilities or remoteness, or where healthcare facilities have been disrupted or are underused.			
<b>Community-based surveillance</b> (e.g., community health workers or volunteers monitoring for rumours and/or conducting house-to-house visits)	To identify cases in a limited geographical area, prior to presentation at a health facility	Time and labour-intensive  May cause concern in the community	Community-based surveillance network set up through an integrated community case management programme during an outbreak
<b>Contact tracing</b>	To identify cases prior to presentation at a health facility, provide prophylaxis and early referral, and interrupt chains of transmission	Logistically intensive, requiring dedicated team(s)  May not be practical in large outbreaks	VHFs (e.g., EVD, Marburg), diphtheria, meningococcal disease, measles

#### 12.4.2 Collecting individual data using standardized case investigation forms and a line list

A case investigation form is used to collect data on cases during an outbreak investigation. It should include the variables required to verify if the outbreak case definition has been met. Table 25 (above) describes the minimum variables required for the case investigation. These should be further expanded and adapted, depending on the type of disease or event being investigated. Standardized case investigation forms for many diseases, as well as detailed descriptions of minimum data requirements, are available in the [WHO Outbreak Toolkit](#) .

Cases identified during an outbreak investigation should also be systematically recorded and managed in a standardized line list. A line list collects the basic details about each case associated with an outbreak to support descriptive epidemiological analyses and situational awareness throughout the outbreak. This should include assigning a unique ID to each listed individual to enable linkage with confidential patient data (e.g., names stored separately), laboratory data and other databases created during an investigation (e.g., contact lists).

Data on cases in an outbreak can be collected using paper-based forms or electronic data collection tools disseminated to reporting sites. Data should preferably be entered into an electronic database at the earliest possible opportunity to ensure data analysis is done as quickly as possible, data quality is high and missing data are addressed early. As more personal and potentially identifying data are collected, protecting data and the confidentiality of case information is critical (see [Module 10 paragraph 10.3](#) .

Line list records may include both cases and other individuals investigated as suspected/probable cases but subsequently excluded. Case classifications should be captured for each record according to the outbreak case definitions (e.g., suspected case, probable case, confirmed case, non-case). Note that, while all cases should preferably be line listed, not all cases that are line listed necessarily need to be investigated (see examples in Box 20).



**Box 20.**  
**Examples of use of case investigation forms**

In a **cholera** outbreak, a case investigation form may be used to investigate initial cases or clusters. However, it may not be necessary to continue to investigate all cases once transmission is confirmed in an area and the modes and risk factors are well understood.

In **Ebola virus disease**, all cases must be fully investigated using a case investigation form so that the links to existing cases can be fully documented and understood for each individual case, and the spread of the outbreak known.

However, in both these examples, **all cases must be line listed** using a smaller subset of variables compared to the detailed case investigation form.

12.3.5 Step 6: Conduct descriptive epidemiological analyses

Descriptive data from the outbreak can reveal critical information about the groups at risk of infection; hypotheses for the specific agent; source of infection and mode of transmission. Line listed data should be analysed based on the principles of descriptive epidemiology to define the burden of the outbreak by person (who are the cases?), place (where do cases live?) and time (when did the cases occur?) (Fig. 14).

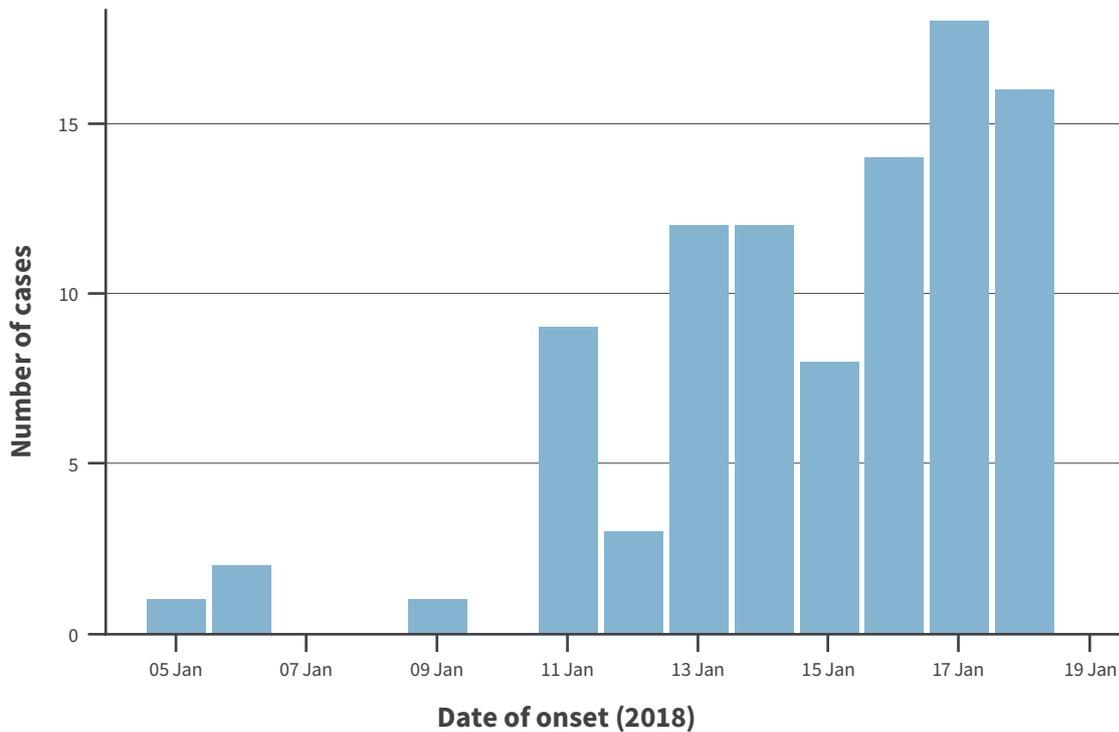
Fig. 14. Descriptive analysis of outbreak data and hypothesis generation



### 12.3.5.1 Analysis by time

Surveillance data produced by IBS (e.g., cases, incidence rate, deaths) can be plotted over time to form an **epidemic curve**. Epidemic curves are the main visual tool to establish the distribution of the number of cases over time (example in Fig. 15).

Fig. 15. Example of an epidemic curve – Suspected and confirmed cholera cases reported in Nambutu in January 2018



The date of symptom onset should preferably be used. However, some cases may not recall the exact date of onset or it may not be possible to systematically record onset for all cases (e.g., died prior to detection). In the absence of this, proxies can be used (e.g., date of presentation to a health facility, date of hospitalization, date of specimen collection). Alternatively, the date of symptom onset can be inferred from the distribution of known delays between onset and presentations in a subset of cases. If this method is used, it should be applied consistently.

Observe the shape of the epidemic curve (3, 4). This pattern may indicate when the outbreak began; potential sources (e.g., point source, continuous common source, propagated/progressive source); how quickly the disease is spreading; the stage of the outbreak (start, middle or end phase) and whether control efforts appear to be having an impact. Note that care should be taken in interpretation as it is subject to bias due to changes in surveillance (e.g., addition of more reporting sites, better compliance with case definitions, and reporting frequency or availability of laboratory testing); inherent reporting delays (e.g., misleadingly showing a decline in recent days/weeks) could also lead to biased interpretation.

Important dates can be indicated alongside the epidemic curve (e.g., date of the first case reported, changes in surveillance, declaration of the outbreak, the opening of major health facilities, changes in case definitions, availability of laboratory testing, response efforts, changes in response strategies, other important events) (75, 76).

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Module 10 paragraph 10.2.6  outlines additional considerations for the visualization and assessment of time trends.

### 12.3.5.2 Analysis by place

Analyses of outbreak data by place is used to describe the geographic extent of the outbreak, to identify higher risk areas (hotspots) and populations based upon differences in burden between geographical areas. These analyses may also identify patterns/clusters that provide important clues about the source of exposure or agent when unknown.

Analyses may include simple either tabulations or graphical representations of cases by administrative areas, or mapping cases by location or places of exposure. [Module 10 paragraph 10.2.8](#)  provides details on steps for creating maps, including the selection of map types, data and software needs, and considerations for interpretation. Note that mapping does not have to be complicated; it can be done using pen and paper.

When case location data are collected at a sufficiently granular level, spot/dot maps can be particularly useful in outbreaks during early stages when confined to a single geographical area; when outbreaks are suspected to be linked to a point source (e.g., contaminated sanitation facilities in a camp); or when occurring in an area/facility that is not well defined by traditional administrative boundary data (e.g., an outbreak in a health centre or camp). Including other geographic variables or points of interest that might be associated with the causal agent (e.g., rivers, water sources, vector breeding sites) may also provide useful insights. Note that the collection of addresses and GPS information on cases, and presentation of these data in spot maps can be highly sensitive. Use of such maps, therefore, should be limited to situations when they will aid control efforts (e.g., for a ring vaccination effort, where potential contacts need to be identified) and for the identification of sources; they should generally not be disseminated widely or publicly published.

