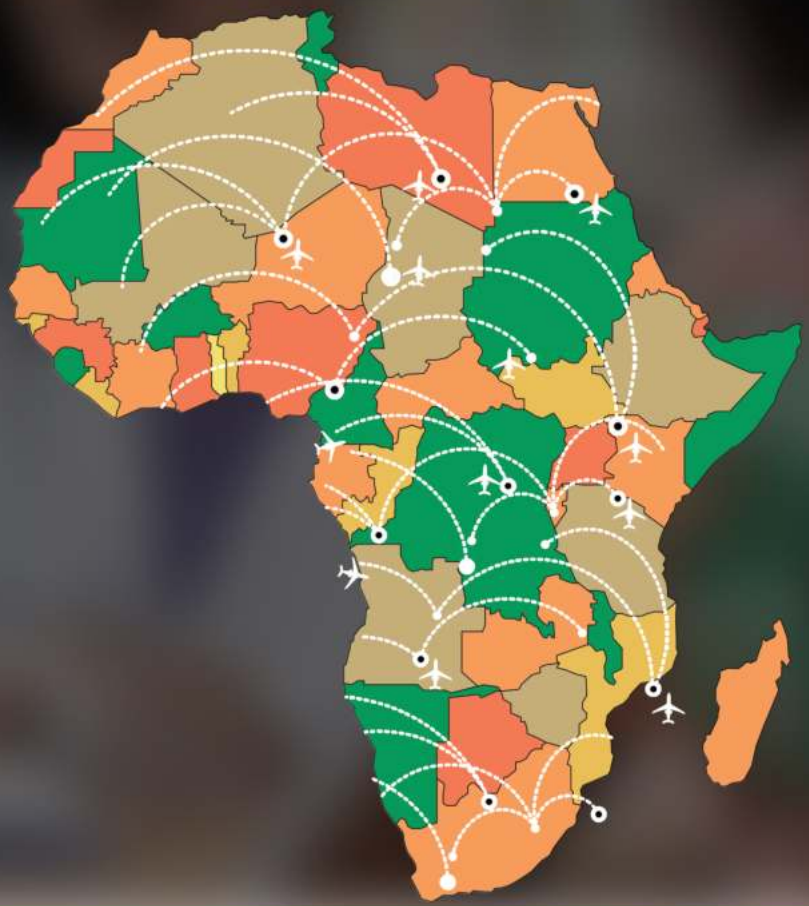
African Union

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

Africa CDC Event-based Surveillance Framework



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- African Union Member States implementing event-based surveillance
- Africa CDC Regional Coordinating Centres
- World Health Organization
- World Organisation for Animal Health
- Food and Agricultural Organization of the United Nations
- Non-governmental organisations including Resolve to Save Lives
- Technical partners, European Centre for Disease Prevention and Control and US Centers for Disease Control

The extensive list of contributors is listed on the following page. The production of the document was funded by Africa CDC.

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Abbreviations and Acronyms

Africa CDC	Africa Centres for Diseases Control and Prevention
AU	African Union
AWP	Annual Work Plan
CAHW	Community-based animal health worker
CEBS	Community event-based surveillance
CHW	Community health worker
EBS	Event-based surveillance
EI	Epidemic Intelligence
EOC	Emergency Operation Centre
EWAR	Early warning and response
FAO	Food and Agricultural Organization of the United Nations
HCW	Healthcare worker
IBS	Indicator-based surveillance
IHR	International Health Regulation
IDSR	Integrated Disease Surveillance and Response
MCM	Multisectoral, One Health coordination mechanism
M&E	Monitoring and evaluation
MS	Member States
FP	EBS Focal Person
SMS	Short message service
TWG	Technical working group
WHO	World Health Organization
WOAH	World Organisation for Animal Health

Glossary of Terms

Community event-based surveillance (CEBS): Africa CDC defines community event-based surveillance as the detection and reporting of unusual health events or health risks occurring within a community, by community members including community volunteers, community health or animal health workers, the public, religious leaders, civil society members, teachers, and other similar groups.

Community animal health worker (CAHW): Defined by WOAH as a person selected by their own community and provided with short, initial, or recurring vocational training to perform basic animal health and animal husbandry-related tasks, who is accountable to a veterinary para-professional and/or veterinarian, and who is currently active in their community. The CAHW can also play an important role in a range of sanitary tasks such as disease reporting.[1]

Community health worker (CHW): CHWs provide health education and referrals for a wide range of services, and provide support and assistance to communities, families and individuals with preventive health measures and gaining access to appropriate curative health and social services. They create a bridge between providers of health, social and community services and communities that may have difficulty in accessing these services. CHWs may also be known as community health volunteers, among other names. According to a WHO Study Group, community health workers may be members of the communities where they work, should be selected by the communities, are answerable to the communities for their activities, and should be supported by the surveillance and/or health system but not necessarily a part of its organisation.

Early Warning and Response (EWAR): Defined by the WHO as the organised mechanism to detect any abnormal occurrence or divergence from the usual or normally observed frequency of phenomena (e.g., disease outbreaks, natural disasters, civil unrest, etc.) as early as possible.

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

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

Event: The International Health Regulations (IHR) define an event as *"a manifestation of disease or an occurrence that creates a potential for disease*", which can include events that are infectious, zoonotic, chemical, radiological or nuclear in origin and transmitted by persons, vectors, animals, goods/food, or through the environment.

Event-based surveillance (EBS): The organised collection, *monitoring*, assessment, and interpretation of primarily unstructured ad hoc information regarding health events or risks, which may represent an acute risk to human, animal, plant, or environment health.

[1] The World Organisation for Animal Health (WOAH) does not have an official definition for CAHW. However, in the context of activities of the Capacity Building Department at WOAH regarding veterinary workforce development, this informal, unofficial definition is being used to communicate the meaning of CAHW to distinguish CAHWs from veterinary paraprofessionals.

Facility: Defined as a place, building or location used for a particular activity. Examples include hospitals, clinics, or healthcare facilities that engage in direct on-site patient care for humans or animals; laboratories; water treatment facilities; educational facilities; etc.

Facility event-based surveillance (FEBS): *Event-based surveillance* that is conducted in a facility. EBS focal points (FP) identified at these facilities support the detection and reporting of signals or events happening at these facilities that are not covered through routine indicator-based surveillance.

Hazard: An agent or a source that has potential to cause adverse health effects in exposed populations.

Hotline: A hotline (toll-free) is a phone line that the general public can use to contact an institution/organization about a particular health concern.

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

Indicator-based surveillance (IBS): Defined by WHO as the systematic (regular) collection, monitoring, analysis, and interpretation of structured data, i.e., of indicators produced by a number of well-identified, mostly health facility-based, formal sources.

Integrated Disease Surveillance and Response (IDSR): Proposed by the WHO Regional Office for Africa (AFRO), Integrated Disease Surveillance and Response is an approach to improve public health surveillance and response in the African region by linking community, health facility, district, and national levels.

Intermediate administrative level: Intermediate administrative levels may be defined differently in different countries. For this document, the intermediate level is the health administrative level(s) below the national-level that is responsible for conducting preliminary investigations and implementing responses to reported health-related events or suspected outbreaks in a given jurisdiction. The intermediate level may otherwise be referred to as districts or counties, among others. Some countries have two administrative layers (e.g., provincial and district) that make up their intermediate level.

Local administrative level: Local administrative levels may be defined differently in different countries. For this document, a local administrative level is the lowest administrative division within a country, directly above the community-level.

Media scanning (also known as "media monitoring"): The active monitoring of the content of media sources on a continuing basis to get information about specific topics.

Monitoring: Defined by WHO as the routine and continuous tracking of the implementation of planned surveillance activities (monitoring the implementation of the plan of action) and of the overall performance of surveillance and response systems.

Multisectoral: Participation of more than one sector working together with a common vision and perspective on a joint program or response to an event (e.g., a joint investigation by public health, animal health, education, and law enforcement).

Multisectoral, One Health coordination mechanism (MCM): A multisectoral, One Health coordination mechanism (MCM) refers to any formalized, standing, group that acts to strengthen or develop collaboration,

communication, and coordination across the sectors responsible for addressing health concerns at the human-animal-environment interface. An MCM has routine, ongoing functions and is responsible for coordination, leadership, and governance of efforts among the relevant sectors to achieve jointly determined and agreed common goals.

One Health: One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines, and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development.[2]

Outbreak: A disease outbreak is the sudden occurrence of cases of disease in excess of what would normally be expected in a defined population, geographical area, or season. An outbreak may occur in a restricted geographical area or may extend over several countries. It may last for a few days or weeks, or for several years. A single case of a communicable disease long absent from a population, or caused by an agent (e.g., bacterium or virus) not previously recognized in that community or area, or the emergence of a previously unknown disease, may also constitute an outbreak and should be reported and investigated.

Reporting: The process by which signals, or events are brought to the knowledge of the health authorities.

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

Response: Any action triggered by the detection of a health risk (e.g., monitoring of the event, information of the public, triggering field investigation and/or implementation of any control or mitigation measures). The nature of the response will have to be adapted according to the nature of the health risk.

Risk: The likelihood of an *event* resulting in negative consequences for health (e.g., animal health, public health, etc.).

Risk assessment: A systematic process for gathering, assessing, and documenting information to assign a level of *risk* to an *event*. Data collected through the risk assessment process are used to inform risk characterization and any immediate actions to be taken in response.

Risk characterization: According to WHO, once a risk assessment team has carried out hazard, exposure, and context assessments of an event, a level of risk should be assigned. This process is called risk characterization.

Sensitivity: The ability of EBS to detect health risks. Sensitivity refers to the proportion of events that were effectively detected through EBS among all events that occurred for a given period of time.

Short Message Service (SMS): Commonly known as a “text message”. A short message sent electronically from one cell phone to another.

[2] Quadripartite, One Health High Level Expert Panel’s definition of "One Health".

Signals: Data and/or information considered by the Early Warning and Response system as representing potential acute health risk, such as an outbreak. Signals may consist of reports of cases or deaths (individual or aggregated), potential exposure of human beings to biological, chemical, or radiological and nuclear hazards, or occurrence of natural or man-made disasters. Signals can be detected through any potential source (health or non-health, informal or official) including the media. Raw data and information (i.e., untreated and unverified) are first detected and triaged in order to retain only the one pertinent to early detection purposes i.e., the signals. Once identified signals must be verified. When it has been verified, a signal becomes an "event".

Social media messaging: Online platforms that enable the general public to report and share information and engage them in social networks, for example Facebook, Twitter, etc.

Surveillance: Is the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of health-related practice, closely integrated with the timely dissemination of these data to those who need to know.

Triage: The process of screening and selecting information that is relevant for early detection purposes. The process of triaging involves two steps: 1) filtering, or screening out, irrelevant or duplicative information; and 2) selection, which is a human analyst driven process that includes selecting relevant reports based on the focus of a particular EBS unit and/or country priority. Once information is triaged, it becomes a "signal".

Verification: Verification is the pro-active cross-checking of the validity (veracity) of the *signals* collected by *EWAR*, by contacting the original source, additional sources, or by performing a field visit to the site of occurrence. Verification requires that hoaxes, false rumours, and artefacts are eliminated from further consideration.

Wildlife: According to WOAH, wildlife include feral animals, captive wild animals, and wild animals. Feral animals are domesticated species that live without direct human supervision or control. Captive wild animals are non-domesticated animal species that are captive or otherwise live under direct human supervision or control, including zoo animals and pets. Wild animals are non-domesticated species that live independent of direct human supervision or control.

Zoonotic disease or zoonoses: an infectious disease that can be shared between animals and humans; can be spread by food, water, fomites, or vectors.

Use of the Event-based Surveillance Framework

The Event-based Surveillance Framework is intended to be used by authorities and agencies responsible for surveillance and response. This framework serves as an outline to guide stakeholders interested in implementing event-based surveillance (EBS) using a multisectoral, One Health approach. To that end, the document is arranged in interlinked chapters and annexes that can be modified and adapted, as needed, by users.

This is a revised version of the original "Framework for Event-based Surveillance" that was published in 2018. This framework does not replace any other available EBS materials, but rather builds on existing relevant or related documents and serves as a practical guide for the implementation of EBS in Africa. This framework is aligned with the third edition of the WHO Joint External Evaluation for the following indicators: strengthened early warning surveillance systems that are able to detect events of significance for public health and health security (Indicator D2.1); improved communication and collaboration across sectors and between National, intermediate and local public health response levels of authority regarding surveillance of events of public health significance (Indicator D2.2); and improved national and intermediate-level capacity to analyse data (Indicator D2.3). As countries begin to implement and demonstrate EBS functionality they will ensure an increase in JEE scores and progress towards meeting the requirements outlined in the IHR[3].

Additionally, in African Union Member States that have adopted the Integrated Disease Surveillance and Response (IDSR) strategy, this document is a complement to and can enhance the implementation of IDSR, especially for the 3rd edition (2019) that includes components related to EBS.

[3] International Health Regulations (2005) - third edition

Executive Summary

Event-based surveillance (EBS) is defined as the organized collection, monitoring, assessment, and interpretation of primarily unstructured ad hoc information regarding health-related events or risks that may represent an acute risk to human, animal, plant, or environment health. EBS complements existing indicator-based surveillance and both surveillance types, as part of epidemic intelligence, improve a country's early warning and response (EWAR) capacity. This Event-based Surveillance Framework offers guidance to health practitioners seeking to implement EBS in their countries. This document has been organised in a modular fashion; each chapter is briefly described below.

Chapter 1: Introduction to the concept and steps of EBS. This chapter introduces the concept of EBS and discusses the relationship between EBS relates to indicator-based surveillance, epidemic intelligence, and early warning. In addition to this, the fundamental steps for how best to conduct EBS are also described.

Chapter 2: Considerations for implementing EBS. This chapter highlights the various considerations and necessary requirements for EBS implementation - including how best to adopt a multisectoral, One Health approach in implementation. Considerations for signal development, information flow, workforce, resource needs, and how to implement EBS at the borders and during a pandemic is also included.

Chapter 3: Hotline event-based surveillance. Hotlines can act as a good source of information about emerging health events or outbreaks that are taking place in the community. Hotlines, short message service (SMS), and social media messaging platforms can be leveraged in the implementation of this type of EBS. This chapter describes how best to implement this modality of EBS.