A proportional symbol map could be appropriate to show the distribution of cases and deaths. In this type of map the symbol's size varies in proportion to the quantity it represents. A choropleth map is favoured to represent health indicators such as morbidity and mortality (see example in [Module 10 paragraph 10.2.8](#) , Fig. 12). Wherever possible, area-specific rates should be presented to account for difference in underlying population.

Note that the apparent absence of cases on a section of the map may not represent the reality of transmission; it may instead indicate poor reporting. Identifying these gaps will be useful as they may be checked against reporting activities and, where necessary, further enhance case-finding in this area.

### 12.3.5.3 Analysis by person

This analysis describes a potential high-risk demographic and other group(s) that could be targeted for intervention. An initial description of cases by age and sex will provide useful information to draw hypotheses with regard to outbreak dynamics. In addition, describing characteristics of individuals who died from the disease will help to target initial activities to reduce mortality. The following are example analyses by persons' characteristics:

- proportion of hepatitis E cases among pregnant women (as they are at high-risk of maternal and foetal death);
- proportion of unvaccinated cases among measles cases among children <5 years or recent refugee arrivals to a camp;

- proportion of persons reporting use of non-treated water sources;
- proportion of cases hospitalized or with severe morbidity or complications; and
- consider if demographic characteristics may be associated with transmission (e.g., healthcare-associated Ebola infections in children (77)).

Using the line list data, key epidemiological indicators should be calculated and represented in charts to reflect disease burden over time (see Table 27 and [Module 10 paragraph 10.2.5](#) ).



Table 27. Key epidemiological indicators used during outbreaks

Indicator	Definition	Numerator	Denominator
<b>Disease burden indicators</b>			
<b>Attack rate (AR)</b>	The proportion of an at-risk population <sup>#</sup> that has contracted a disease during a given time interval. Often presented as a rate (x 10 <sup>n</sup> e.g., per 100 000 population).	Number of new cases during a given time interval	Total at-risk population at the start of the time interval
<b>Incidence rate (IR)</b>	The proportion of an at-risk population <sup>#</sup> that contract a disease during a given time interval. Often presented as a rate (x 10 <sup>n</sup> e.g., per 100 000 population).	Number of new cases during a given time interval	Average population during time interval
<b>Age/sex-specific attack rate</b>	The proportion of an age/sex-specific at-risk population <sup>#</sup> that contracts a disease during a specified time interval. Often presented as a rate (x 10 <sup>n</sup> e.g., per 100 000 population). Similarly, attack rates may be calculated for other defined subpopulations/groups.	Number of new cases in a specific age or sex group during a specified time interval	Age/sex-specific at-risk population at the start of the time interval
<b>Unadjusted/ simple case fatality ratio (CFR)</b> <b>Adjusted CFRs</b>	The proportion of cases* who died due to a specific condition during a specified time interval. Often presented as a percentage or proportion per 100 cases. Adjusted CFRs partly control for inherent reporting biases by limiting to cases with a known outcome.	Number of deaths from a specific condition among reported cases during a specified time interval	$CFR_{unadjusted} = \text{Total cases reported during the same time interval}$  $CFR_{adjusted} = \text{Cases with a known outcome (deceased and recovered persons) reported during the same time interval}$

During early phase of an emergency

Indicator	Definition	Numerator	Denominator
<b>Examples of control indicators</b>			
<b>Proportion of cases vaccinated</b>	Proportion of partially or fully vaccinated persons among cases*, calculated to monitor and highlight areas of under-vaccination (or vaccine failure) among different groups for further investigation. Often presented as a percentage or proportion per 100 cases. Note, vaccination status must be well defined and systematically recorded, and consider factors such as time for a vaccine to confer protection, doses, waning when calculating and interpreting.	Number of new cases who were fully (or partially) vaccinated at the time of illness onset during a specified time interval (frequently excluding cases recently vaccinated)	Total cases reported during the same time interval
<b>Secondary attack rate (SAR)</b>	Proportion of incident cases* among contacts, calculated to monitor the rate of transmission among close contacts. Often presented as a percentage or proportion per 100 contacts.	Number of new cases among contacts during a specified time interval	Total number of contacts identified in the same time interval

- # An at-risk population is the total number of persons in a defined area who are susceptible to contracting a disease at the start of the observation period, which (wherever possible) excludes groups who are immune or otherwise not susceptible to the same condition. Total estimated resident populations may be substituted where number of non-susceptible individuals is unknown/negligible.
- \* Cases include individuals who meet the outbreak case definitions. May include all cases or limited to a subset (e.g., confirmed, probable suspected or a combination thereof) when appropriate for the condition.

#### 12.3.5.4 Integrated Outbreak Analytics (IOA)

In interpreting the findings, the principles of IOA should be used.

IOA proposes that the analysis and interpretation go beyond time, place and person to incorporate contextual, political, socioeconomic and sociocultural factors that can explain the trends in indicators, risk factors and populations at-risk that have been found in the outbreak investigation (42).

Any available quantitative and qualitative data on healthcare accessibility, availability and status; health programmes such as preventative measures; local context such as recent political, environmental and economic events; and social and community dynamics should be analysed in an integrated way.

Examples from the systematic application of IOA can be found for COVID-19, Ebola and plague in the Democratic Republic of the Congo (42, 62, 64, 65, 67, 68, 78).

#### 12.3.6 Steps 7 and 8: Develop and test hypotheses, and update the case definition

In many outbreaks, descriptive epidemiology highlights who is at-risk and where transmission is occurring, and confirmation by laboratory or epidemiologic investigation is sufficient to mount agent-specific response measures for the group(s) at risk of infection or severe morbidity. For example, during an outbreak of hepatitis E in a refugee camp in Darfur, Sudan, control measures, including the

construction of new latrines and soap distribution, were scaled to the population at-risk as soon as the pathogen was confirmed through laboratory testing (79).

In other outbreaks, descriptive epidemiology highlights various working hypotheses about the agent, exposure source, risk factors or the effectiveness of control measures. For example, in a camp context, persons in a specific block of a refugee camp appear more likely to have become ill with AWD, and they all use a specific block of latrines. Or, recent arrivals to the camp, particularly children <15 years who are likely unvaccinated for measles, appear at risk of infection (80).

These hypotheses require further investigations, which may include epidemiological and social science studies, further laboratory investigations and environmental sampling (see the WHO guide *Environmental health in emergencies and disasters* (81)). In some scenarios, better ascertainment of the exposure (e.g., sanitation blocks, food eaten) and/or the effectiveness of control measures need further investigation among a subset of cases to benefit control measures. This could include the evaluation of hypotheses using epidemiological studies (e.g., case-control studies, cohort studies) but also social science studies (e.g., knowledge, attitude and practices studies, health-seeking behaviour studies). Hypotheses can be formulated and reconsidered over time as new information on incident cases is gathered. The data and the working hypothesis should be reassessed frequently to figure out the most probable exposure and source for the outbreak.

Likewise, outbreak case definitions should be revised based on descriptive epidemiology and further studies to improve the efficiency and accuracy of case-finding and case classification.

### 12.3.7 Step 9: Implement agent-specific control measures

See [Module 11](#) (82) for information on agent-specific control measures.

### 12.3.8 Step 10: Develop public health messages with affected communities and response actors

Crafting public health messages with the communities, the national public health authorities (or its equivalent) and other response partners about the outbreak, and effectively communicating those messages to the communities in easy-to-understand terms and local languages, are key to controlling outbreaks. Messaging should emphasize:

- awareness about the outbreak – where it is taking place, groups at higher risk (e.g., pregnant women during a hepatitis E outbreak), exposure sources and other risk factors;
- steps to prevent exposure/infection (e.g., use of safe water and sanitation); and
- actions to take and resources available if exposure/infection is suspected (e.g., prompting health-seeking behaviour, availability of prophylaxis and treatment, quarantine/isolation precautions).

When developing these messages, careful attention should be brought to the following (see [RCCE Global Strategy](#) (83) by the [Collective Service](#) (84)).

- Where will the messages be disseminated? Are these sources trusted by the communities?
- Is this channel contextually appropriate?
- Does the message convey a sense of self-efficacy?

In addition, profusion of information, including false or misleading information, should also be actively sought and fought against using evidence-based analytics and approaches (see [Infodemic](#) )

### 12.3.9 Step 11: Communicate findings

A general outline for producing reports and communicating findings is given in [Module 15](#) .



# 13

## Training and supervision

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# 13. Training and supervision

All persons involved in EWAR at all levels work towards the common goal of early detection and response. A plan for structured training and supportive supervision is essential to ensure EWAR meets its expected aims and objectives, and that challenges and bottlenecks are identified and corrected as soon as possible. High quality training and supportive supervision will additionally contribute to the motivation and retention of staff working on EWAR.

“A plan for structured training and supportive supervision is essential to ensure EWAR meets its expected aims and objectives, and that challenges and bottlenecks are identified and corrected as soon as possible.”

Training and supportive supervision should be a continuous and integral part of EWAR implementation (as opposed to a one-off effort), and should be periodically scheduled as part of the EWAR SOPs. Supervision is closely linked with the ongoing monitoring of EWAR activities (e.g., monitoring of completeness of reporting from health facilities).



## 13.1 Train those involved in EWAR implementation

EWAR training is not a case of simply leaving materials and job-aids with health facilities. It requires a comprehensive introduction of the EWAR team and the EWAR system, roles and responsibilities, SOPs, continuous supportive supervision and establishment of a feedback loop.

Prior to EWAR implementation, train all of those involved, including health facility staff, community volunteers and data managers, on how to fulfil their roles and responsibilities. Training is based on context-specific SOPs and includes structured training and supervision plans. Where possible, it may also include simulation exercises, as they allow for the consolidation of roles and responsibilities, testing the SOPs, identification of gaps, and a better understanding of the system in which EWAR operates. In settings with large numbers of staff involved in EWAR implementation, a train-the-trainers approach could be considered, in which the training could follow a cascade model. For those involved in supportive supervision, specific training should be organized with its objectives and methods.

In addition to the initial training, regular refresher training should be organized to ensure that knowledge and practice is up-to-date, as well as to provide a platform for staff working at all levels to discuss observations and challenges and to ask questions.

Training plans and methods need to be sensitive to potentially volatile situations. In case of low security, different modes of training delivery should be considered (including remote, online-based training), and the training plan should be kept flexible but consistent. The development of job-aids should be prioritized over in-person visits, in case continuous training has to be delivered remotely by telephone or internet.

### 13.1.1 Training participants

Participants in formal training should include EWAR focal points, NGO health coordinators and reporting units. It is important to start with EWAR focal points, who should assist with the training of lower levels to ensure rapid scaling-up and conclusion of training.

Formal training is not recommended for all community members – it is not feasible. However, selected key community informants may be included in training for EWAR focal points and NGO health coordinators.

### 13.1.2 Training schedule

Priorities for the training schedule should be established; a phased approach may be adopted.

- Phase 1. The EWAR implementation team trains provincial focal points and NGO health coordinators.
- Phase 2. Provincial focal points, supported by the EWAR implementation team, train district EWAR focal points.
- Phase 3. Provincial and district focal points train reporting-unit staff for scaling-up within one week, to ensure that all reporting units start reporting by the end of the training week. In each reporting unit, at least the medical staff in charge of completing the surveillance forms should be trained.
- Phase 4. Provincial and district focal points train relevant community leaders and partners.

Continuing on-the-job training should start as soon as the EWAR becomes operational. This is particularly useful in an emergency context, where turnover of trained health workers tends to be high. Opportunities for on-the-job training include scheduled staff meetings for EWAR focal points and NGO health coordinators, and supervision and monitoring visits to health facilities and the affected community. Health workers directly involved in care delivery should also be encouraged to share relevant health messages, including the need to report unusual health events in the community (e.g., several members of a family coming down with the same disease, or a cluster of deaths in a single neighbourhood).

### 13.1.3 Training materials

Standard EWAR training modules should be developed and adapted to address key functions of each reporting level (from community or health facility to central coordination level).

The training module for EWAR focal points and NGO health coordinators should include both theoretical and practical elements, including:

- risk factors for various diseases in the environment and among the affected population
- characteristics of pathogens causing disease in the area covered by the EWAR
- methodology for investigating an outbreak
- management of alerts and response
- common epidemiological analytical outputs
- communication and dissemination of EWAR information
- emphasis on the role of these people in supervision, monitoring and on-site refresher training.

The training module for reporting units should have more hands-on, practical content, including:

- how to keep proper records in a register
- how to tally the relevant data from the register
- how to complete and transmit the EWAR weekly reporting form
- how signals should be reported and what details should be shared
- application and enforcement of case definitions, and alert thresholds
- adequate sample collection and referral pathways.

The community education module should focus on the following points.

- community awareness and knowledge of priority diseases;
- potential sources of community information for informal signals – pharmacists, schoolteachers, private clinics, village leaders, religious leaders, traditional healers, trained birth attendants or other community health workers; and
- where and how to report unusual health events – for example, by phone or text message to the hotlines, or verbally to the nearest health facility or CHW.



## 13.2 Conduct supportive supervision visits

**Supportive supervision** is a process of helping staff to improve their own work performance continuously (70). It encourages open, two-way communication and building team approaches that facilitate problem-solving. It focuses on monitoring performance towards goals, using data for decision-making, and depends upon regular follow-up with staff to ensure that new tasks are being implemented correctly. It is carried

out in a respectful and non-authoritarian way with a focus on using supervisory visits as an opportunity to improve knowledge and skills of health staff. It ensures high-quality performance of the team by identifying potential gaps and knowledge and by providing “on-the-job training”. Lastly, it provides an opportunity for staff to identify critical challenges for EWAR (e.g., low stock of RDTs, poorly functioning mobile network).

Supportive supervision visits are a crucial part of strengthening EWAR performance in areas such as data collection and reporting, and should be used to motivate staff. A structured training and supervision plan (see above) forms the basis of the supervision. It is important that the content of supervision is predictable and consistent for busy health workers; however, the frequency and timing of the visits could be ad hoc or unexpected.

When designing the training and supervision plan, existing supervision structures should be maintained; for example, if there is an existing network of CHWs/CHVs who are supervised by health facility staff, this structure should continue if possible. However, keep in mind that the supervision of EWAR implementation is an added work burden, and that a different supervision structure might have to be designed to ensure the feasibility and quality of the supportive supervision visits.

If supportive supervision visits cannot be conducted in-person (e.g., due to security or other limiting factors), efforts should be made to carry out visits remotely by phone or internet. This could, for example, include sharing the last X number of register pages (without identifiers) to see if data have been reported correctly and completely.

Electronic data collection can also provide opportunities to monitor data quality and provide feedback to staff. For example, dashboards continuously updating results of data completeness and timeliness analysis are particularly useful for users. If this is closely monitored on a central level, electronic data collection tools can be used for the early identification and correction of any data quality issues. This may be especially important in remote programming situations due to insecurity.

Members of the EWAR who are involved in supervision should be trained by the EWAR coordination team to adequately conduct supportive supervision. All supervisors should ensure that the members of the team under their supervision clearly understand their roles and responsibilities according to their specific job description. The EWAR coordination team is responsible for the monitoring of the quality of the supportive supervision.

### 13.2.1 Supportive supervision at health facilities

Typically, the supportive supervision visits at health facilities are organized in a decentralized manner, in which the national public health authorities, NGOs and Health Cluster partners are responsible for conducting supporting supervision at health facilities that they run/support. In addition, epidemiologists and surveillance officers in the EWAR implementation team should conduct regular supportive supervision visits. Each health facility should receive a supportive supervision visit at least once per month and ideally once every two weeks.

The visits should be conducted using a standard supervisory checklist ([Annex 5](#) ) to ensure consistency among all health facilities in the network, including government and NGO-operated facilities. The checklist also serves as a record of the visit and highlights key activities and performance areas to be reviewed (Box 21).

To monitor the quality of the supportive supervision, a 360 degrees assessment tool can be designed and implemented.



**Box 21.**  
**Activities**  
**and areas of**  
**performance**  
**to be included**  
**in supervision**  
**visits**

- Perform spot checks of the OPD register for timeliness and completeness of reporting of alerts and weekly reports.
- Have access to, and use of, standardized forms.
- Ensure availability of the latest version of the digital or paper-based data collection form.
- Assess perceptions of community engagement and acceptability of EWAR.
- Assess knowledge and correct application of case or event definitions and alert thresholds.
- Check availability of medical and laboratory supplies.
- Check proportionate utilization of laboratories to confirm disease outbreaks.
- Give support to the reporting units during such visits, including on-the-job training of new staff or of current staff, based on gaps identified.
- Check the use of alert log, and if all alerts detected by an EWAR system (regardless of the source) are systematically documented.
- Check the functioning of feedback loops from surveillance system to those collecting data at the field-level (e.g., community health workers, surveillance nurses) to inform how collected data is used to inform public health actions.