Chapter 4: Media scanning event-based surveillance. Media scanning EBS uses unstructured data from diverse web-based sources, radio, television, newspapers, etc. to provide early warning and situational awareness of events impacting human, animal, plant, and environmental health. This chapter describes how the use of media scanning can act as a type of EBS, as well as the steps of EBS that should be carried out accordingly.

Chapter 5: Facility event-based surveillance. Event-based surveillance in facilities (FEBS) is a type of EBS that involves clinicians, nurses, laboratory technologists, veterinarians, and other relevant health professionals detecting and reporting on patterns of disease and unusual health risks and events. FEBS may allow for the recognition of emerging or re-emerging health threats not measured by IBS. This chapter describes how FEBS can be implemented in various facility types to complement existing IBS.

Chapter 6: Community event-based surveillance. This chapter describes the role of the community in early capture and reporting of events. It details key steps for the implementation of community event-based surveillance (CEBS), stakeholders and resources required, as well as the flow of information to and from community-level sources and the EBS units.

Chapter 7: Monitoring and Evaluation for event-based surveillance. Monitoring and evaluation (M&E) is a key component in providing timely information on the functionality and efficiency of EBS. This chapter provides recommendations for developing an EBS M&E plan, including information on what data sources, indicators, and evaluation methodologies to consider.

Chapter 8: EBS data management and Event Management Systems. EBS generates a large amount of data which needs to be collated, analysed, and disseminated in a manner that allows for timely and effective action. This chapter highlights key considerations for EBS data management and the use of event management systems.

CHAPTER 1: INTRODUCTION TO THE CONCEPT AND STEPS OF EVENT-BASED SURVEILLANCE

The World Health Organization (WHO) revised the International Health Regulations (IHR) in 2005 to require a core set of surveillance, detection, and outbreak response capabilities for each Member State. In 2014, WHO published a global guidance document[4] to provide general guidance for the enhancement of early warning and response (EWAR) within the framework of national surveillance systems. This document introduced and focused on event-based surveillance (EBS) as a part of the epidemic intelligence (EI) needed to detect, verify, assess, and investigate events and other health risks with an early warning objective. EI integrates multiple sources of information, like EBS and routine indicator-based surveillance (IBS), as well as other contextual information such as vaccination coverage and demographics, to efficiently detect acute health events.

IBS consists of the systematic and routine collection of structured data from mainly health facility-based, formal sources, and is the conventional form of surveillance in many countries. EBS is the organised collection of mainly unstructured, ad hoc information regarding health events that may represent an acute risk to health. Data for EBS systems can originate from a variety of sources including the community, media reports, laboratories, health facilities, and hotlines. Event-based surveillance data can be sporadic or ad hoc (reported when a situation arises, and not necessarily on a daily, weekly, or monthly basis). A key feature of EBS is an emphasis on immediate detection and rapid reporting of signals.

Both IBS and EBS are complementary with each having a different purpose and role to play. Event-based surveillance is likely to be better at picking up small outbreaks early, while IBS is better suited for monitoring disease trends over time, as well as signalling the start of seasonal outbreaks of endemic disease. As an example, data gathered through an influenza-like illness (ILI) sentinel surveillance system can be used to generate seasonal and epidemic alert thresholds by comparing trends in current activity to previous years. Designating alert thresholds for influenza or other immediately reportable diseases (e.g., cholera, viral haemorrhagic fevers) in an IBS system essentially creates the opportunity to detect an EI "signal". However, IBS may not be very useful for detecting smaller events because signals are either averaged out in large data sets or lost in the noise of smaller data sets. This is where EBS can be most useful, since EBS is better at picking up signals where access to healthcare is limited. EBS, when implemented correctly, can offer a simple and flexible form of surveillance, and can be tailored to different settings and sectors according to the needs of the country. This *Event-based Surveillance Framework* focuses on how various types of EBS can be implemented and integrated into national surveillance systems.

[4] WHO: 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

Steps of EBS

EBS has five main steps: detection, triage, verification, risk assessment, and alert for action and response. It is important to note that although the final step, alert, is the act of reporting that is made to a responsible health official to take action, each step of EBS may also include some type of reporting, especially when information needs to be passed from one focal point to another within a defined reporting structure.

Detection

Detection is the process of capturing information through various modalities (e.g., in the community, via media reports, etc.) on potential health events through the process of EBS. EBS practitioners use a list of predefined signals to help identify potential health events. A ***signal*** is data and/or other information considered by the EWAR system to represent a potential acute health risk, such as an outbreak. Signals may consist of reports of cases or deaths (individual or aggregated), potential exposure of human beings to biological, chemical, or radiological and nuclear hazards, or occurrence of natural or man-made disasters. Signals can be detected through any potential source (health or non-health, informal or official) including the media.

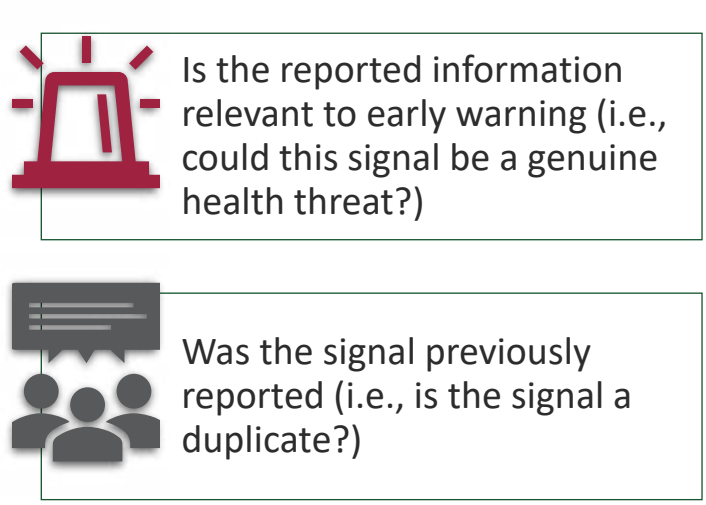
As part of detection, key information needs to be collected and recorded, or logged, for immediate reporting to the next level. The person responsible for handling the initial contact should collect the following information about the occurrence using a reporting form (See Annex 1-4):

- Unique identifier (e.g., person's name/animal ID)
- Geographical area (e.g., village, district) name
- Date of reporting and source information/contact details of reporter
- Date and time when event occurred
- Description of event
- Any actions taken

Triage

After detection, any EBS information identified needs to go through a process of triage to retain only the information deemed pertinent to early detection purposes, i.e., the ***signals***. Triage involves two steps: 1) **filtering**, or screening out, irrelevant or duplicative information; and 2) **selection** of EWAR relevant reports based on the focus of a particular EBS unit and/or country priority.

Questions to ask during the triage process include:



There may be instances where information for the same event is reported simultaneously from different sources or are reported repeatedly from the same source, which may represent the severity of the threat. Due to its high sensitivity, EBS is likely to generate information which may not be relevant for early warning. It is therefore important that health authorities detecting and/or receiving reports, triage the incoming information based on relevance. The established country priority event list should guide the decision of whether or not information could signify a genuine health threat. Because EBS operates as a sensitive surveillance system, authorities should continue to encourage the reporting of information even if they may be later discarded as "non-events." Once information is triaged, it becomes a "signal". Any signal that has the potential to be relevant to EWARN and is not a duplicate must then be **verified**.

Verification

Verification is the process of assuring the authenticity of a signal (i.e., it is not a false alarm or a false rumour). **As a rule, signals should be verified within 24 hours of detection**. However, countries may decide whether this 24-hour window of verification is appropriate, or whether it should be shortened or extended according to the severity and priority of each defined signal, as well as existing surveillance capacities. Criteria for verification may include asking questions to those who have reported the signal to ensure that they have correctly understood the signal (e.g., information regarding person, place, and time). **All signals detected must be verified before they can be considered an event** (Figure 1). However, signals from official sources (e.g., the Ministry of Health website, the WHO website, the AU Twitter account, etc.) do not have to go through the

verification step because they are already considered verified and therefore *events*.

Figure 1. This model can be used to determine the outcome of signal verification once sufficient information has been collected and validated.

Following the structure of the country's current surveillance system, a signal should be verified at the lowest administrative level possible, typically the level closest to the signal's location. Verification may involve any of the following depending on the source and the event:

- Contacting local health authorities;
- Contacting the original source;
- Cross-referencing information with other sources;
- Visiting the site of occurrence to establish the authenticity of the information; or
- Consulting the internet to determine if official information is available.

To assist with the verification process, official FPs should be designated as contacts prior to the implementation of EBS. To assist in the verification of signals according to the type (e.g., human, animal, environmental), location, and subject matter of the event, a list of official FPs should be created. This list should include experts in various fields and subject matters. It is recommended to assign EBS FP(s) at the intermediate and local levels to handle receipt and verification of signals, and to communicate and share information with other stakeholders in other relevant sectors for events involving things like zoonotic diseases or environmental hazards. The list below includes examples of official points of contact for event verification and characterization. Other stakeholders within additional sectors at all levels can be included to foster a One Health approach. Though this list may overlap with typical EBS information sources, these sources are useful for collecting additional information to corroborate an event:

- Ministry of Health, Agriculture, Environment or other relevant ministries, and the healthcare system

- Epidemiology units
- Laboratory units
- Intermediate and local-level health facilities, particularly those conducting facility event-based surveillance (FEBS)
- Communities conducting community event-based surveillance (CEBS)

Request for Verification

Requests for signal verification can be sent to the EBS FP(s) or health authority in charge of verification in different ways, such as by landline phone, mobile phone, email, wireless device, SMS, fax, or a cross-platform messaging service like WhatsApp. A country can use any tool it wants, but it should think about the resources it has to use these tools. For example, you need a reliable internet connection to send and receive emails. The tools that are used to report must allow for quick notification so that health events can be checked and dealt with quickly. Depending on the resources and capabilities of the current surveillance system, electronic reporting through a web-based application may be a good alternative to reporting by hand. Electronic systems can help with things like registering, reporting, checking, responding, and analysing. It can make sure that all relevant levels that have access to the system get reports right away and in parallel. It may also be able to generate reports automatically.

Systematic verification of all signals detected through EBS is essential in order not to overburden the surveillance or health systems with false signal investigations or responses, or with unreliable information. **It is important to note that, during the process of verification, the responsible authority could perform a second level of triage by verifying again if the reported signal is relevant to EWARN.** Once a signal is verified to be true and becomes an ***event***, this information should be updated in the logbook, or register. At this point individuals at the local level should promptly start collecting further information in the field in accordance with existing guidance to inform a risk assessment. These may include taking photos or laboratory samples, conducting physical examinations, and recommending laboratory testing.

Risk Assessment

In an EBS system, all events must undergo the process of risk assessment. Risk assessment is the systematic and ongoing process of gathering, evaluating, and documenting information that will form the basis of the actions required to manage and minimise the negative consequences of a serious health event. The process results in assigning a level of risk that an event presents to human, animal, plant, and environment health. Risk assessment should be conducted by health authorities who are responsible for proposing the actions or responses that must be taken to manage and minimise the negative consequences of serious health events.

A risk assessment should be conducted within the first 24 hours of signal verification and should be repeated as new information becomes available until the end of the response to an event. As new information about the situation can arise at any time, the ongoing risk assessment ensures that the appropriate response is triggered, and that it reflects the level of risk the event poses to health. Resources must be set aside to train staff in risk assessment.

Risk assessment should be performed at the lowest administrative level with capacity depending on the magnitude of the event or the capacity of staff across the levels of the sector(s) implementing EBS (e.g., national or intermediate level). The speed with which assessments can be conducted will depend on the relationships the National EBS unit has with local-level health authorities or facilities near the origination of the event. Under the supervision of the national unit, the involvement of local-level health authorities in verification, and where possible a preliminary assessment, will make the system more responsive.

Example questions to ask when conducting a risk assessment:

- Does the suspected event have a high potential for spread (e.g., cholera, avian influenza)?
- Is there a higher than expected mortality or morbidity reported for the event?
- Is the event unusual or unexpected in the community?
- Is there a cluster of cases with similar symptoms?
- Does the event have possible consequences for trade or travel?
- Does the event have possible consequences for human health?
- Does the event affect livestock/wildlife?
- Are there environmental consequences?

Risk assessment can have three different outcomes:

- No new investigation or action is required, and the event may be closed if the risk is low;
- The event must be monitored for future changes in risk if the risk is moderate; or
- An investigation and a response must be initiated if the risk is high or very high.

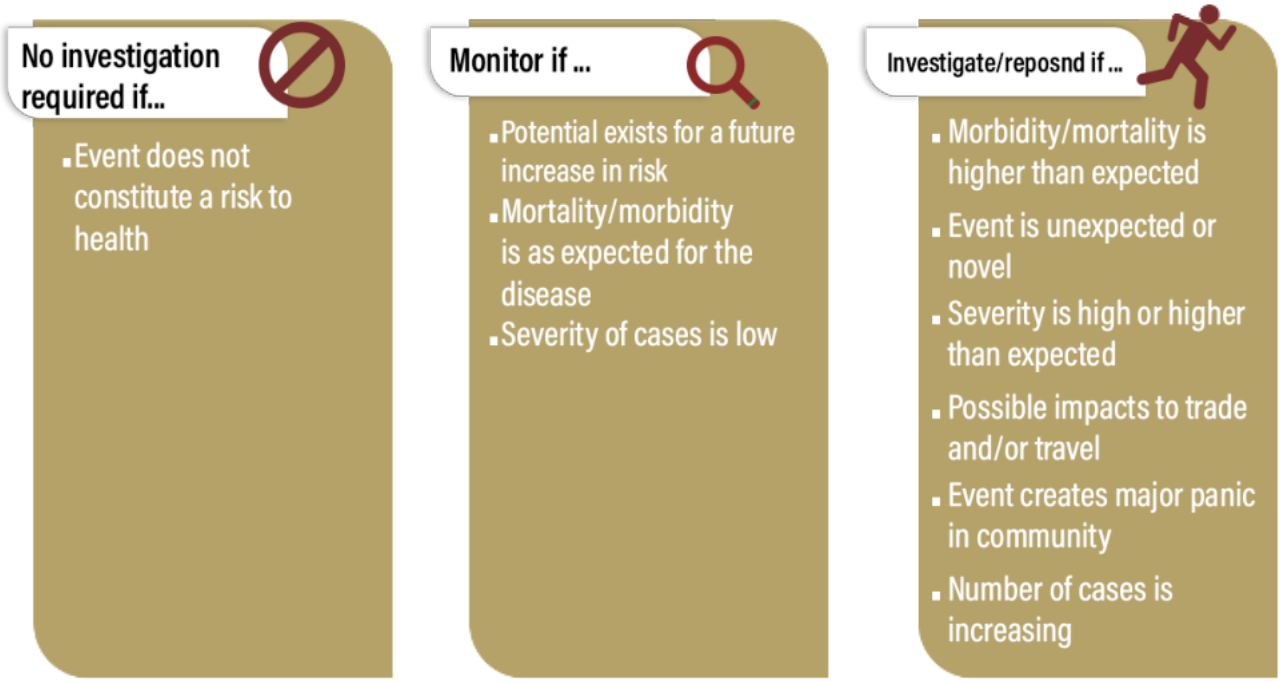


Figure 2. Processes and possible outcomes of risk assessment

Once risk questions are decided upon, the team is ready to undertake the risk assessment process. The level of risk assigned to an event is based on three elements: hazard, exposure, and context.

> **Hazard assessment** is the identification of the characteristics of a health hazard - including possible aetiologies, causes, and/or sources - and the associated adverse health effects. Hazards can include biological, chemical, radiological, and nuclear events.

Exposure assessment is the evaluation of the vulnerability of individuals and populations to likely hazards. The key output of the assessment is an estimate of the population that may have been exposed and an estimate of those that may be susceptible.

Context assessment is an evaluation of the environment in which an event is taking place. This may include the physical environment (climate, vegetation, land use, and water systems and sources), the health of the population (nutritional status, disease burden and previous outbreaks), infrastructure (including transportation, clinical, and health systems), and cultural practices and beliefs. Context assessment also considers social, ethical, technical, scientific, economic, environmental, and political factors that can affect the potential severity of the event.

Risk characterization

Once the EBS unit has carried out the hazard, exposure, and context assessments, a level of risk should be assigned. This process is called risk characterization. For some units, risk characterization results in mathematical output from a quantitative model or comparison with an external standard value. But an equally acceptable process may result in a risk characterization based on the expert opinion of the EBS unit, with input from SMEs. Several tools have been developed to assist with the risk assessment and characterization process (e.g. WHO manual for the rapid risk assessment of acute public health events[5], ECDC Operational tool on rapid risk assessment[6], Tripartite Joint Risk Assessment Operational Tool[7]). Below we list two generic tools, a risk matrix and risk algorithm, that have been adapted from WHO and Africa CDC methodology, respectively. Countries are encouraged to explore and adapt the methodologies that fit best for them.

This **risk matrix** combines estimates of the likelihood of event spread with estimates of the event consequences. As most acute health event risk assessments are qualitative, the categories used in the matrix are not based on numerical values but on broad descriptive definitions of likelihood and consequences (see Figure 3 and Tables 1-2). When applying the matrix, the definitions of likelihood and consequence can be refined to fit with the national or intermediate-level context in each country.

[5] WHO: Rapid risk assessment of acute public health events

[6] Operational tool on rapid risk assessment methodology - ECDC 2019

[7] Tripartite: Joint Risk Assessment tool

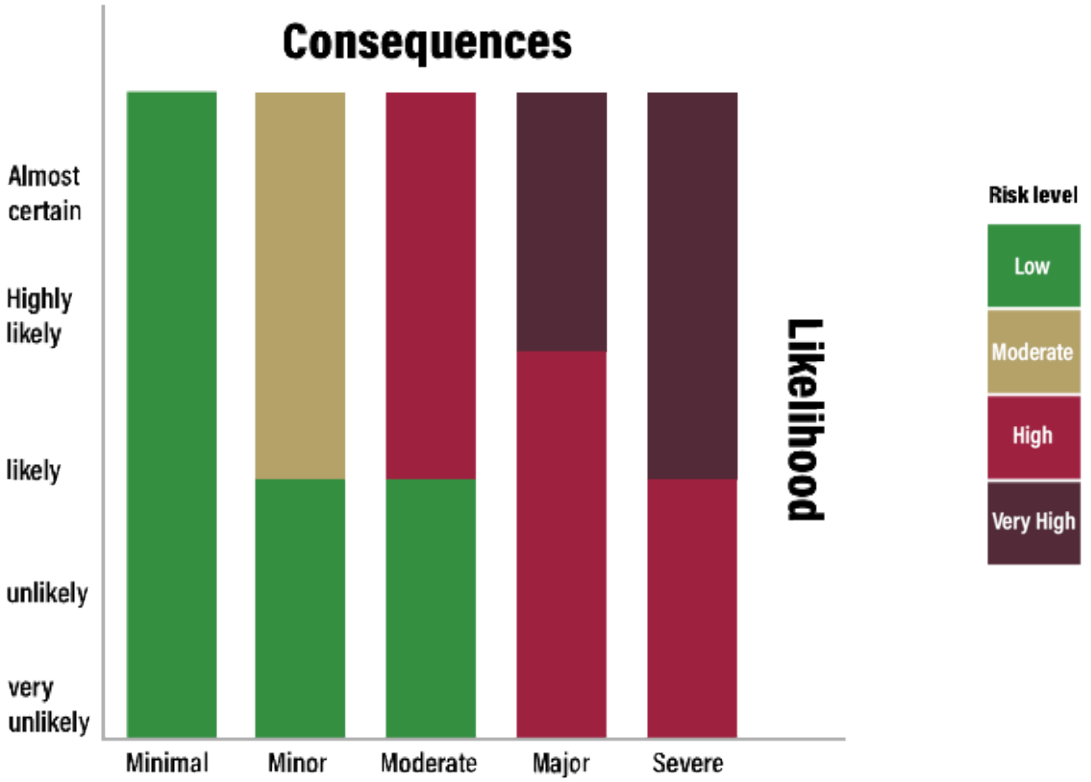


Figure 3. Risk characterization matrix

Table 1. Estimates of likelihood

Level	Definition
Almost certain	Is expected to occur in most circumstances (e.g., probability of 95% or more)
Highly likely	Will probably occur in most circumstances (e.g., a probability of between 70%-94%)
Likely	Will occur some of the time (e.g., a probability of between 30% and 69%)
Unlikely	Could occur some of the time (e.g., a probability of between 5% and 29%)
Very unlikely	Could occur under exceptional circumstances (e.g., a probability of less than 5%)

Table 2. Estimates of consequences

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

This **risk algorithm** is a series of questions that reflect upon the hazard, exposure, and context assessments and allow for a risk determination to be made based upon the responses to these questions.

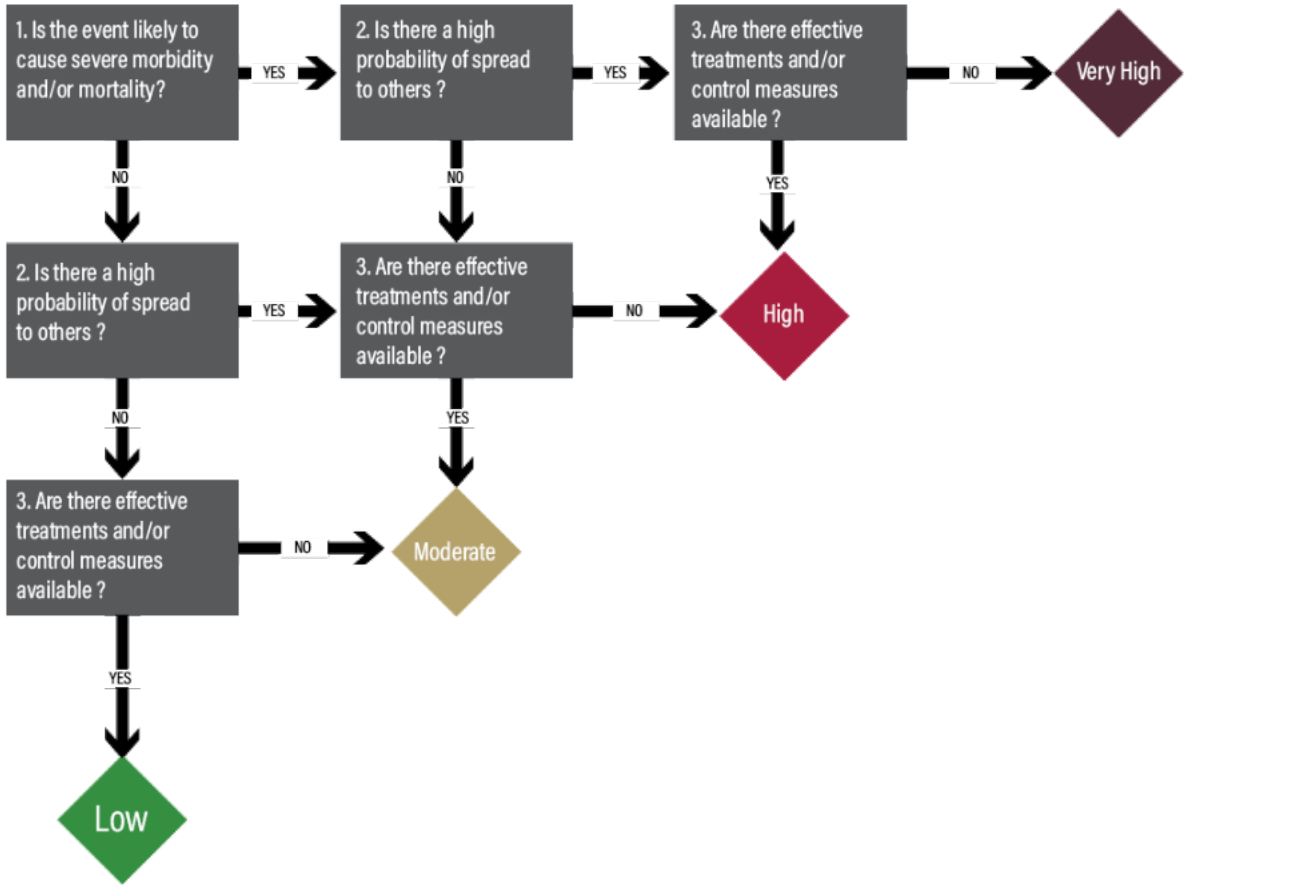


Figure 4. Risk Assessment Algorithm

The risk assessment team should decide how frequently the risk assessment should be updated. Usually, if there is an observed change that entails escalation, or de-escalation, of interventions, the risk assessment should be reviewed and updated.

Alert

Regardless of the source, once an event has been verified and the risk assessed, the responsible authorities should be alerted to respond to the event accordingly. This involves the immediate communication or notification of the event to the authorities designated for response and further action. The type of action taken will be dependent on the level assigned from the rapid risk assessment (Table 3).

Table 3. Risk levels and recommended actions

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

The most critical component of early warning and response systems is the response element. This has been widely covered in IDSR manuals(https://apps.who.int/iris/handle/10665/112667) and other WHO documents and will not be addressed in this document.

CHAPTER 2: CONSIDERATIONS FOR EBS IMPLEMENTATION

When a National Public Health Institute (NPHI), or equivalent health authority responsible for surveillance initiates EBS implementation, careful consideration should be given to multisectoral and cross-border collaboration as well as the requirements needed to initiate and sustain EBS. This chapter highlights some of these key areas for consideration when establishing or strengthening EBS with a country.

Considerations for EBS Placement

When initiating the implementation of EBS, countries must consider the appropriate unit or department where this function will sit. Ideally, a centralised EI unit (which oftentimes can be a surveillance unit) should be identified or created at the national level to monitor, collect, analyse, and act upon information collected through each type of EBS. Where available, Emergency Operation Centres (EOCs) can act as an EI unit or hub that receives, analyses, and visualises data from multiple sources, including EBS and IBS surveillance data. EI units should be staffed with a trained workforce capable of analysing and interpreting data in real time to inform effective decision making. EI (or EBS) units can also be housed within an NPHI, or equivalent health authority embedded within an epidemiology, surveillance, or equivalent department, rather than existing as a standalone programme. EI units should include focal points (FPs) from all relevant sectors performing surveillance, especially if a multisectoral, One Health approach to event monitoring and response is of interest.

Multisectoral, One Health and Cross-border Collaboration

As of 2023, WHO has declared seven public health emergencies of international concern (PHEICs), six of which are concerning zoonotic diseases, or diseases that can be transmitted between animals and humans. Given that most emerging and re-emerging diseases in humans are zoonotic or of animal origin, there is increasing awareness that early warning and response measures need to be initiated further upstream. Looking at events impacting the environment or animal populations can not only help detect and prevent disease spill over events into the human population but can also improve EWAR for priority events that solely impact the environment, plants, and animals.

Several global and continental One Health initiatives have been established to support and strengthen the integration of the One Health approach in Member States. To help strengthen governments and organisations with mainstreaming One Health policies at global, regional, and country level through a multisectoral EBS systems, the Food and Agriculture Organization of the United Nations (FAO), World Organisation for Animal Health (WOAH), United Nations Environment Programme (UNEP) and WHO, referred to as the “Quadripartite”, have established a One Health High-Level Expert Panel (OHHLEP)[8]. Further, to advance the One Health approach in mitigating health threats on the African continent, the African Union established a One Health Coordination Group on Zoonotic Diseases.

In alignment with these global and continental agencies, when planning for EBS implementation, public health authorities should consider establishing an EBS technical working group to foster collaboration with other programs, sectors, or entities using a multisectoral, One Health approach. This should be strengthened by establishing formal data sharing linkages through the establishment of Multisectoral, One Health Coordination Mechanisms (MCMs) and data sharing policies. Sectors can include ministries that deal with health (like animal, environment, and border), but they can also include other ministries that deal with things like disaster

[8] UN Environment Programme joins alliance to implement One Health approach

management, education, finance, transportation, community engagement, social welfare, and so on. The multisectoral EBS technical working group is strategically placed to establish a priority list of signals and mobilise resources for capacity building across all sectors. Pathways for collaboration, coordination and communication need to be prioritised, because they can be very useful in detecting and reporting signals both within and across sectors. For example, signals related to the death of animals at the community level could reflect a potential zoonotic disease or environmental contaminant that could impact both human and animal health. Thus, community health workers (CHWs) and community animal health workers (CAHWs) should both be trained to detect and report these signals. Cross-communication between the human, animal, plant, and environment sectors ensures that these signals are ultimately reported through EBS. Similarly, collaboration with the Ministry of Education may ensure that school-related illnesses are reported to health authorities.