### 13.2.2 Supportive supervision at the community level

In some settings where there is an existing CHW/CHV structure, health facility staff are already tasked with their supervision. If this structure is already in place, and it is feasible to add the supervision of EWAR implementation by CHWs/CHVs to the workload of the health facility staff, it is the best option to continue with it.

If this is not feasible, a new supervision structure should be considered. This could include the supervision of CHWs/CHVs by a newly recruited cadre, specifically tasked with supportive supervision.

Each worker or volunteer should receive a supportive supervision visit at least once per month if feasible (see [Red Cross Red Crescent Community-based surveillance \[website\]](#)  for further information). The visits should be conducted using a standard supervisory checklist to ensure consistency. The supervision checklist should be developed according to the local context.

# 14

## Monitoring and evaluating EWAR performance

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# 14. Monitoring and evaluating EWAR performance

The consistent monitoring of system performance on a continuous basis is key for assuring that EWAR is working effectively to improve early warning capabilities. Structured evaluations will help key stakeholders understand whether the activities have produced the outcomes/changes that were envisioned initially.

Monitoring and evaluation are closely linked but occur at different times in the programme cycle. **Monitoring** is a continuous activity focusing on outputs, and performed regularly during the EWAR implementation to allow for timely course correction. Those who are responsible for the continuous monitoring of EWAR performance are typically persons who are part of the implementation team.

“Monitoring is a continuous activity focusing on outputs and performed regularly during the EWAR implementation to allow for timely course correction. [...] Evaluation is a periodic activity that has a greater focus on outcomes and impact.”

**Evaluation** is a periodic activity that has a greater focus on outcomes and impact. They may also look more broadly at system issues such as policy, legislation coordination, collaboration, partnerships, funding, workforce, supplies and equipment, community participation and empowerment. Those responsible for the periodic evaluation of EWAR are most often recommended to be persons external to the implementation team to ensure objectivity, but evaluations can also be conducted jointly with members of the implementation team. Evaluations are resource intensive in terms of funding, scope, staff and time. While they should be planned during the design phase of the EWAR, it is not advisable to immediately implement evaluations while EWAR is being set up and becoming functional.

In addition to the monitoring and evaluation described in this chapter, it is crucial that the feedback mechanism of stakeholders is clearly established and communicated; for example, an email address, forum or other means of contact where EWAR stakeholders can provide feedback or ask questions regarding anything related to the EWAR.



# 14.1 Monitoring EWAR performance

EWAR performance at every level – from national to subnational, subnational to health facility, and health facility to community level – must be regularly monitored to ensure that functions are carried out correctly, and to identify any difficulties they may encounter. The monitoring of EWAR should be integrated from the very start; applying performance indicators (Table 28) and frequency and methods for collection should already be explicitly included in the implementation plan and SOPs.

EWAR focal points at all levels must clearly understand how the system will be monitored, what specific activities need to be implemented at each level, and the expected EWAR performance standards and key performance indicators. EWAR focal points should also understand how to assess data quality of collected indicators. If there are any changes to indicators, EWAR focal points should ensure that all reporting sites are aware and make the adaptations.

Monitoring of EWAR is facilitated greatly by the availability of the data itself; for instance, completeness of surveillance reports and consistency and timeliness of weekly reporting from health facilities can be easily assessed, based on the flow of data/available data at health facility level.

Goals or targets may be set for each attribute to help gauge the level of performance. When setting targets, it is important to keep in mind the contextual appropriateness of the targets, and the importance of monitoring trends over time to get an indication of how well the EWAR is doing. Further guidance, including suggested targets, is provided in the WHO [Booklet four of the IDSR technical guidelines](#) and [EWARN in emergencies: evaluation protocol](#).



Table 28. EWAR key monitoring indicators

Attribute	Indicator/element	Frequency	Numerator	Denominator
<b>Completeness</b>	Completeness of reporting	Weekly	Number of reporting sites that reported (including zero reporting) in a given week	Number of reporting sites in EWAR
<b>Timeliness</b>	Percentage of sites submitting reports on time	Weekly	Number of total reporting sites submitting a report in a given week by the stated deadline	Number of total reporting sites submitting a report in a given week before or after the deadline
	Number of EBS signals reported on time	Weekly	Number of new EBS signals reported within a specified timeframe after detection (48 hours)	-
	Proportion of signals verified within 48 hours	Weekly	Number of new signals verified within a specified timeframe (48 hours)	Number of new signals reported in the same week
	Proportion of outbreak investigations initiated within 72 hours after verification	Weekly	Number of outbreak investigations initiated within a specified timeframe (72 hours) after verification	Number of outbreaks verified in the same week
	Number and proportion of suspected outbreaks that were laboratory-confirmed within 72 hours	Monthly	Number of suspected outbreaks that were laboratory confirmed within 72 hours	Number of suspected outbreaks in the same week
	Proportion of events risk assessed and investigated within 48 hours after verification	Monthly	Number of new verified events that are risk assessed and investigated within a specified timeframe (48 hours)	Number of new events verified in the same week
<b>Data quality</b>	Proportion of reporting sites receiving routine supervision visits	Monthly	Number of reporting sites receiving a routine supervision visit in a given month compared to a set threshold	Number of reporting sites

## 14.2 Evaluation of EWAR performance

The periodic evaluation of EWAR should combine quantitative and qualitative methods and ensure meaningful community participation and engagement. More concretely, the evaluation should assess community ownership of the system, and whether communities are empowered with tools, skills and resources to lead community-based public health functions and health service delivery, particularly for vulnerable and hard-to-reach populations.

The evaluation includes the assessment of the surveillance system attributes (Table 29) (81,82). At minimum, the evaluation should address attributes that are of the highest importance in the specific context. The evaluation of each attribute provides evidence on what elements of EWAR are functioning well and what elements could be strengthened.

Table 29. Table key indicators by attribute

Attribute	Indicator
<b>Simplicity</b>	<ul style="list-style-type: none"> <li>• EWAR integration with other systems</li> <li>• Method to collect, manage, enter, analyse and disseminate data</li> <li>• Time spent on maintaining the system</li> <li>• Amount and type of data collected for each priority disease</li> </ul>
<b>Flexibility</b>	<ul style="list-style-type: none"> <li>• Process to add/remove health units/partners</li> <li>• Retrospective review of how system responded to a new demand, such as:               <ul style="list-style-type: none"> <li>• Emerging health events</li> <li>• Changes in case definitions</li> <li>• Variations in funding</li> </ul> </li> </ul>

Attribute	Indicator
<b>Data quality</b>	<ul style="list-style-type: none"> <li>• Quality control practices</li> <li>• Critical discussion of data and reports with partners</li> <li>• Use of standardized tools and forms</li> <li>• Staff who can correctly identify immediately notifiable diseases</li> <li>• Staff who accurately provide case definitions</li> <li>• Staff who accurately provide alert thresholds</li> <li>• Staff who can correctly explain the alert notification procedure</li> <li>• Training:               <ul style="list-style-type: none"> <li>• Current EWAR health facility staff trained in EWAR</li> <li>• New EWAR partners/reporting sources (added within the past six months) trained in EWAR</li> <li>• Length of training courses (initial and refresher)</li> </ul> </li> <li>• Supervision and feedback:               <ul style="list-style-type: none"> <li>• Health facilities which received feedback in the past X period</li> <li>• Health facilities which received supervisory visits in the past X period</li> </ul> </li> <li>• Legibility of forms and registers</li> <li>• Completeness of forms and registers</li> <li>• Application of case definition based on observation (if feasible)</li> <li>• Regularity of reporting sites</li> </ul>
<b>Acceptability</b>	<ul style="list-style-type: none"> <li>• Barriers to reporting</li> <li>• Organization/agency/staff willingness to participate</li> <li>• Perceived strengths and weaknesses of the system</li> <li>• Support and feedback to EWAR staff</li> <li>• Regular meetings to review EWAR (e.g., strengthen practices, discuss progress, feedback)</li> <li>• Responsiveness of the system to suggestions or comments</li> </ul>
<b>Representativeness</b>	<ul style="list-style-type: none"> <li>• Groups or subgroups not covered by or included in the system</li> <li>• Systematic exclusion or barriers to healthcare access</li> </ul>
<b>Stability</b>	<ul style="list-style-type: none"> <li>• Interruptions to reporting and impact on the system</li> <li>• Costs involved to maintain the system</li> <li>• Staff turnover</li> <li>• Uninterrupted weeks with functioning health facilities in the last X period</li> </ul>
<b>Usefulness</b>	<ul style="list-style-type: none"> <li>• Perceived usefulness of EWAR data and bulletins</li> <li>• Public health action (e.g., control measures implemented) based on EWAR data</li> <li>• System's ability to meet its objectives</li> </ul>



Attribute	Indicator
<b>Sensitivity</b>	<ul style="list-style-type: none"> <li>• Of mode of detection</li> <li>• By disease, if feasible</li> </ul>
<b>Predictive value positive</b>	<ul style="list-style-type: none"> <li>• Overall</li> <li>• By disease, if feasible</li> </ul>
<b>Timeliness</b>	<ul style="list-style-type: none"> <li>• Time from signal notification to verification</li> <li>• Time from signal verification to investigation</li> <li>• Time from investigation to receipt of results</li> <li>• Time from verification to implementation of control measures</li> <li>• Sites reporting by the weekly deadline</li> </ul>

For a full list of key indicators for EWAR evaluation, see the WHO [EWARN in emergencies: evaluation protocol](#) .