Cross-border Considerations

In addition to establishing multisectoral, One Health collaborations within a country, it is important to also see where the same linkages can be made across country and regional borders. The cross-border ecosystem remains particularly vulnerable and at risk to health threats due to a variety of factors including the intensified movements and interactions that can happen between humans, animals, and commodities on both sides of the border. These are further complicated by variations in surveillance structures and national guidelines. The cross-border ecosystem represents a territorial entity made up of several local or regional authorities that are co-located but belonging to different nation states. The EBS process in this setting involves establishing a permanent and systematic communication mechanism for effective information exchange regarding events taking place near country and regional borders. This can be organised through a network of NPHIs or other institutions with a surveillance mandate through bilateral agreements or under the umbrella of the African Union or a regional economic community. Cross-border EBS can be established at the national-level through media scanning and hotlines or at the community level within the “grey” zones where both countries co-exist and interact in trade, farming, education, etc.

Collaboration may take many forms when implementing EBS, some of which are outlined in Table 4.

Table 4. Examples of EBS collaboration partners within the Ministry of Health, across sectors, and with other entities.

Collaboration between programs within Ministry of Health	Collaboration across multisectoral, One Health partners
- Emergency response programs - Disease surveillance and control programs (e.g., communicable, endemic, etc.) - Expanded Program on Immunization - Environmental health program/department - Food safety (INFOSAN) and AMR - Infection prevention and control - Central laboratories - Programs that utilise CHWs (e.g., maternal and child health, disease specific initiatives) and promoted health education initiatives	- Ministry of Agriculture, Livestock, and Fisheries (or similar agency) - Ministry of Environment (or similar agency) - Ministry of Wildlife (or similar agency) - Ministry of Education - Ministry of Labour - Ministry of Defence - Ministry of Tourism - Other relevant government agencies (e.g., commerce, foreign affairs, social affairs, interior, natural resources)

Collaboration with other entities

- Implementing partners, donor organisations, multilateral organisations
- Non-governmental organisations
- Factories and workers' unions
- Private medical practices including veterinarians and pharmacies
- Civil Society Organisations
- Immigration services
- Other relevant private sector entities (e.g., professional organizations)

Priority Events and Signal List Development

Prioritizing what signals and events should be detected and reported is complex, and requires input from many different government sectors, including human health-related sectors but also, animal (e.g., wildlife, livestock, and other domestic animals), agriculture, environment, and border health/quarantine government sectors among others. It is recommended to create a technical working group made up of representatives from different relevant sectors that can contribute to EBS. This multisectoral technical working group should define a list of priority events to inform EBS implementation, and may wish to refer to several disease prioritisation tools (e.g. WHO *Setting priorities in communicable disease surveillance*[9], ECDC tool for the prioritisation of infectious disease threats[10], WOAH's Phylum tool[11], US CDC One Health Zoonotic Disease Prioritization Process[12], etc.) that can be adapted to help with this process.

[9] WHO: Setting priorities in communicable disease surveillance

[10] ECDC: Tool for the prioritisation of infectious disease threats

[11] WOAH: Phylum tool

[12] US CDC: One Health Zoonotic Disease Prioritization (OHZDP)

Once a priority list of events has been developed for EBS, signals that would allow for the early detection of these events should be drafted. The WHO defines signals as data and/or information representing potential acute risk to human health, such as an outbreak or occurrence of natural or man-made disasters. Signals recognize patterns and other occurrences, such as clusters of illness, animal deaths, and ill persons presenting with symptoms or signs not usually seen (e.g., treatment failure on standard drug regimen). Signals should be broad, aiming for high sensitivity, and should be framed in a manner that allows for the capture of emerging threats and all hazards. Signals are not meant to be standard case definitions for specific diseases or conditions. In general, to ensure sustainability, the list of signals should be limited in number so as not to burden stakeholders and the entire surveillance and health system. It is also important to note that the process of event and signal selection should be dynamic, readily amenable for additions or deletions as the need arises. It is suggested that a routine review of signals and their definitions be conducted to assess their performance and suggest modifications. For communities, signals should be simple and should take into consideration both local language and cultural contexts. It may be worthwhile to field test the signals before full-scale implementation of EBS.

Note: Where EBS incorporates a One Health approach, sector- or population-specific signals should be developed to capture events that affect different groups (e.g., humans, animals, plants, environment) or are detected by different sectors.

A short list of example signal definitions is listed below; however, we encourage readers to review the more detailed list of signal definitions by sector and facility type listed in Annex 5.

Examples EBS signal definitions:

- Cluster of deaths in a healthcare facility, village/community, farm, wildlife or domestic animal population, construction site, mine, school, prisons, orphanage
- Cluster of disease of unknown aetiology in a healthcare facility, village/community, farm, wildlife or domestic animal population, construction site, mine, school, prison, orphanage, or other institution over a defined period (e.g., two weeks)
- Any unusual event or occurrence in the community which may affect human, animal, plant, and environment health
- Any health-related event that raises concern, fear, and alarm in the community.
- Any event /occurrence which may have a known, suspected, or possible impact on health

Information Flow

A country can choose to implement all types of EBS covered in this document or choose to incrementally implement EBS, for example initially focusing on media scanning or community event-based surveillance (CEBS), and subsequently adding other types of EBS later. Whatever direction the stakeholders take to implement EBS, it is imperative to ensure there are efficient coordination mechanisms (e.g., MCM, data sharing policy) in place, both between levels of government and across relevant collaborating sectors, to support the integration, flow, and use of data at all levels. The information flow for EBS reporting and feedback should also align with and leverage on existing surveillance reporting structures. Figure 5 illustrates how information can flow within and across sectors or bordering countries. Most typically signals that are detected at the community level by CHWs, CAHWs, key informants, or other community members are reported immediately to a community level supervisor or “local EBS FP”. Signals or events that are detected at a facility level are reported to the intermediate-level FP. Signals detected in small health facilities may also be reported to the local level. The local-level EBS FP triages and verifies

signals, and reports events up to the intermediate level. In the absence of the local level, surveillance officers at small facilities and community health worker supervisors report signals up to the intermediate level or could be trained to verify facility and community level signals, respectively.

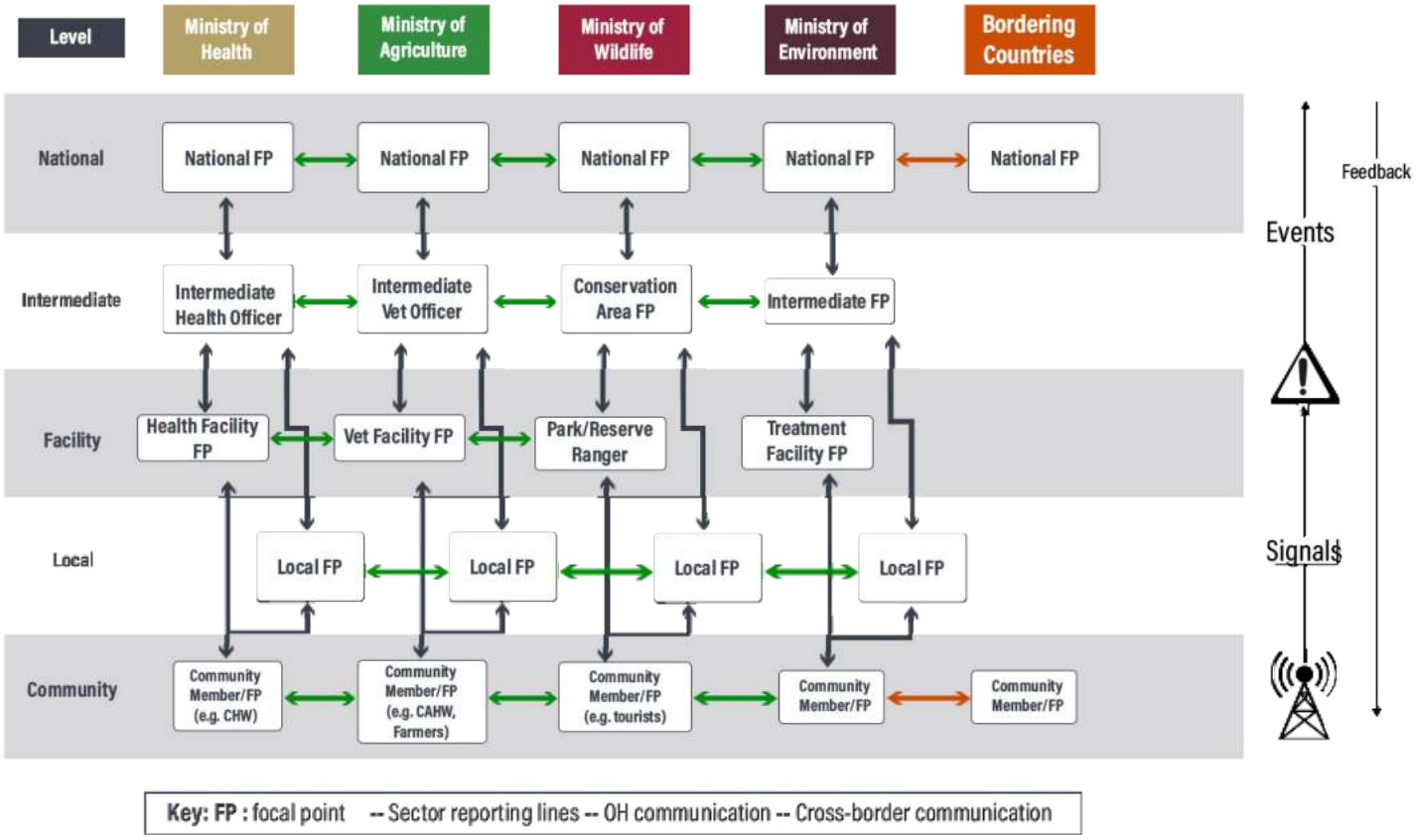


Figure 5. Flowchart for EBS implementation, indicating the flow of data collected through various EBS sources as well as the feedback loop.

Signals reported by community members through a hotline may initially be received at the national level but should be referred to the local or intermediate level for triage and verification. All events received at the intermediate level require an assessment of risk and may require consultation with higher administrative levels depending on the magnitude of the event. Once the event has undergone a risk assessment and characterization, an alert should be issued to the responsible authorities that need to undergo any response related activities.

Timely and routine feedback should be provided in a similar fashion. Higher administrative levels should provide feedback to intermediate-level health authorities on reported events. Intermediate-level authorities should provide feedback about events and signals to reporters at the local level and large health facilities, respectively. Feedback on reported signals should be given to smaller health facilities and stakeholders at the community level by local-level authorities.

The success of EBS implementation is contingent on the early detection and reporting of signals and events through a country's surveillance and reporting structure. Timely and routine feedback can help to encourage reports and maintain consistent EBS implementation.

Note: While each country may classify the intermediate level differently (e.g., region, district, county, etc.), this term refers to the level of a country's surveillance system that is responsible for conducting preliminary investigations and implementing responses to reported health events or suspected outbreaks in each jurisdiction. In some countries, and in the Integrated Disease Surveillance and Response (IDSR) system, the intermediate level may be the district-level unit and seen as the unit of implementation of public health services. For this framework, the term intermediate level will be used to denote this level of the surveillance system. Because of their proximity to communities and health facilities, health authorities at the intermediate level can be engaged and trained to ensure that events reported to them are accurately assessed for risk. The integration of EBS data into existing national surveillance platforms may also occur at this level.

Routine EBS Meetings

Event-based surveillance, especially when using media scanning and hotline, will capture a number of signals from a wide variety of sources each day that need to be sent for verification and follow-up. To remain relevant and timely, the national EBS unit should conduct regular meetings (e.g., daily) to review the detected signals and their verification and response status. Relevant information should be collected for these meetings. Daily EBS meetings are recommended at the national level for routine work. If there is an emergency or a signal of high importance, an immediate meeting is recommended. A daily report for the detected signals and their verification status should be disseminated to stakeholders defined by the country. A weekly meeting summarising the activities of the EBS unit for the week should also be prepared and disseminated to a wider audience, including members of the EBS network in the country (e.g., CHW, CAHW, healthcare professionals, and veterinarians).

Workforce Considerations

Event-based surveillance should be part of routine surveillance and response systems within a country. In addition to health authorities at the national level, those at the intermediate level who typically conduct routine surveillance activities should also be involved in carrying out EBS functions.

At the national level, the NPHI or other health agency responsible for the implementation of EBS must build the capacity of national staff in collaboration with relevant partners and stakeholders. Training should be cascaded from the national level to lower administrative levels and include training on conducting risk assessment and characterization. These health authorities should subsequently act as trainers for the workforce involved in EBS implementation at the local level, in both communities and facilities. Following the initial training, periodic refresher training or capacity building should be offered to all EBS staff on the functions of EBS that they should carry out. These refresher trainings can be combined with ongoing or routine monitoring visits conducted by intermediate-level health authorities. Continuous capacity building will ensure consistent implementation of EBS across all administrative levels.

Mentorship

To ensure a network of expertise is continually supporting EBS program staff, implementers should incorporate an element of mentorship. Mentorship is a long-term, mutually beneficial relationship between a person with significant experience in a field (the mentor) and a person with less experience (the mentee), with the goal of helping the mentee improve their professional and personal skills in that field. Mentors give advice, support, and

counsel to their mentees. They do this by coaching, teaching, and modelling the behaviours that mentees need to learn to become established members of their professional domain.

Mentors require a deep understanding of the domain in which they operate, as well as the domain of mentorship itself. It is not enough to be an expert in the field. Knowledge of mentoring methods and when to apply them are essential for promoting the growth of the mentee. EBS mentors should have a strong background in epidemiology and surveillance, as well as previous training in, and a deep understanding of, all aspects of EBS. A network of mentors with an in-depth knowledge of EBS and how it is applied in their countries can provide ongoing peer-to-peer support and training of the health workforce. Networks of mentors and mentees can develop and sustain the capacity of health workers to implement EBS within the country. **Mentors should be trained on all aspects of EBS, how to be a mentor, and how to train health workers in EBS**.

Mentorship is usually sustained over time and a mentor function as an experienced and trusted advisor to the mentee. The mentor's job is to listen, provide feedback, help their mentee explore the options available, provide them with the resources needed to support their decision-making process, and help them develop new capabilities.

When considering implementing a mentorship model to support EBS, programs should consider the following:

- What staff or positions will benefit most from mentorship? (e.g., staff such as EBS FPs at local or intermediate levels may be good candidates)
- What functions and responsibilities might be challenging to staff that are new to EBS, and where mentorship can support these responsibilities?
- What organizations and professional networks might provide access to qualified mentors?
- What is the ratio of potential mentors to those staff that might require mentorship? It is important that the demands on a mentor's time not be excessive.
- What career benefits might a mentor and mentee obtain through this approach?

Supportive Supervision

Routine supervision visits are integral to the effectiveness of EBS and should be conducted on a regular basis. Supervisory visits should be conducted by EBS FPs at each administrative level, with staff from higher levels visiting staff at lower ones. "**Supportive supervision is helping to make things work, rather than checking to see what is wrong**" is a constructive way to approach this supervisory role.

Supportive supervision can increase staff capacity to collect, manage, and use data, helps staff to improve their own work performance continuously, and can help to establish a collaborative working environment. Supportive supervision visits should be 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 staff. This approach encourages open, two-way communication, and a team-building aspect that encourages collaborative problem solving.

Supervisory visits should:

- Discuss challenges with EBS implementation (EBS staffing, training, availability of resources needed [equipment/training materials/forms], problems with filling forms and records, etc.)
- Identify challenges and solve problem together
- Provide technical assistance and provide hands-on refresher training as needed

- Praise for success stories and work well done
- Record observations and collect feedback to report up for process improvement

It is critical that each surveillance level (e.g., intermediate, local) includes supervision visits in their annual workplan and a common supervision calendar should be put in place and followed by all surveillance levels. During work planning, budgets should also reflect these supervisory visits. They can be included as part of other visits to reduce costs, but time must be dedicated to ensuring the checklists are covered completely. This should also be accounted for within the program M&E plan - documenting the proportion of planned supervisory visits that are conducted (with checklists and feedback reports by each level) throughout the year.

Steps for Conducting Supervision Visits

Before the visit:

- Following the supervision calendar, set up supervision visits and identify appropriate supervisors to conduct the visit
- Review previous monthly reports for the supervisee and check if they were completed correctly, completely and on-time
- Review past supervision checklists for the supervisee to understand past challenges and successes and know what recommendations were made for improvements at the last visit
- Know the EBS Guidelines and be an expert in knowing how the logbooks should be completed

During the visit:

- Systematically go through the questions in the checklist with the appropriate staff person and document everything clearly
- Ask to see all tools and documents that should be available at the facility and document where they are stored
- Review logbooks
- Review the findings with the supervisee and discuss why things are going well and what challenges exist
- Jointly come up with specific actions for all questions where things are not going according to plan (“no” in the checklist)

An example supportive supervisory checklist is listed in Annex 6.

Resource Considerations

Where possible, EBS as an integral component of routine surveillance activities, should use existing resources and infrastructure set aside for routine surveillance. One of the resource requirements for EBS implementation is the availability of a training manual and training curricula which should be developed to facilitate training of lower administrative levels. Additional resources may be allocated to ensure that regular refresher training takes place.

Another set of resources required for the implementation of EBS is data collection/recording tools. Events reported to health authorities can be recorded using existing surveillance data collection tools where available, to ensure that data collected through EBS is integrated into existing data platforms. For this document, it is recommended that countries use available tools where applicable, like the IDSR District Log of Suspected

Outbreaks and Rumours (see adapted version in Annex 4) to collect data on signals and events. Supervisory or monitoring tools available for similar routine surveillance functions can also be utilised to monitor EBS functions at intermediate and local levels.

Resources may also be allocated to establish a reporting tool to enable the rapid transmission of information from communities, facilities, and other sources to designated health authorities at the intermediate level. These reporting tools may be electronic or/and paper-based but should be clearly defined among all administrative levels to ensure consistent EBS reporting and feedback.

Resources for EBS Implementation

- EBS training manual
- EBS training curriculum/guidelines and associated resources to carry out training and refresher trainings at lower administrative levels
- Data collection tool for signals and events collection
- Monitoring/supervision tools
- Reporting tool to ensure immediate reporting from lower levels
- Communication and reporting tools such as cell phones, computers, laptops, tablets, an electronic platform
- Fuel for vehicles to conduct verification and/or field investigation

Considerations for Epidemic Intelligence and EBS During a Pandemic

An optimal **EBS system should be able to** detect **events** prior to them evolving into a pandemic **or** a PHEIC**. When an event** evolves **into a larger outbreak, pandemic or PHEIC in other countries or global regions, the same system can be used to** monitor **for and** detect **the introduction of the pathogen as well as the** beginning **of community transmission (**at **the early stages of** the **pandemic) within a country. As the pandemic** evolves there **may be** additional pathogen **characteristics or** response related **activities** that can be detected and monitored through EBS. **These include the** emergence of variants (as in the case **of SARS-CoV-2),** new populations being affected (e.g., **domestic animals** for **SARS-CoV-2 and monkeypox),** or **public health and social measures** put in place (e.g., **vaccines** administered, **movement** restrictions implemented**) to** counteract **the pandemic.** The **following** is an illustration of **how EBS platforms can be** enhanced throughout **the** various phases **of a pandemic** using COVID-19 as an example.

Early Phase: prior to the introduction of a pathogen

When SARS-CoV-2 had not yet reached all countries, the goal of surveillance was to detect the importation of the virus as early as possible to quickly isolate cases, quarantine contacts, and delay establishment of local transmission. At this phase many Member States took the following steps to enhance their existing EBS and prepare for the arrival of SARS-CoV-2 virus:

- Updated country priority event list and signal definitions to detect COVID-19;
- Disseminated updated signal definitions to all PoE, including border communities;
- Established hotlines and engaged the general public on reporting COVID-19 signals through the hotline;
- Established/strengthened event-based surveillance in health facilities and communities to detect cases;
- Engaged laboratories, pharmacies, and community institutions to identify and report detected cases promptly; and

- Revised other surveillance protocols, especially for respiratory-related sentinel surveillance like ILI and SARI. This included expanding testing to include SARS-CoV-2 and monitoring surveillance data for aberrations and increases in cases beyond established baselines and alert thresholds.

Early to Mid-Phase: initial cases or clusters being reported

In this phase, countries are detecting initial cases or clusters of cases linked to a recent importation. They are also monitoring for the transition from only reporting imported cases to community local, indigenous transmission and using this information to trigger response and control measures. For COVID-19, many Member States initiated the following activities in this phase:

- Established/strengthened EBS (and IBS) in health facilities and communities to identify and link symptomatic individuals to testing, isolation, and treatment as well as facilitate contact tracing to minimise transmission and poor outcomes.
- Updated signal definitions and media scanning keywords to include updated terminology that describes populations most affected, new symptoms, recent variations in the pathogen, etc.
- Strengthened regional networks and expanded laboratory capacity to include genomic sequencing and monitoring for genetic variation in the viruses circulating.
- Reviewed other surveillance system data (e.g., sentinel surveillance) for unusual trends that might represent unrecognised transmission and monitored for aberrations and increases in cases beyond previously established baselines and thresholds.

Mid to Late Phase: sustained community-wide transmission with ongoing interventions

Here the goal is tracking the course of transmission in communities, understand the geographic scope of the outbreak, describe the impact of disease (including risk factors for severe disease), and monitor the progress and success of interventions put in place to prevent or control the pandemic. For SARS-CoV-2, this meant putting in place the following activities in many Member States:

- Updated signal definitions and media scanning keywords to include updated terminology that describes interventions or outcomes of intervention put in place (e.g., vaccination coverage or adverse events following immunisation [AEFI]), changes in the pathogen like new variants circulating, etc.
- Reviewed and updated EBS signal definitions at health facilities and within communities to ensure clusters of cases and unusual respiratory events that can signal a resurgence or emergence of variants are being captured.
- Strengthened all existing surveillance, ensuring the pathogen is incorporated into routine monitoring in preparation for transitioning out of an emergency response. This can also include expanding existing surveillance to include other sample sources like wastewater surveillance for SARS-CoV-2.
- Maintained and updated sentinel surveillance to monitor trends and establish alert thresholds when resurgence may occur.

CHAPTER 3: HOTLINES

Introduction

A hotline is most typically a phone line that the general public can use to obtain or provide information. Within EBS, a hotline is used to capture signals reported by the community that may impact the public's health, including signals that could signify emerging health-related events or outbreaks. Key considerations when establishing EBS using hotlines include:

- Establish clear and simple communication channels to facilitate community reporting
- Create short and easy to remember hotline numbers
- Ensure hotlines are operational at all times and are moderated by a team of trained employees who can immediately respond
- Advocate and promote hotlines broadly in the local language to ensure the community knows what to report and who to report to

Sources: Hotline Platforms

Channels such as voice call lines, short message service (SMS), and social media messaging platforms (WhatsApp, Facebook, or Twitter) may be leveraged for the implementation of hotline EBS. If multiple systems are in use, where possible, use the same number to avoid confusion.

Voice Call Line

A voice call line is a direct phone line to a toll-free phone line that the general public can use to contact an institution/organisation about a particular health concern. Voice call lines should preferably be short, and memorable, customised codes or numbers (e.g., 311). These hotlines enable callers to swiftly report signals that indicate the possibility of a health event occurring.

Interactive voice response (IVR) can be used to automatically guide the caller through the initial steps of the triage. IVR can both speed up and facilitate the recording and triage process before directing the call to a human being. For deadly endemic diseases and during outbreaks, automated messages can also be set up to include pertinent health messaging to pass back to the members of the public.

Wherever possible, it is advisable to establish collaborations with telecommunication companies to provide a "service" in every new telephone to readily dial the hotline number. The cost of reporting signals to health authorities should be zero.

Short Message Service and Unstructured Supplementary Service Data

Some hotline systems are set up to allow for the sending of an SMS, or "text message". Correspondents send queries to an institutional SMS contact number, which can also be used to respond to queries about signals or ongoing health events.

Unstructured supplementary service data (USSD) is very similar to SMS but uses a Global System for Mobile Communications (GSM) protocol that creates a real-time connection and allows for a two-way exchange of information between users. USSD is more responsive than services that use SMS.

Chatbots can also be used to automatically guide users through the initial steps of the triage and can be leveraged to speed up and facilitate the recording and triage process before directing the user to a human being.

Social Media Messaging Platform

Social media messaging are online platforms that enable the general public to report and share information and engage them in social networks, like Facebook, Twitter, blogs, and WhatsApp, among others. Most of the platforms are free and available on the internet as downloadable applications to devices, including smartphones. A special dedicated contact number or account can be set up and used to capture signals from these platforms. Chatbots can also be used on these platforms to facilitate the triage process.

Steps of Hotline EBS

Detection and Triage

Typically, both detection and triage occur at the same time with hotlines, which is facilitated by providing the hotline desk operators, or responders, with a list of priority signals that they refer to during the call or while reviewing the messages sent. The hotline team should be trained on how to respond to and collect information from the public in a professional manner. The public should feel respected while reporting information. This ensures sustainability of participation in reporting signals. The responder to the call should start by greeting the caller and thanking them for their proactivity in reporting the concerning potential health events. Then, the responder should follow a prepared script that includes the list of signals and standardised set of responses. Calls can be recorded to help with recording signal information and be used to help monitor and evaluate the team's responses to the calls. The hotline desk team should record the category of the caller (e.g., teacher, health professional, opinion leader) and triage any received notifications to determine which signals are of importance (i.e., exists in the lists of signals). All signals, as well as a minimum set of data for each signal, should be registered in a signal logbook (see Annex 1 for example signal logbook) or using digital tools like a customer relationship management (CRM) system. When an IVR or other automated service is used, the responder will be the one to directly register the signals that meet the predefined list of signals electronically or in a register. In situations where a call is interrupted or disconnected, or if calls are received while the responder is busy, calls should be returned as soon as possible. This will ensure that all signals are collected. The call should be ended by thanking the caller again for their time, patience, and proactivity.

All the above applies to SMS and social media messages received, except that the use of automated messaging could be used to help facilitate communication, triage, and data collection. Information about the sender should be collected to permit further communication and gather additional details about the signal reported. A direct call by the EBS unit to the sender may be the timeliest approach to gathering additional information.

Confidentiality for all callers should be maintained as per the country's laws. Calls or messages received by the hotline but later deemed to be malicious or without merit should be noted and action should be evaluated for response (or to legal teams as appropriate).

Verification

All priority signals picked up through the hotline should be forwarded to designated health authorities for verification. Verification should be done at the level nearest to the location of the signal. Typically, this involves the Hotline operator contacting the intermediate EBS FP for verification. The intermediate EBS FP then contacts the most appropriate EBS FP who can verify the signal at the site of occurrence (e.g., local EBS FP, HEBS FP). If needed, the intermediate EBS FP may also contact the designated EBS FP in another sector (depending on the origin of signal). If the signal is true, it becomes an event and if not, it is discarded, and recorded accordingly in the event register. Feedback is provided from the intermediate EBS FP to the national unit (e.g., hotline desk, disease surveillance FP and other relevant offices).

The individual or unit responsible for signal verification will vary by country but might be either a local or intermediate-level surveillance officer working in the location from where the signal originated. Verification may only require a simple phone call or an actual site visit.

Risk Assessment and Alert

Once verified, depending upon the capacity available, the risk assessment could be performed at either the intermediate level or national level. Once the risk level is determined this EBS unit would then send an alert to the team designated to respond.