An evaluation of the communication and dissemination of EWAR information should also be included, capturing the completeness, timeliness and predictability of communications. For example, did stakeholders receive information; did they understand information; how did they use the information; was information disseminated on the same day every week, through a consistent modality; and were changes clearly communicated to target audiences?

In addition, the EWAR evaluation should look at broader system issues, such as having relevant policies, legislations, coordination mechanisms, funding, sufficient workforce and supplies for EWAR set up in emergencies.

### 14.2.1 Timing of evaluation

The timing of periodic EWAR evaluations depends on the context, feasibility and duration of the emergency. The initial evaluation should be done once the EWAR is set up and running. Once recommendations of the first evaluation are incorporated, it is advisable to conduct a second evaluation to assess improvements. If emergency conditions remain relatively stable, with regular monitoring indicating robust functioning of EWAR, subsequent evaluations can be conducted at different intervals depending on feasibility and need. If the underlying emergency conditions are unstable, evaluations should be planned according to the fluctuating situation.

Regardless of type of emergency, an evaluation could be initiated following any significant change to the system, including:

- system stabilization – reporting sites have stabilized;
- system expansion – increasing reporting sites, introducing or enhancing EBS, introducing hotlines, increasing laboratory testing capacity or introduction of RDTs;
- introduction of new reporting tools, formats or new technologies (including digital systems); or
- integration with other surveillance systems or transition to a routine surveillance system.

## 14.2.2 Evaluators

To ensure objectivity, evaluators are recommended to be persons external to the implementation team to ensure objectivity, but evaluations can also be conducted jointly with members of the implementation team.

The number of evaluators may differ depending on the context, scale of implementation and availability. However, at least two evaluators should be involved for all formal evaluations. The following characteristics are desirable in those responsible for the EWAR evaluation.

- They are not directly involved in the implementation of the EWAR system under consideration.
- There is balance in institutional representation; for example, they ensure the participation of the national public health authorities, Health Cluster and/or other response partners. Evaluators can come from different stakeholders including the National Public Health Institute, Health Cluster, WHO, GOARN, NGOs, academic institutions or independent consultants.
- They bring multi-disciplinary skills and expertise. Depending on the scope and type of emergency, the evaluation team may include experts from laboratory, clinical, epidemiological, health system, social and behavioural science, veterinarian and/or WASH backgrounds.
- They have formal training and/or experience in conducting EWAR evaluations following standardized evaluation guidance.
- They are able to speak the local language(s) in order to be able to implement a qualitative data collection component. If the local language is prohibitive to an evaluator joining the team, another option could also be to use local community liaisons.

If a single evaluator conducts the evaluation, it is crucial that the evaluation findings are interpreted by a larger group of representatives of stakeholders involved in EWAR. This ensures that the findings of the evaluation are interpreted in a way that is appropriate and constructive for the specific context, and that identified recommendations are feasible.

## 14.2.3 Methods of evaluation

A standardized tool should be used for the evaluation of EWAR in emergency settings, adapted to the local context if needed. Where applicable, all tools, templates and questionnaires should be translated into the local language as well.

To obtain a thorough understanding of the functioning of the EWAR, identifying an appropriate methodology is key. A combination of quantitative and qualitative methods should be used in a complementary way. For example, the assessment of the sensitivity of the system uses quantitative data, whereas when assessing the acceptability of the EWAR, qualitative methods are more suitable than quantitative methods.

WHO Regional Office for the Eastern Mediterranean (EMRO) and the United States Centers for Disease Control and Prevention (CDC) developed the [Early warning, alert and response network in emergencies: evaluation protocol 2017](#) , which is a standardized emergency-specific tool that can be used for the evaluation of EWAR. This protocol establishes standard practices for evaluating EWAR systems, focusing on common challenges faced by the implementation, operations and termination of EWAR in emergencies, as well as the challenges faced by the evaluation itself. In addition, it provides standard templates and questionnaires for data collection and data analysis matrices linked to indicators, while providing special considerations in conducting remote evaluations where physical access is limited.

## 14.2.4 Dissemination of evaluation findings

Plans for dissemination of findings should be prepared at the time of conceptualizing the evaluation, listing all intended users. Intended users and methods of dissemination of findings depend on the context. Intended users may include:

- Ministry of Health, Agriculture/Forestry and others deemed relevant;
- Those involved in the EWAR implementation (e.g., surveillance stakeholders at community level, healthcare facility level, subnational and national level, national public health authorities, National Institute of Health, NGOs, WHO, Health Cluster, WASH Cluster, Nutrition Cluster and other inter-sector groups);
- stakeholders involved in response activities;
- donors;
- other surveillance stakeholders, also from other sectors where appropriate; and
- the wider community/population under surveillance.

When the evaluation has been finalized, it is recommended to convene a meeting with the intended users as specified above. The meeting should be dedicated to sharing and discussing the findings, identified recommendations and their implementation status in plain and non-technical language. In addition, the evaluation findings can be shared using, for example, summary papers/reports, oral presentations at health sector meetings and formal consultation meetings. These should especially consider different administrative areas beyond the central location.

To ensure a feedback loop to those collecting the data, dissemination efforts should specifically be directed to reporting sites and community-based informants. This may require the development of appropriate dissemination materials that are translated into the local language.

The dissemination of findings does not end the process of evaluation of EWAR. It should set the stage for stakeholders to pledge commitment to implement the evaluation recommendations.

## 14.2.5 Implementation of recommendations

The implementation of recommendations is a crucial step in the evaluation process. A core group should be formed to monitor the implementation of recommendations. An action plan with clear timelines should be made to complete recommended improvements and corrections, and to include omissions.

Some recommendations may require adjustments to process, improvements to capacity building, and information sharing and response, while others may include adopting new ways of working, such as introducing new technologies. Depending on the nature of recommendations, adequate resources should be mobilized to fund system changes.

Following the successful implementation of recommendations, the core group should decide on the next evaluation cycle to capture enhancement-of-system attributes following recommendations.

# 15

## Communication and dissemination of EWAR information

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# 15. Communication and dissemination of EWAR information

Communication refers to the flow of information between stakeholders and includes the dissemination of EWAR results. The functioning of the EWAR depends heavily on the quality, speed and completeness of communication between different actors in the system, and its capacity to report results that truly inform public health actions. This includes ensuring the correct information is communicated in a timely manner between stakeholders, and that it captures all crucial pieces of information needed for action. It is essential to close the communication loops and ensure a flow of information that is multi-directional. Effective communication will contribute to ownership and buy-in from all stakeholders as it will become clear why data are collected and how they are used. EWAR is only as good as the information that is communicated effectively between all partners who contribute to the system.



## 15.1 Principles of communication



Communication in emergencies should be accessible, actionable, credible, relevant, timely and understandable (83). Moreover, the information shared should be rigorous, accurate, concise and science-based. These principles should be considered when setting up or updating communication and dissemination structures for EWAR information.

“Communication in emergencies should be accessible, actionable, credible, relevant, timely and understandable.”

When designing the EWAR, a communication flowchart should be included in the SOPs that clearly indicates designated roles and responsibilities, means of communication for each stakeholder, directions, content and frequency. SOPs are developed based on laws and regulations that control information sharing. The communication flow chart will help identify any gaps in the flow of information. “Closed communication loops” refers to a multi-directional information flow, in which data sources receive feedback on the data collected and how the data were used.

All stakeholders should be included in the multi-directional EWAR communication loops. The list of stakeholders receiving information should be reviewed periodically to ensure new stakeholders are included, as well as to exclude those who are not involved anymore. This should especially consider reporting sites such as health facilities, contributing NGOs, community volunteers and members of communities that participate in the surveillance. It is essential to ensure that all stakeholders are reached and have access to information.

Different means of data dissemination (e.g., via text messages, calls, electronic platforms) should be agreed on in the flow of information plan. Where possible, electronic data collection and dissemination are preferred over paper-based to save resources and allow for more timely data dissemination. Means of communication must be appropriate to the context. Considerations include ensuring translation of reports in local languages, the level of literacy (reading/writing and technology literacy) of different stakeholders, and the availability of phone and internet networks.