Advocacy

Advocacy for the hotline should involve health authorities, community health workers, non-governmental organisations, religious and other leaders, or schools. They can all actively be involved in the dissemination of information to the public about what information should be reported and how the public can report this information (i.e., what number to call). Hotline numbers can also be advertised through promotional messaging on traditional platforms such as TV, radio, and newspapers. This messaging should be in locally spoken languages to ensure inclusiveness and reach the maximum number of individuals.

Developing partnerships with major communication companies as well as communication ministries or agencies within a government may also support widespread messaging about the existence and utility of an EBS hotline. For example, communications companies can send SMS messages to their clients to spread the message about the purpose of EBS, the importance of immediately reporting signals, and how signals can be reported.

Monitoring and Evaluation

The procedures implemented for responding to calls and messages should be regularly reviewed and updated as needed in collaboration with the Hotline EBS team. The calls received could highlight the need for revising the list of signals based on the requests or concerns raised by the public. The recording of conversations with the EBS unit using digital tools such as CRM, where applicable and based on local laws, should also be regularly analysed to verify the established procedures are correctly followed, deliver refresher training to the EBS unit, or to address individual cases.

CHAPTER 4: MEDIA SCANNING

Introduction

Media are channels of general communication amongst a population, and they act as gathering tools used to store and disseminate information or data. Media include newspapers, magazines, TV, radio, bulletins, and other printed forms of communication. Electronic or online media sources, such as social media, can substantially frame public opinion. Digital media platforms are increasingly becoming an important tool used by many media organs to reach a wide diversity of audience and thus forms a critical source to be leveraged for early detection of health events.

Internet-based media scanning is a rapid process of capturing EBS information from a wide variety of digital media sources. Not only should a country's specific sources be scanned, but neighbouring or cross-border programs, regional, and global sources are recommended to be considered for media scanning as well. The sources for media scanning can be publicly accessible or may require registration. Some websites are for internal communication, for example, the WHO Event Information Site for national IHR focal points. Internet-based media sources can be classified into official and non-official sources.

Official Sources

Signals detected through official sources are reliable and do not need further verification to be classified as events. The following are examples of official sources:

- Official websites and social media accounts of governmental sectors including, but not limited to Ministries of Health, Agriculture, Environment, and Foreign Affairs
- Official public health agencies' (e.g., Africa CDC, US CDC, ECDC, China CDC, UKHA) websites
- Websites for official organisations such as universities and internationally recognized centres of research
- Official pages/accounts on social media for governmental and official organisations: most organisations have official accounts on social media which can be considered a reliable source of information
- WHO official websites for Early Warning (e.g., WHO's IHR Event Information Site for national Focal Points) which is a secured platform accessible only to national focal points
- WHO Disease Outbreak News (DONs)
- Websites for WHO regional offices (e.g., AFRO, EMRO, EURO, SEARO, WPRO, PAHO)
- Disease-specific sources (e.g., Global Influenza Surveillance and Response, OFFLU)
- World Organisation for Animal Health (WOAH); World Animal Health Information System (WAHIS)
- Food and Agriculture Organization (FAO) of the United Nations; EMPRES-i
- International Food Safety Authorities Network (INFOSAN), European Food Safety Agency (EFSA)
- The International Atomic Energy Agency (IAEA) for environmental events (radiological and chemical)
- Network of WOAH reference laboratories

Unofficial Sources

The signals detected through unofficial sources need to be verified, though they may be a good source for detecting and gathering information on acute health events. The following are examples of unofficial sources:

- Newspapers and magazines
- Online content of TV and radio channels
- Social media (e.g., Facebook, Twitter)
- ProMed

Steps of Media Scanning EBS

Detection

Media scanning is an active process that should be performed using various media sources. A list of priority events to be monitored along with a standard operating procedure on how to detect and monitor for these signals and events should be prepared before implementation. Both national and international sources should be considered. Media scanning is recommended to be performed at the national level but can be rolled out even to sub-national levels, depending on administrative structures and availability of resources.

Online information sources can be scanned manually on a daily, or more frequent, basis by visiting pre-defined websites regularly and searching for relevant information according to the list of priority events. Searches can be conducted automatically through advanced technological tools that aggregate online information from multiple sources using keywords compiled from a list of signals. An automated method of conducting EBS can provide much more information with less time and effort. However, information captured by the platform must be triaged by a person to decide whether the information is a signal that should be verified or otherwise acted on. The country can choose which media scanning method to use, according to available resources.

Media Scanning

Manual scanning requires taking the following steps:

- Develop a checklist of online sources for scheduled review
- Develop a list of prioritised signals regarding hazards, strategies, capacities, and resources of the country
- Develop a list of keywords related to the list of priority diseases, syndromes, or conditions; if needed, translate the list of keywords into the local language
- Visit all predetermined websites in the checklist of online sources to scan for keywords
- Audit the source checklist continuously to ensure that newly available sources are added to the predefined source list and that non-working / non useful sources are removed

Automated Scanning

There are multiple automated technological tools that can be used for scanning of online information from predefined sources. These tools can save time and effort and support early detection of signals from animal, human, environment, and other relevant sectors:

- Rich site summary or really simple syndication (RSS) is a web standard that allows users and providers to share updates to websites in a standardised and computer readable format.
- Data aggregators are client software or web applications that monitor and aggregate designated websites and inform the user with updates.
- Contributor-based sources are based on sharing information among health professionals, in which individuals collect information that can be accessed through shared feeds. ProMED mail is the most relevant example.
- Automated information feeds or services developed by governments or international organisations that collect health information from several sources - decreasing the time spent in scanning for individual sources. These are also called media aggregators, and many are currently undergoing development. EIOS (https://www.who.int/initiatives/eios) and GPHIN (https://gphin.canada.ca/cepr/aboutgphin-rmispenbref.jsp?language=en_CA) are the most relevant examples.

The difference between an RSS feed and a data/media aggregator is that RSS feed is a standard for sharing updates from websites sharing content updates while aggregators are software tools that can use RSS to retrieve updates from multiple websites or sources.

Technology tools for scanning online sources of information may be developed by each country for optimum customization, while free applications for scanning the online content are available. For example, Google Trends can track keyword queries in time and by location. Additionally, Google Alert is a free service that sends emails to the user when it finds new results matching the user's keyword queries.

Triage

If the EBS information matches one of the predefined signal definitions for the country and is not a duplicate, the signal should immediately undergo verification. If the signal is generically defined, for example, an unusual event that may pose a health threat, a qualified health specialist or team leader should assess the signal to decide whether to discard the signal, or to proceed for verification. Signals detected from official sources do not need further verification and can be logged and undergo risk assessment immediately after detection.

Logging Signals

In media scanning, signals are detected using manual or automated tools as described above. It is recommended that signals that are captured from media correspond to the predefined list of signals and should be registered in a signal logbook. Each signal captured should include data about the signal's detection and verification until the response (see example in Annex 1). Signal registration for media scanning should include the following minimum data set for tracking purposes:

- Source/informant: the website where media scanning signal was obtained
- Signal: when it happened, who/what was affected (cases, deaths) and where it originated and spread
- Follow up of the signal: verification, risk assessment and response

Verification

For media scanning at the national-level, verification can be done via two possible pathways:

- Direct contact from the national level to the local level: This pathway bypasses the intermediate level. However, the intermediate level may not have enough information about the signal to carry out verification and response if needed. Direct contact to the local level may ensure immediate contact with the authority in charge for verification.
- The usual pathway of routine surveillance (national -> intermediate -> local) is recommended because it ensures notification and follow-up of the intermediate level, which may also facilitate response to the event, if needed.

Risk Assessment

At this stage, the FP at the intermediate level convenes a multi-disciplinary team to determine the extent and magnitude of the event. The steps are the same as those listed for the hotline.

Alert

The unit at the national level should assign at least one person to follow up on signals sent for verification until verification is obtained. According to the country's capacity, the country can decide the number of responsible personnel for follow up. However, at least one person from the media scanning team should be responsible for the follow up of the signals that were sent for verification until it is confirmed that the verification process is

completed. If the EBS unit is operating 24/7, the same person who captures signals should follow up those signals waiting to be verified, during the same working shift. For proper handover between shifts, the ending shift should update the starting shift with the verification status of the signals.

CHAPTER 5: FACILITY EVENT-BASED SURVEILLANCE

Introduction

Facilities for event-based surveillance (FEBS) include human health, animal health facilities (e.g., veterinary clinics, zoos, farms), laboratories, environment (e.g., wastewater facilities) and others. Clinicians, nurses, CHW, veterinarians, para-veterinarians, CAHW, field extension workers and other relevant professionals are trained within the facilities on how to report on signals. Depending on the type of facility, the signal may take a variety of forms such as: cluster of deaths (health facility), antimicrobial resistance AMR (laboratory), animal abortions (animal health facility), etc. A detailed list of signals by sector and facility type is listed in Annex 5. Event-based surveillance may allow for the recognition of emerging or re-emerging health threats because it is not disease-specific, requires immediate notification, and it is highly sensitive and broad. Additionally, since EBS does not require laboratory results for reporting and relies on health facility workforce reporting patterns (such as healthcare workers' sickness after treating an ill patient), it may be more practical, and simple to establish and sustain. This type of surveillance should include all health facilities including private practitioners or facilities that may not participate in routine reporting through IBS.

Ideally, all facilities public and private, including practitioners, should participate in both IBS and EBS since signals can come from both surveillance systems as part of EI to inform EWAR. Historical data gathered over time during routine sentinel surveillance (e.g., IBS) can provide alert thresholds or benchmarks against which to compare the early course of an event or outbreak, particularly if baselines and thresholds have previously been defined. For example, alert thresholds put in place for influenza-like illness (ILI) surveillance that are exceeded can indicate the start of an influenza or other respiratory disease outbreak. However, if IBS reporting is not routinely followed or acted upon, receiving FEBS signal reports could reinforce the urgency of the potential event.

Steps of Facility EBS

Detection

Signal detection for FEBS is highly specific to the sector and facility type conducting this type of EBS. Focal points (FP) should be identified within each facility or that will cover multiple facilities (e.g., veterinarians that cover multiple farms within a region). These FPs should be trained on signals that need to be detected and reported immediately. These FEBS FPs should sensitise other staff at the facility on signals and how to report them to the FP.

Triage and Verification

Given the same signal could be reported by different health care workers from the same facility, the FP needs to triage these signals and verify accordingly. The FP always needs to work in close collaboration with the reporting staff or facility (e.g., if this signal is reported from another facility) to perform verification. Once the signal is verified, the risk assessment process is completed by the health unit. **Note: the process of verification and reporting should be completed within 24 hours.**

Risk Assessment and Alert

Risk Assessment most typically happens at the health unit within its jurisdiction whether this is at the local, intermediate, or national level. See chapter 1 for more detail on risk assessment methods. **Risk assessment should take place within 48 hours of signal/event detection.**

Based on the risk assessment and characterization, the signal becomes an event and appropriate response should be conducted by the intermediate or national level.

Health facility staff scenario

A previously healthy clinician of a large, tertiary hospital develops severe respiratory symptoms and calls in sick a few days after caring for a patient with severe respiratory illness. Worried that this clinician acquired the infection from one of their patients with severe respiratory disease, the clinician's colleagues immediately report this as a signal to the FEBS FP.

Immediately upon hearing about this signal, the FEBS FP should notify his or her designated point of contact at the local or intermediate level. Health authorities at these levels will then take the necessary steps to triage and verify the signal as an event, assess its risk, and implement appropriate investigation and response measures. In this scenario, the roles of the ill clinician's colleagues and FEBS FP are to detect, sometimes triage and immediately report this signal to their point of contact at the local or intermediate level.

Animal health facility scenario

During a routine farm visit, a veterinary field officer (VFO) noted that several animals in the herd were bleeding from the nares, reluctant to move, trembling, and having difficulty breathing. Concurrently, he received a call from a neighbouring farm where cattle presenting with similar clinical symptoms suddenly died. The VFO confirmed the occurrence of a cluster of animal deaths at the neighbouring farm and immediately reported this as an event to the intermediate-level EBS FP from the Ministry of Agriculture.

Given that this domestic animal event could pose a threat to both wildlife health and human health, the intermediate FP should immediately alert the EBS colleagues within those sectors. The intermediate FP should also conduct a rapid risk assessment to help inform who is alerted and what actions should be taken next. In this scenario, the role of the VFO is to detect signals and verify events during visits to "animal health facilities'' or farms. The role of the intermediate EBS FP is to conduct a risk assessment and immediately report this animal event to their point of contact at the national level and within the other collaborating sectors. They can also support other steps of EWAR including response to the event.

Information Flow

The flow of information for notification and feedback on Facility EBS is illustrated in Figure 6. According to this structure, signals are detected at the facility level and reported to a designated FP at either the local or intermediate level. In the case of a human health facility, the detected signals are then notified immediately to the designated EBS FPs of the surveillance system. Signals detected in small facilities could be reported to the facility FP within that jurisdiction or to a local-level health authority depending on country reporting architecture. Signals detected at large facilities are triaged and verified by the facility surveillance FP.

Surveillance FPs and local health authorities should report all events to the intermediate level where these health authorities can assess the risk of each event and respond appropriately.

FPs should encourage healthcare workers and other facility staff supporting EBS to continue detection even when certain signals are not real health events and are discarded. Regular feedback on the signals and events reported is imperative to sustain motivation to report among healthcare professionals and EBS FPs.