All communications (and especially public communications) should be approved and led by local health authorities as the owners of EWAR data, and be developed in collaboration with community members. Throughout the data and information dissemination process, it is crucial to maintain data confidentiality and avoid sharing sensitive information unless strictly necessary. When possible, information shared with other stakeholders should be anonymized.

Communication and dissemination of EWAR should be routinely monitored and evaluated along with other components of the system (see [Module 14](#) )

The [WHO strategic framework for effective communications](#) ) provides further information on these principles.



## 15.2 Dissemination plan

To ensure structured and clear dissemination of EWAR information, a dissemination plan should be developed during the design phase of the EWAR (see example in Table 30). Establishing and communicating the dissemination plan to all stakeholders is important to ensure the predictability of information dissemination, so that all stakeholders know when and how they may expect feedback, and what information will be included. To reach all stakeholders, different means may need to be used. When drafting the dissemination plan, the team should develop a template that contributes the minimal and appropriate information necessary to guide public health actions.

The dissemination plan usually changes over time, and a phased approach is often taken. For example, typically at the onset of an emergency and rapid establishment of the EWAR, existing/simpler dissemination channels could be used, and these may progressively be complemented/replaced by more detailed information products or a dashboard. For example, a phased approach may include doing the following.

1. Identify existing means of communication and dissemination (even if verbally or on paper).
2. Develop an information product that periodically captures the information to be disseminated.
3. Modify the periodicity to better suit the audience needs.
4. If the event is ongoing and resources allow, develop a dashboard to improve timeliness.



Table 30. Example of a dissemination plan for EWAR data

Who: Stakeholders	What: Info. to be disseminated	How: Methods of disseminating	When: Frequency of dissemination
Government (e.g., all relevant branches of the national public health authorities, one health authority)	Frequencies, indicators, maps	<ul style="list-style-type: none"> <li>Epidemiological bulletin</li> <li>Dashboard</li> <li>Presentations</li> </ul>	Weekly
Partners (e.g., multi-lateral agencies/UN/NGO, Health and WASH Clusters participating in the emergency response)	Frequencies, indicators, maps	<ul style="list-style-type: none"> <li>Epidemiological bulletin</li> <li>Dashboard</li> <li>Dedicated time for presentations (2–3 slides) at weekly Health and WASH Cluster meetings</li> </ul>	Weekly
Healthcare providers (e.g., health facilities, laboratories)	Frequencies, indicators, maps	<ul style="list-style-type: none"> <li>Report for health facilities including key indicators</li> <li>Dashboard</li> </ul>	Weekly
Community	Frequencies, indicators, maps	<ul style="list-style-type: none"> <li>Flyers/posters</li> <li>Group sessions (verbally sharing surveillance findings)</li> <li>Social media accounts</li> </ul>	Weekly

Cross-functional actions

### 15.2.1 Epidemiological bulletins/updates

The most traditional way of sharing EWAR data is through an epidemiological bulletin. As set out in [Module 10 paragraph 10.2.9](#)  Table 24, the epidemiological bulletin typically includes information on the time, place and person aspects of events, alerts and any ongoing outbreaks or other acute emergencies. In addition to numbers, proportions, indicators and maps, the epidemiological bulletin can include interpretations of the data and recommendations for action. Usually, the epidemiological bulletin is compiled weekly.

Consideration must be given to the means of disseminating the bulletin and the target audience. EWAR bulletins may be published online or disseminated internally among response teams and partners (e.g., via email, instant messenger groups). Caution should be used when including potentially sensitive information in bulletins, as these may be readily forwarded outside the immediate response team.

## 15.2.2 Dashboards

Increasingly, dashboards are developed that can provide near real-time data on public health hazards under surveillance in specific settings. Key advantages of dashboards are that they allow for automation and timely information sharing, especially when electronic data collection tools are used that may directly feed into a dashboard. A shortened delay between the collection and dissemination of data through a dashboard can facilitate rapid response to public health hazards. To aid interpretation, it is important to highlight when the data was last updated.

Dashboards can be set up to require a password to access or can be freely accessible to all internet users. The accessibility of the dashboard is usually decided based on the sensitivity of the data that are shown.

Dashboards may also incorporate automated analysis using predefined thresholds and may trigger a signal when thresholds are crossed. To get maximum benefit, it is important to consider integrating interpretations into the dashboard itself where possible. The dashboard should also be complemented by other products (e.g., an epidemiological bulletin) to facilitate accurate interpretation of the data.

## 15.2.3 Flyers/posters

Flyers or posters may be used to facilitate open communication with the wider community; however, they should never be the sole means of community engagement. For example, flyers and posters could be put on the walls of the waiting areas of health facilities that are included in the EWAR. These could include key messages about the EWAR system itself, important findings or awareness about current outbreaks/acute emergencies, and any preventative actions that the community can take.

When designing the flyer or poster, it is important to keep in mind the level of literacy and preferred language of the stakeholders, and to involve members of the community. It is further recommended to limit the content of the flyers and posters to simplified messages and figures, preferably in colour so that they are attractive to read. However, there are challenges with keeping paper-based flyers and posters up-to-date with the most recent EWAR information, which may make this a less appropriate modality of timely dissemination.

## 15.2.4 Presentations/group sessions

Dedicated sessions should be established with response teams, local government and partners to present and provide interpretation of key EWAR findings. This may include short updates (e.g., two to three slides) for routine updates at incident management or cluster meetings, and more in-depth analysis of any current major events, alerts and outbreaks/other acute emergencies.

Depending on the context and literacy of community stakeholders, some settings may benefit from verbally sharing surveillance findings (e.g., clinicians and managers at health centres, community stakeholders). This could be done in an efficient way by adding messages on surveillance and response data to existing infrastructures. For example, if there already is a surveillance mechanism in place for community volunteers or health promotion workers, they could be trained to also lead meetings with community members to share surveillance findings and prompt actions.

### 15.2.5 Media briefings and social media

Media briefings may be used to rapidly raise wider public attention to acute issues and provide general updates on an evolving situation.

Social media accounts (preferably institutional accounts) can be used to share existing EWAR materials (e.g., epidemiological bulletins or situational reports) and key messages with the wider public. Attention should be given to specifically design or adapt content for the intended social media platform.

### 15.2.6 Scientific publications

Scientific publications (e.g., in peer-reviewed journals) should be encouraged, facilitated and included in the EWAR communications plan. These may be published, for example, periodically throughout an emergency, following an evaluation or change in activity (e.g., an evaluation or a switch to a new reporting system), after a significant outbreak/other acute emergency or following the emergency/once the EWAR system has transitioned to a routine system. These help to document the type of system established, epidemiological findings, how the system performed in this context and any lessons identified. These publications greatly benefit public health actors globally, and enable continuous improvement of EWAR guidance, systems and tools.



# 16

## Transition strategy

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# 16. Transition strategy

When the emergency is over or when moving into the recovery and development phase, priorities may expand – from detecting disease outbreaks through the emergency EWAR to implementing a more nuanced surveillance system.

Emergency EWAR should not continue to operate independently from the routine surveillance system once an emergency stabilizes, but its activities should be integrated with the routine district, provincial or national surveillance system. A transition strategy must be developed with the aim to increase country capacity for EWAR and ultimately contribute to sustainable surveillance mechanisms. The transition of EWAR is a key component to ensure that there are no health surveillance and response gaps between the emergency phase and the recovery/development phase.

This chapter provides some key considerations when developing an EWAR transition strategy. It should be noted that transition strategies are context-dependent in terms of their content, timing and criteria that trigger the transition. In some settings, new routine surveillance will have to be established. In other contexts, there may be a region or district with existing routine surveillance in areas that have not been affected by the emergency. Transition strategies also depend on adequate funding, including from external sources, and on adequate human resources to continuously support the district or national surveillance system.

“Emergency EWAR should not continue to operate independently from the routine surveillance system once an emergency stabilizes, but its activities should be integrated with the routine district, provincial or national surveillance system.”

The national public health authorities are the ultimate decision-maker in transition plans. Below are different transition scenarios set out; however, there are many others imaginable, depending on the context and local preferences.

**If the routine surveillance pre-emergency is sufficiently functional** (per the guidance in [Modules 2](#) and [3](#)), and the country is able to restart the routine surveillance after the emergency ends, ensure that the government system has the capacity/strategy in place to absorb surveillance coverage for the affected populations that were previously covered by the emergency EWAR. If the affected populations are internally displaced persons or refugees, discuss and agree on the country’s strategy for incorporating these populations in their ensuing routine surveillance. Recommendations on how to improve their current system can also be included here.