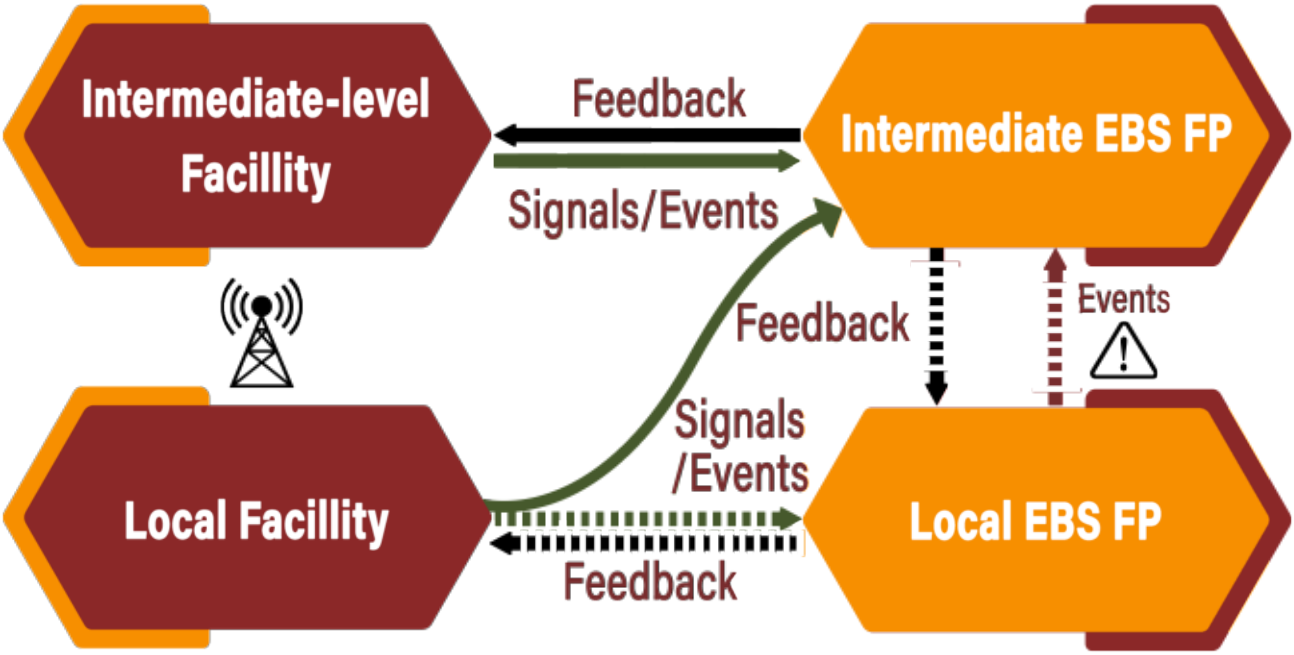


Figure 6. Flow chart for Facility EBS implementation, indicating the flow of data collected and feedback given

Resources

The implementation of EBS does not require many resources at the facility level. The recommended resources are described below. Communication materials such as posters and pamphlets can be developed and distributed to help raise awareness about EBS, particularly about what signals need to be reported from facilities and how the persons receiving the notifications can be reached.

It is recommended for the national and intermediate level to develop all facility signals, signal registers or tools. Facility staff (e.g., healthcare workers, park rangers, water treatment plant technicians) and EBS FPs should be encouraged to simply detect and report the signals immediately. A clear notification mechanism needs to be established to quickly transmit information from facilities to the designated health authorities or those at the higher level. These notification mechanisms can take many forms and can be done through, for example, the telephone, emails, SMS, or mobile applications. Increasingly, social media applications and platforms are being used to quickly report information between facilities and the designated health authorities and can be leveraged as a platform for notification and feedback in EBS reporting.

Physical resources recommended for Facility EBS implementation by facility staff and EBS focal points.

- Communications materials (e.g., posters, pamphlets)
- Established mechanism for rapid reporting (e.g., phone, hotline, SMS based or social media platforms)
- Training materials

Roles and Responsibilities

Like all other forms of EBS, the success of FEBS is based on the early detection and immediate notification of signals. The two general responsibilities of professionals in each facility are 1) able to detect signals, and 2) able to immediately notify the FEBS FP of each signal. FEBS FPs may be able to verify the signals directly at the facility and then should communicate with the next appropriate level the events detected at the facility for risk assessment and response activities.

Table 5 describes the main roles and responsibilities of EBS FPs and designated health authorities in the implementation of the Facility EBS. Each worker should be aware of their role and responsibilities and, in health facilities, must be empowered by health authorities to detect and report signals.

Table 5. Main roles and responsibilities of stakeholders that actively participate in FEBS.

FEBS actors	Roles and responsibilities
Facility Staff	- Detect signals - Share information on signals with FEBS FP - Receive feedback about signals from FEBS FP - Participate in training on FEBS, facilitated by health authorities
FEBS FP	- Participate in training on FEBS, facilitated by health authorities - Sensitise facility staff and key informants on FEBS - Detect signals - Record signals in notebook or applicable e-platform - Lead signal triage and verification for signals detected at facility - Report signals and events immediately to designated health authorities (e.g., local- or intermediate-level FPs) - Support risk assessments as needed - Receive feedback about reported signals/events from health authorities
Local-level supervisor/FP	- Participate in FEBS training, facilitated by health authorities at national/intermediate level - Assist in sensitising community stakeholders involved in FEBS - Receive reports of signals from local-level facilities - Record signals in register/logbook or an electronic register - Support local-level facility FP with signal triage and verification - Report signals/events immediately to intermediate-level FPs - Participate/conduct risk assessment and response activities - Provide feedback to local-level facilities reporting signals/events

Intermediate-level supervisor/FP	- Facilitate FEBS training for facility staff and FPs with national level - Assist in sensitising community stakeholders involved in FEBS - Receive reports of signals/events from Facility FPs (and local-level FPs, where applicable) - Record signals/events in register/logbook or an electronic register - Support Facility FPs with signal triage and verification - Report events immediately to national-level FPs - Conduct risk assessment and response activities, where applicable - Provide feedback to immediate lower level (e.g., local-level and facility FPs)

CHAPTER 6: COMMUNITY EVENT-BASED SURVEILLANCE

Introduction

The implementation of surveillance in community settings is essential for early detection, reporting, and response to emerging health events. Traditional indicator-based surveillance (IBS) systems generally collect surveillance data from healthcare sources and may miss health events or emerging outbreaks within a community, especially in areas where access to healthcare is low and/or where there is underutilization of formal health services. This chapter focuses on the role of CEBS as a function of EWAR and involves the community in the detection and reporting of signals.

The terminology used to describe surveillance conducted at the community level has varied in existing scientific literature, and has included community event-based surveillance, community-based surveillance, and community health surveillance, among others.

To be sustainable and effective, CEBS needs to be linked and integrated with existing national surveillance platforms. Ideally, the reporting of signals should occur through established surveillance and health structures.

Steps of Community EBS

Detection

Due to their connections to community residents and their networks, CHWs and/or key informants are most likely to detect signals using a predefined list of community signals. Community signals should be broad (non-disease specific), simplified, and free of scientific terminology to facilitate comprehension by community members. These signals should also be limited in number but broad enough to capture health risks in the community. Detected signals can be recorded in a notebook by CHW and reported immediately to health authorities.

Example CEBS Signal Definitions

- Two or more cases of people presenting with similar severe signs/symptoms from the same community, school, or workplace within one week ('severe' can be elaborated at the community level as needing to seek medical care)
- A cluster of unexplained domestic or wild animal deaths
- An unexpected change in animal morbidity/mortality
- An illness with novel or rare symptoms ('novel or rare' can be explained as signs/symptoms that the community has not seen before)
- Abnormal colour or odour of community water source (e.g., river, well, spring)

CHWs/CAHWs and key informants should immediately report detected signals to the next appropriate level. Once a signal is reported, health authorities at the appropriate level with capacity should perform the next steps of triage, verification, risk assessment and alert. Throughout this process, CHWs/CAHWs may be asked to assist with additional information gathering.

Triage

It is highly recommended that the CHW/CAHW is trained to perform the first level triage as signals could be detected and reported by community members. In this case, they would have the capacity of cross checking the reported signal with the pre-defined community list of signals. In a case whereby, the signal is detected by the

CHW/CAHW, the next higher level (e.g., the CHW supervisor) would be better positioned to triage. Systematic triage and verification of all signals detected through CEBS is essential in order not to overburden the surveillance system with false signals or unreliable information.

Verification

It is recommended that the CHW/CAHW and supervisor within the community or facility is trained to carry out verification. This could be done through a physical visit, telephone call or other means of communication with the source to establish if the information is true. The EBS FP conducting the verification may conduct a second level triage by cross checking if the information reported meets one or more of the pre-defined signals.

Risk Assessment

This step should be done at the lowest level with capacity (e.g., intermediate level). It should take place within 48 hours of the signal detection. See chapter 1 for additional details on how to conduct risk assessment and characterization within the framework of EBS.

Alert

The final report should be prepared by the risk assessment team and then submitted to the relevant authority (e.g., intermediate level, national level, etc.).

Workforce

CHWs and Community Networks

As CEBS entails working closely with communities, the most critical component of CEBS implementation is the recruitment and retention of those individuals with primary responsibility for signal detection. Those holding this responsibility may go by different titles in different countries, for instance, CHWs or community health volunteers. They may be paid employees of the surveillance system, paid through disease-specific programs or other donors, or may work as unpaid volunteers. For this chapter, the term CHW will be used to describe primary reporters from the community.

Community networks are an important resource for CEBS. Traditional healers, schoolteachers, village health chiefs, pharmacists, farmers, and small traders, among others, who reside in the community and regularly interact with other residents should form these networks as key informants. Such community networks can act as the “eyes and ears” on the ground, assisting CHWs and greatly increasing the chances of signal detection from the community.

Community event-based surveillance requires the training of CHWs and community networks to look for and report signals that they witness or hear about. A critical component of CEBS is refresher training: following initial sensitization, periodic refresher training should be offered to CHWs and community networks on signals that should be reported, as well as who to report to. These refresher trainings can be combined with ongoing or routine monitoring visits conducted by health authorities. Many countries also have a field animal health volunteer or field animal health workers who can be engaged with CEBS. CHWs are well positioned to act as primary reporters of signals because of their connections to the community. Ideally, CHWs should be community residents selected by their communities to lead CEBS activities on a voluntary basis. The recommended criteria for CHW selection are described below. It is recommended that CHWs be integrated as part of the healthcare system.

Recommended CHW Selection Criteria

- Resident in the community
- Well known, trusted, accepted, and respected among other community residents
- If role is voluntary, not expect compensation
- Willing to be a champion of their community
- Selection supported by community residents
- Recognized by all identified groups where ethnic, religious, and gender differences exist
- Literacy is encouraged, but is not a prerequisite
- Able to communicate in local language(s)

Congregate Settings in the Community

While many community health worker systems are focused on serving household units within a community, special consideration should also be given to congregate settings for the implementation of event-based surveillance. Congregate settings may include schools, large workplaces, houses of worship, and detention facilities. While each setting has its own unique characteristics, each is likely to have staff or leaders that act as key informants, as described above.

Community health workers and EBS FPs at the local level should support key informants that represent congregate settings in the community to strengthen EBS detection and reporting functions. While congregate settings have potential for rapid spread of infectious disease due to factors like large gatherings and close quarters, they also serve as mechanisms for rapid dissemination of information to populations at risk and understanding potential chains of transmission. Recruiting school nurses, teachers, workplace managers, faith leaders and other key informants in congregate settings should be a high priority when establishing CEBS.

Resources

Aside from human resources, CEBS requires minimal resources for its implementation. Recommended resources are described below. The development and distribution of communication materials such as posters or pamphlets may increase and sustain the awareness of community residents, key informants, and CHWs of CEBS, particularly on signals to be reported. These communication materials can either be distributed to community residents, or posted in public spaces, especially outside schools, in local marketplaces, and outside CHWs homes. In addition, these materials can also be used to sensitise community residents to CEBS in formal settings, such as during community meetings.

In addition to communication materials, CHWs could be provided with a notebook to enable the collection and recording of signal information. This notebook should not be a register, but rather a place for CHWs to record information before reporting. It should also contain a calendar, and if needed, pictorial representations of signals. An example CHW notebook is provided in Annex 3. Countries may also choose to pay the workers incentives or support the volunteers with phone credits, rain boots, or other items as additional incentives.

Minimum Resources for CHWs

- Communication materials (e.g., posters, pamphlets)
- Notebook to record signal information
- Mechanism for rapid reporting (e.g., phone, internet, or SMS credits)

Resources for Key Informants and Community Residents

- Communication materials (e.g., posters, pamphlets)

Furthermore, relevant information on signals reported to local-level supervisors could be recorded using a simple paper-based signal register/logbook or an electronic register. An example of a signal register can be found in Annex 2. Resources can also be allocated to establish a clear reporting mechanism to enable the rapid transmission of information from communities to designated local-level supervisors. These reporting mechanisms can take many forms and can be done through telephone, SMS, electronic web reporting, or social media platforms. Establishing these clear mechanisms will improve CEBS reporting and feedback.

Resources for Local-level Supervisor

- Signal register/logbook or an electronic register
- Established mechanism for rapid reporting from lower levels (phone, mobile applications, SMS, or social media platforms)

Roles and Responsibilities

Like all other types of EBS, the success of CEBS lies in the early detection and reporting of signals. The three main responsibilities for CHWs/CAHWs are to sensitise populations and community networks to recognize signals and immediately report them to designated health authorities.

Table 6 outlines the major roles and responsibilities of community residents, key informants, CHWs/CAHWs and local-level supervisors in the implementation of CEBS. Each stakeholder should be aware of their roles and responsibilities, and be empowered by health authorities to conduct them.

Table 6. Main roles and responsibilities of stakeholders that actively participate in CEBS.

CEBS actors	Roles and responsibilities
Community residents	- Detect signals - Share information on signals with CHWs/CAHWs - Receive feedback about signals from CHW/CAHW
Key informants	- Detect signals - Share information on signals with CHW/CAHW - Receive feedback about signals from CHW/CAHW - Participate in training on CEBS, facilitated by health authorities
Community Health Worker/Community Animal Health Worker	- Sensitise community residents and key informants on CEBS - Detect signals - Record signals in notebook or applicable e-platform - Report signals immediately to designated health authorities - Participate in triage, verification and risk assessments as needed - Receive feedback about reported signals from health authorities

Local-level supervisor/FP	**- Participate in CEBS training, facilitated by health authorities at national/intermediate level** **- Assist in sensitising community stakeholders involved in CEBS** **- Receive reports of signals from CHWs/CAHWs** **- Record signals in register/logbook or an electronic register** **- Triage and verify all signals to determine whether they are events** **- Participate/conduct risk assessment if applicable** **- Report events to FP at the next level up (e.g., intermediate or national level) for either risk assessment or response as applicable** **- Provide feedback to immediate lower level**

Information Flow

The information flow for reporting and feedback for CEBS is illustrated in Figure 7. According to this structure, signals are detected at the community-level. The detected signals are then notified immediately to the designated health authority (e.g., local-level EBS supervisor).