**If the routine surveillance pre-emergency is weak/not functional**, then detailed recommendations on how to improve the current routine surveillance system should be established. Recommendations surrounding surveillance standards outlined in [Modules 2](#) and [3](#) may support this task. In addition, detailed recommendations on the operational aspects of implementation, with proposed timelines, resource and other technical requirements, provide decision-makers with a clearer picture of what is needed to successfully transition the system.



## 16.1 Elements of a transition strategy

A transition strategy needs to be addressed in the initial emergency EWAR proposal, work plan and projected budget. Moreover, the transition strategy should:

- specify what conditions and their thresholds need to be met for transition
- specify timelines, budget and human resources planning
- minimize duplication of activities between emergency EWAR and the national surveillance system
- allocate roles and responsibilities of stakeholders
- outline multiple scenarios for transition.

The following elements of the transition should be the minimum covered.

- Who? Those responsible for strategy design, initiation and implementation.
- What? Specific surveillance systems, processes, diseases/conditions that will and will not be transitioned to the national surveillance system, and any adjustments to the frequency of reporting.
- When? Criteria that trigger the transition, and the timing (e.g., after one year, after three years) or timing of when to evaluate if transition is appropriate (e.g., after one year re-evaluate the possibility of transition).
- How? Financial, human and operational implications of the strategy for resources and funding needed.



## 16.2 Factors to consider when transitioning

In addition to the drafting and resourcing of a transition plan, previous assessments of a country's preparedness capacity and surveillance priorities (see [Modules 2](#) and [3](#)) will highlight factors to consider when transitioning. As part of these assessments, a rough idea could be obtained of how much

and which type of support a country would need when transitioning back to its routine surveillance system, or if a new surveillance system is needed.

The following key factors should be considered when transitioning (2).

- Confirmation is established that the emergency phase has passed.
- Agreement exists between emergency and development teams.
- Presence of a functional national surveillance system (either pre-existing or newly established) of good quality is in place, for example:
  - at least 70% of health facilities are covered by the national surveillance system
  - weekly completeness of reporting is at least 70%
  - at least 70% of health facility staff is trained in the new surveillance system.
- Routine system capacity to absorb coverage for populations previously covered by EWAR exists.
- Technical infrastructure/capacity of national surveillance system (e.g., SOPs, standardized case definitions) exists.
- Human, financial and operational resources are in place to optimize the national surveillance system.



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# Annexes

-  **Annex 1.** Diseases with epidemic potential and risk factors in emergencies →
-  **Annex 2.** Examples of community case definitions in emergencies →
-  **Annex 3.** Examples of event definitions in emergencies →
-  **Annex 4.** Examples of syndromic case definitions in emergencies →
-  **Annex 5.** Supportive supervision checklist →
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# Annex 1. Diseases with epidemic potential and risk factors in emergencies

Modified from the [WHO Communicable Disease Control in Emergencies Field Manual](#) .



Table A2.1 Major diseases with epidemic potential

**Diseases with epidemic potential in emergency situations**

- Cholera/AWD
- Shigellosis/bloody diarrhoea/bacillary dysentery
- Measles
- Meningococcal meningitis
- COVID-19
- Human influenza

**Diseases with epidemic potential in certain geographical areas and populations**

- Acute hepatitis (hepatitis A and E)/acute jaundice syndrome
- Chikungunya
- Dengue/severe dengue
- Diphtheria
- Hantavirus
- Leptospirosis
- Louse-borne typhus
- MERS
- Monkeypox
- Neonatal tetanus
- Nipah and henipaviral diseases

<b>Diseases with epidemic potential in certain geographical areas and populations (continued)</b>	<ul style="list-style-type: none"> <li>• Plague</li> <li>• Relapsing fever</li> <li>• Rift Valley fever (RVF)</li> <li>• Seasonal influenza</li> <li>• Severe Acute Respiratory Syndrome (SARS)</li> <li>• Tetanus</li> <li>• Trypanosomiasis</li> <li>• Typhoid</li> <li>• Viral haemorrhagic fevers (VHFs)/acute haemorrhagic fever syndrome</li> <li>• Visceral or cutaneous leishmaniasis</li> <li>• West Nile fever</li> <li>• Yellow fever and emerging arboviruses</li> <li>• Zika virus disease</li> </ul>
<b>Diseases of eradication</b>	<ul style="list-style-type: none"> <li>• Poliomyelitis/AFP</li> <li>• Dracunculiasis (Guinea worm)</li> </ul>
<b>Endemic disease that may increase due to risk factors</b>	<ul style="list-style-type: none"> <li>• Acute respiratory illness (ARI)</li> <li>• Diarrhoeal diseases</li> <li>• Malaria</li> </ul>
<b>Non-epidemic diseases/syndromes in certain geographical areas and populations</b>	<ul style="list-style-type: none"> <li>• HIV/AIDS</li> <li>• Tuberculosis</li> </ul>



Table A2.2. Potential risk factors for outbreaks in emergencies

**Acute respiratory infections**

- Inadequate shelter with poor ventilation
- Indoor cooking
- Poor healthcare services
- Malnutrition
- Overcrowding
- Age group under 1 year old
- Large numbers of elderly
- Cold weather
- Low vaccination coverage for vaccine-preventable diseases

<b>Diarrhoeal diseases</b>	<ul style="list-style-type: none"> <li>• Overcrowding</li> <li>• Inadequate quantity and/or quality of water</li> <li>• Poor personal hygiene</li> <li>• Poor washing facilities</li> <li>• Poor sanitation</li> <li>• Insufficient soap</li> <li>• Inadequate cooking facilities or unclean water storage containers</li> </ul>
<b>Malaria</b>	<ul style="list-style-type: none"> <li>• Movement of people from endemic into malaria-free zones, or from areas of low endemicity to hyperendemic</li> <li>• Interruption of vector control measures</li> <li>• Increased population density promoting mosquito bites</li> <li>• Stagnant water</li> <li>• Inadequate healthcare services</li> <li>• Flooding</li> <li>• Changes in weather patterns</li> <li>• Resistance to anti-parasitic treatment</li> </ul>
<b>Measles</b>	<ul style="list-style-type: none"> <li>• Measles vaccination coverage rates below 80% in country of origin</li> <li>• Overcrowding</li> <li>• Population displacement</li> <li>• Malnutrition</li> </ul>
<b>Meningococcal meningitis</b>	<ul style="list-style-type: none"> <li>• Meningitis belt and other countries with previous epidemics</li> <li>• Dry season</li> <li>• Dust storms</li> <li>• Overcrowding</li> <li>• High rates of acute respiratory infection</li> </ul>
<b>Mosquito-borne diseases</b>	<ul style="list-style-type: none"> <li>• Stagnant water</li> <li>• Rainy seasons/monsoon</li> <li>• High population density</li> <li>• Lack of community engagement in vector control actions (e.g., breeding site reduction)</li> </ul>
<b>Tuberculosis</b>	<ul style="list-style-type: none"> <li>• High HIV seroprevalence rates</li> <li>• Overcrowding</li> <li>• Malnutrition</li> <li>• Resistance to treatment</li> </ul>

**Viral haemorrhagic fevers**

- Contact with human cases (Ebola/Marburg virus disease)
- Contact with wild-caught rodents (Lassa fever)
- Tick-infested areas (Crimean-Congo haemorrhagic fever)
- Poor infection control in healthcare facilities

**Louse-borne typhus**

- Highland areas
- Poor washing facilities
- Body lice
- Endemic typhus/cases of Brill-Zinsser disease



# Annex 2. Examples of community case definitions in emergencies

Table A3.1 Community case definitions in emergencies.

Note, these are examples that will need to be adapted to the local context adapted from [Section 1 – Annex 1B](#) of the Technical guidelines for integrated disease surveillance and response in the African Region .

Disease/Hazard	Definition
<b>AFP</b>	A child or adult with acute paralysis/weakness in any of the extremities
<b>Acute jaundice syndrome</b>	A child or adult with yellow eyes
<b>AWD</b>	A child or adult with three or more watery stools in the last 24 hours with or without vomiting
<b>Cholera (outside an outbreak)</b>	A person >5 years with AWD develops severe dehydration or dies of AWD
<b>Diarrhoea (any)</b>	A child or adult with three or more loose stools in 24 hours
<b>Diphtheria</b>	A child or adult with fever, sore throat, swollen glands in the neck, difficulty swallowing and grey membrane in the throat and tonsils
<b>Fever</b>	Hot body, sweating or shivering
<b>Measles</b>	A child or adult with fever and rash
<b>Meningitis</b>	A child or adult with sudden onset of fever and either neck stiffness or altered consciousness



# Annex 3. Examples of event definitions in emergencies

The event definitions below are examples used in emergencies (35).

For any given source of EBS information (e.g., CHWs), a maximum of three to four event definitions should be applied to guide notifications. For example, during an acute drought in a conflict setting, the CHWs already in place were asked to conduct house-to-house health promotion and report the following events:

- an illness with novel or rare symptoms (i.e., signs/symptoms the community has not seen before)
- two or more persons severely sick, weak and being unable to walk within one week
- an unexplained death in the community.

In some settings and for some reporting sources, event definitions can be very broad and expect the reporting source to know what is “unusual” or “unexplained”. Such definitions tend to generate more true signals in situations where the reporting source obtained a certain level of medical and epidemiological training, as well as regular feedback and supervision. Examples include:

- 
- any potential outbreak or public health event
  - any unusual health events (e.g., multiple deaths from unknown causes)
  - any unusual event that raises concern/fear/alarm in the community
  - an illness with novel or rare symptoms (i.e., signs/symptoms the community has not seen before).
  - an unusual pattern of disease in the community
  - an unexplained death in the community
  - unexpected number of people sick with similar symptoms presenting within one week
  - unexpected number of children absent from the same school within one week
  - unexpected numbers of people purchasing the same medicines or presenting with similar illnesses at a pharmacy within one week.

In some settings and for some reporting sources, event definitions are more specific and give detailed instructions on what should be reported; often setting a threshold that should be reached before reporting a signal (e.g., five or more cases of severely sick persons in one village). These definitions

are more often used for reporting sources with no/limited medical background, and/or very limited possibilities for training, feedback and supervision. Using such definitions can increase specificity but can risk missing some crucial events that did not cross the given threshold. Examples include:

- five or more cases of people presenting with similar signs/symptoms from the same community, school or workplace within one week
- two or more hospitalized cases and/or deaths with similar symptoms from the same community, school or workplace within one week
- two or more persons dying in the same community, school or workplace within one week.

Several event definitions aim directly to identify potential zoonosis and are often used in places where animal health and human health surveillance are well integrated. Examples include:

- a cluster of unexplained animal deaths within one week
- unexpected large numbers of animal deaths.

Some event definitions are tailored to healthcare workers reporting to EBS. Examples include:

- a cluster of healthcare workers that are sick with a similar illness
- unexplained death of a healthcare worker
- multiple patients with a disease that does not resolve with usual treatment.



# Annex 4. Examples of syndromic case definitions in emergencies

Table A5.1. Examples of typical syndromic cases definitions applied in emergencies. Modified from the [WHO Outbreak surveillance and response in humanitarian emergencies: WHO Guidance for EWARN implementation](#) and from [Section 1 – Annex 1A of the Technical guidelines for integrated disease surveillance and response in the African Region](#).

Disease/Hazard	Definition
<b>Suspected poliomyelitis/AFP</b>	Any child <15 years with AFP OR any paralytic illness in a person of any age if poliomyelitis is suspected
<b>Acute haemorrhagic fever syndrome</b>	Acute onset of fever of less than three weeks duration in a severely ill patient <b>AND TWO</b> of the following signs: <ul style="list-style-type: none"> <li>• haemorrhagic or purpuric rash</li> <li>• bleeding from the nose (epistaxis)</li> <li>• vomiting blood (haematemesis)</li> <li>• coughing up blood (haemoptysis)</li> <li>• blood in stools</li> <li>• other haemorrhagic symptom and absence of predisposing host factors for haemorrhagic manifestations.</li> </ul>
<b>Acute jaundice syndrome</b>	Acute onset of jaundice (yellowing of whites of eyes or skin or dark urine) <b>AND</b> severe illness with or without fever <b>AND</b> the absence of any known precipitating factors

Disease/Hazard	Definition
<b>Suspected cholera/ AWD</b>	Any person 5 years or older with severe dehydration or death caused by acute diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours)  During a cholera epidemic, any person 2 years or older with acute diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours), with or without dehydration
<b>Suspected shigellosis/ bloody diarrhoea</b>	A person with diarrhoea (three or more abnormally loose or fluid stools in the past 24 hours) with visible blood in stool (preferably observed by the clinician)
<b>Suspected measles</b>	Any person with fever <b>AND</b> maculopapular (non-vesicular) generalized rash <b>AND ONE</b> of the following: cough, runny nose (coryza) or red eyes (conjunctivitis) <b>OR</b> any person in whom a clinician suspects measles
<b>Suspected meningitis</b>	Any person with sudden onset of fever (>38.0°C axillary) <b>AND ONE</b> of the following signs: <ul style="list-style-type: none"> <li>• neck stiffness</li> <li>• altered consciousness</li> <li>• petechial or purpuric rash</li> <li>• other meningeal signs*</li> </ul> <p>In children &lt;1 year, meningitis is suspected when fever is accompanied by a bulging fontanel</p>

\* Severe neck stiffness causing the patient's hip and knees to flex when the neck is flexed, severe stiffness of the hamstrings causing inability to straighten the leg when the hip is flexed 90°.

# Annex 5. Supportive supervision checklist

Notes for administering this checklist:

- The aim is to collect feedback in a respectful and non-authoritarian way, with a focus on using this as an opportunity to improve knowledge and skills of health staff.
- Where appropriate, provide context to your questions. Show trends in reporting of priority diseases from the health facility you are visiting or from the district or health zone the health facility belongs to. Show examples of alerts reported and responded to by this or other units.
- Where needed, refresh/reinforce knowledge where gaps have been identified and reinforce the importance of EWAR reporting.

Health facility name:	Province:	District:
Name of EWAR focal point in HF:	Phone number:	
Date of current supervision visit:	Date of last supervision visit:	
<b>Tools/Materials</b>		
Are case definitions for priority diseases displayed in OPD (in the appropriate language)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are alert thresholds displayed in OPD?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the standard outpatient register available and being used in OPD?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are SOPs or technical guidelines for surveillance/EWAR available?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Are the standard reporting forms available (case-based reporting form, weekly reporting form, line listing form, suspected outbreak/rumour logbook)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If NO, which forms are out of stock?		
Are alert hotline(s) and names of contact persons displayed in OPD and staff office?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If RDTs are used, are they:	Approved RDTs?	<input type="checkbox"/> Yes <input type="checkbox"/> No
	Stored correctly and within expiration date?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are materials for sample collection available (e.g., Cary-Blair transport medium, clean leak-proof container, blood tubes, paper cards?)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If NO, which materials are out of stock?		

Tools/Materials				
Average number of patients visited per day in the last week: OPD_____ IPD_____				
Number of staff handling EWAR: _____ Number of staff trained on EWAR: _____				
Number of alerts entered in the register over the past two weeks that were NOT reported immediately: _____				
Over the past month, were any community rumours reported? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Number of priority diseases entered in the OPD register over the past two weeks that were NOT included in the weekly reporting form: _____				
If reporting from facility has been delayed (weekly reports or alerts), what reasons have been given for the delays?				
Ask health facility staff whether they can explain the case definitions of AFP/measles/cholera/VHF, and explain the sample collection process for these diseases. <i>(Fill out the table below, making the healthcare worker feel comfortable; explain that the main objective of these questions is to understand better how the supervisors can help them better, not to judge them.)</i>				
	CASE DEFINITIONS*	SAMPLE COLLECTION#		
AFP	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Measles	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cholera	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No
VHF	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Adequate knowledge?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<i>*Mentions all signs and symptoms correctly. # Mentions all processes, timing and materials needed.</i>				
Community-based surveillance				
How often do you meet with community health workers (CHWs) or CHWs' representative? (Insert number of weeks, e.g., once every three weeks): _____				
When did you last meet with them? (Insert date): _____				
Do you assess the CHWs' performance (e.g., reporting process, recognition of case definitions)? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Do you provide feedback? <input type="checkbox"/> Yes <input type="checkbox"/> No			Do you provide training? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Feedback				
When was the last time you received feedback from your EWAR submissions? (Insert date): _____				

**Action points and follow-up needed**

Indicate below ALL action points needed, by when they should be done and who should follow up.

Action point / Follow-up	Person(s) responsible	Follow-up date







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**Populations affected by emergencies are continually at risk of outbreaks of epidemic-prone diseases and other public health hazards. Early Warning, Alert and Response (EWAR) is a systematic approach that provides an early warning of acute public health events, and then connects this function to an immediate public health response. It is one of the most immediate and important functions of a surveillance system.**

**This operational guidance aims at supporting public health stakeholders responsible for disease surveillance in establishing and strengthening EWAR systems that are adapted to their context – enabling effective early detection, investigation and response to potential health threats in preparation for and response to emergencies. It builds upon previously published WHO foundational guidelines, providing a logical series of modules that may be more easily understood and applied during emergencies, standardizing and consolidating key concepts, and incorporating new developments and lessons identified from recent emergencies.**