At the next appropriate level, the designated health authority must triage and verify all signals that come to their attention. All signals verified as events should be reported to the lowest level with capacity where health authorities there can assess the risk of each event and respond appropriately. Regular feedback should be provided to CHWs and their community networks.

The success of CEBS is based on the early detection and reporting of potential health events. Designated health authorities should encourage those who report from communities to continue detection even when certain signals are discarded as not to true health events. The motivation of CHWs, key informants, and community residents who report can be maintained through feedback and encouragement.

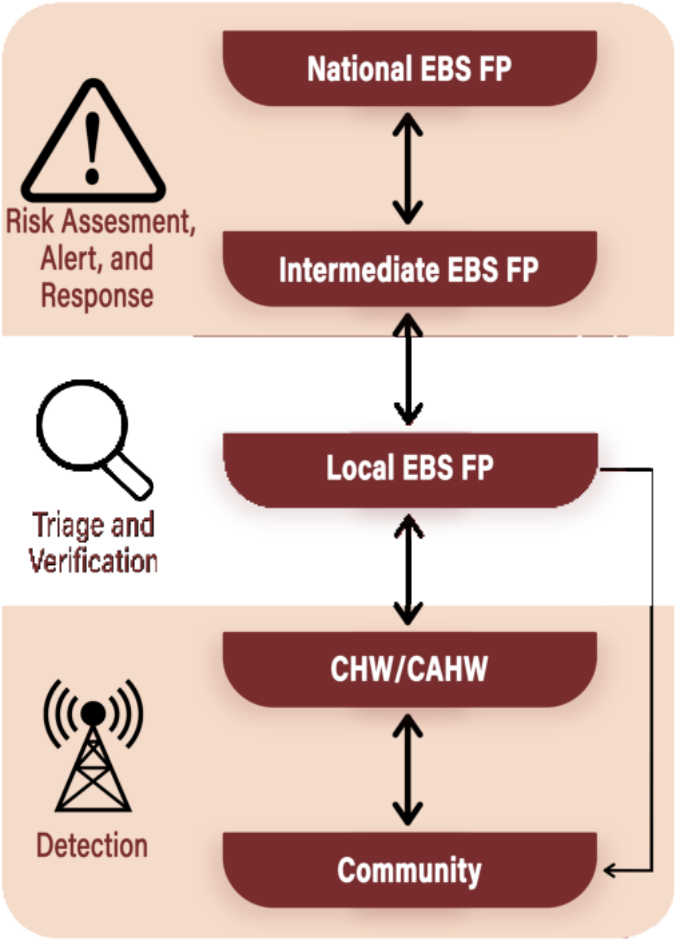


Figure 7. Sample flowchart for CEBS implementation, indicating the flow of data collected and the feedback loop

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Severe Illness in a Community Scenario

A CHW hears in the market that a few people are very sick with vomiting and diarrhoea in the village. Two adults and three children were taken to a health centre because they had at least five episodes of vomiting and diarrhoea today. Ten other adults and six children are sick. Nobody is sure if any of the sick persons have a fever.

The CHW should immediately report this information to their local-level supervisor as it may be a highly communicable disease and other people may be affected. It is essential that this signal be notified immediately to ensure minimal risk to community residents. Immediately after learning about this signal, local health authorities will take the necessary steps to record, triage, and verify the signal as an event. Once verified, they will report up to the intermediate level, where authorities will assess the risk of the event and implement appropriate investigation and response measures. In this scenario, the role of CHWs is to immediately detect, record, and report this signal to their point of contact at the local administrative level.

Conclusion

A successful CEBS system needs to find the means to keep CHWs motivated. Most CHWs are volunteers that are tasked with the delivery of several activities. Motivation can take two forms: financial and non-financial. Financial incentives include the payment of allowances or the allocation of physical resources such as mobile phones or bicycles, and require sufficient and sustainable funding to cover the related costs. Non-financial incentives may include participation in refresher training, continuous feedback, and community stakeholder recognition by health authorities. By recognizing the full value of community residents, key informants, and CHWs in conducting CEBS, these incentives help to build trust between community-level stakeholders and the surveillance system in a sustainable way.

Routine supervision of CHWs is key to the success of CEBS; supervisory visits can be used to provide refresher training to CHWs and can serve as a form of motivation. local-level supervisors should ensure that regular feedback be provided to CHWs on the status of signals that were reported from their communities.

Finally, CEBS should be seamlessly integrated into existing surveillance and reporting structures. This streamlined form of surveillance can help detect potential acute health risks, which can facilitate a rapid response to new health events.

CHAPTER 7: MONITORING AND EVALUATION FOR EVENT-BASED SURVEILLANCE

The primary goal of EBS is the early detection of outbreaks and other health threats.[13] Those involved in EBS implementation at different levels need to use surveillance information to rapidly address identified health events; accurately report to the next level; and update partners and donors on implementation progress. Thus, there is a need for EBS implementers to review their performance in detecting and responding to events as well as account for EBS program activities and resources needed to stakeholders.

Africa CDC developed this monitoring and evaluation (M&E) chapter to assist EBS implementers at all levels, to track EBS activities and monitor progress in meeting this goal. This chapter can also serve as a resource for developing training, supervision, monitoring and evaluation of surveillance activities. The adaptation of this chapter will vary from one AU Member State to another.

This chapter provides guidance for the implementation of an EBS M&E program, including suggested metrics for measuring success and a timeline for measuring results. The proposed M&E tools in Annex 7-9 support implementation of EBS alongside IBS guiding documents like WHO-AFRO's Integrated Disease Surveillance and Response (IDSR)[14] and WHO-EMRO's Integrated Disease Surveillance Strategy (IDSS)[15].

An ideal M&E plan for EBS systems should provide timely information on whether a system is functioning properly and meeting targets, while providing data to guide continuous performance improvement. An EBS M&E plan should ideally describe why, how, and when changes towards a desired surveillance goal are achieved. In brief:

> **Monitoring** is the process of continuously tracking progress or delay in inputs, activities, outputs, and outcomes.[16] Monitoring helps keep track of implementation processes and provides a basis for re-adjustments based on performance plan metrics.
>
> **Evaluation** is the process of periodically assessing the relevance, effectiveness, and impact of a program or system. Evaluation ensures that the EBS system meets the objectives for which it was set by providing evidence-based explanations for achievements and shortcomings and recommending its improvements.

Developing an EBS M&E Plan

Our M&E guidance is premised on a logical framework termed the results chain, or pipeline, model (Figure 8) that tracks inputs, activities, outputs, outcomes, and impacts. This framework illustrates how a project or program actions taken at one level will lead to desired results at a higher level, over a defined period of time. The logic is that specific resources (inputs) are required to undertake program tasks (activities) whose

[13] S. Arunmozhi Balajee, Stephanie J. Salyer, Blanche Greene-Cramer, Mahmoud Sadek & Anthony W. Mounts (2021) The practice of event-based surveillance: concept and methods, Global Security: Health, Science and Policy, 6:1, 1-9, DOI: 10.1080/23779497.2020.1848444

[14] WHO AFRO: Technical Guidelines for Integrated Disease Surveillance and Response in the African Region - third edition

[15] WHO EMRO: A regional strategy for integrated disease surveillance – overcoming data fragmentation in the Eastern Mediterranean Region

[16] WHO: Communicable disease surveillance and response systems

accomplishments (outputs) bring about system changes (outcomes) that eventually lead to an overall health (impact).

Figure 8. The five basic levels of results chain model that shows how EBS programmes can be assessed routinely; how they are conducted (inputs & activities); their level of performance (outputs); and their achievements (outcomes & impact)

- **Inputs:** are all the resources required for the implementation of the EBS program. Inputs include implementation documents (legal frameworks, policies, guidelines); curriculum and tools; human resource, time, finance, materials, infrastructure, stakeholders (communities, healthcare workers, national and intermediate-level surveillance staff and leadership, multi-sectoral partners) and other resources.
- **Activities:** involve any tasks, actions, processes, or procedures undertaken during the EBS program implementation through the utilisation of the inputs. Activities rely on a well thought out strategy for the successful EBS implementation. They include tasks such as planning meetings, procurement of supplies, training and sensitizations, and the rollout such as the EBS processes (detection, reporting, triaging, verification, risk assessment, and response), support supervision, coordination, and operation support.
- **Outputs:** are the immediate gains of activities during the EBS program implementation activities. Outputs can include number of people trained, number signals triaged, or number of events responded to, etc.
- **Outcomes:** are short-term and medium-term direct changes resulting from the EBS implementation. These include EBS implementation outcomes that demonstrate changes in the promptness of detection of events, timeliness in notifications, and rapidity in response to acute threats to health.
- **Impacts:** are the overall long-term improvements in health outcomes attributed to the EBS program implementation. The impacts are aligned to the EBS program goals and may be due to the implementation outcomes only or in combination with the outcomes of other health programs. Impacts include reduction in health emergencies and or reduction in mortalities, disabilities, and morbidities due to acute health threats.

M&E Guiding Principles

When developing an M&E plan, you should ensure that the plan should:

- Make references to existing baseline data or begin with a baseline evaluation
- Be developed in a participatory fashion and involve all program stakeholders, including implementers and beneficiaries

- Respect and protect the rights and confidentiality of all participants
- Be integrated into other surveillance systems for sustainability beyond the life of the program
- Be considered a living document that needs to be reviewed on an annual basis and updated to reflect any changes in referenced technical guidelines or whenever the EBS program is modified.

Data Sources and Data Collection

The collection of EBS monitoring data should be integrated into the routine systems for sustainability and cost effectiveness. Data can come from EBS specific data tools (e.g., signal reporting, verification, risk assessment and response), EOCs or a Hotline Call Centre call logs and rumour registers, support supervision checklists, and general patient registers and medical records. Annex 8 provides example monitoring and evaluation indicators and suggestion on what data sources could be accessed to measure these indicators; however, each MS is free to adopt a method that works best with the respective health service delivery system.

Evaluation of data sources includes routine monitoring in addition to information collected from external sources through interviews, observations, surveys and questionnaires, case studies, and focus group discussions as well as key informant interviews. Standard evaluation tools are recommended for the formative and process evaluation activities to track progress. Annex 9 provides a generic evaluation plan; however, each MS is free to adopt a method that works best with the respective health service delivery system.

Indicators

Indicators are measurable variables that provide information on status of the EBS program and enable managers to track progress, demonstrate results, and take corrective actions where necessary to improve the system. There are different types of indicators based on the steps of the program results chain framework.

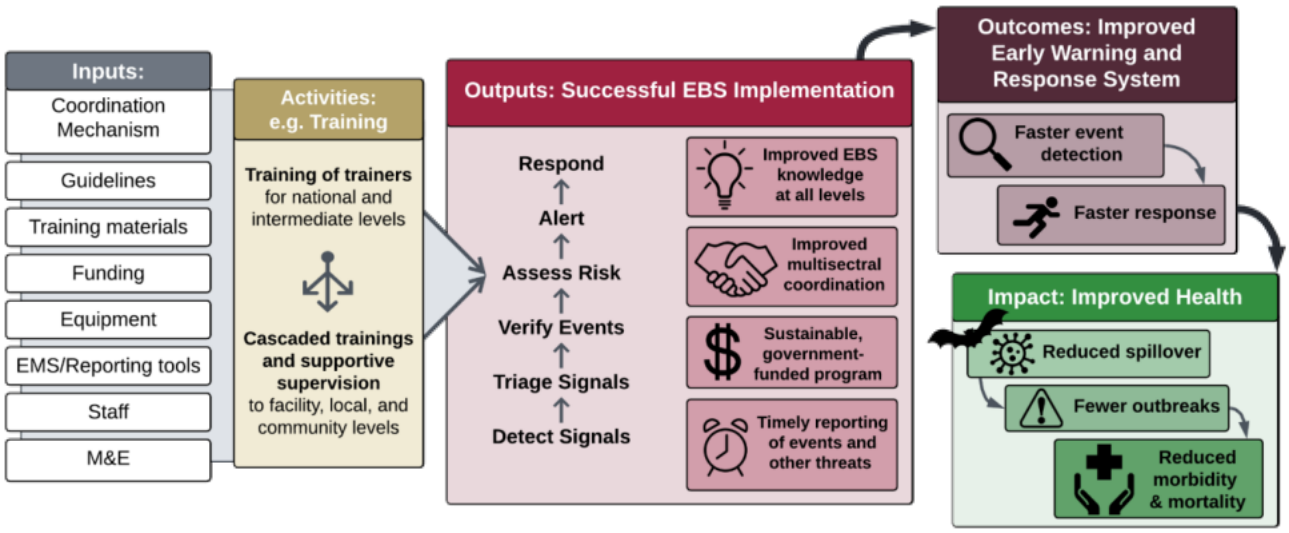

Figure 9: Theory of change for EBS, relating the results chain model components to potential indicators[17]

[17] adapted from: Clara, A., Dao, A.T.P., Mounts, A.W. et al. Developing monitoring and evaluation tools for event-based surveillance: experience from Vietnam. Global Health 16, 38 (2020). https://doi.org/10.1186/s12992-020-00567-2

- **Input indicators:** refer to the resources needed for the implementation of EBS or an EBS-related activity. Examples include:
    - Number of staff and key stakeholders identified to implement EBS at each level
    - Amount of financing for EBS implementation
    - Technical guidelines, SOPs, and training materials are available for use
- **Process/Activity indicators:** measure whether planned activities took place. Examples include:
    - Number of personnel trained and equipped by sector and type of EBS implemented
    - Equipment and reporting tools for EBS are procured and in place
    - Number of planning meetings held
- **Output indicators:** measures the immediate results of EBS-related activities. Examples include:
    - Monitoring indicators reported
    - Number of signals reported, triaged, and verified
    - Number of events assessed for risk and responded to
- **Outcome indicators**: measure the quality of the surveillance system and the extent to which surveillance and early warning and response (EWAR) objectives were achieved. Examples include:
    - Proportion of signals verified within 24 hours of detection
    - Proportion of events which were notified within 24 hours after verification
- **Impact indicators:** measure the improvement of overall health that can be attributed to EBS. Examples include:
    - Reduced mortality
    - Reduced outbreak costs

A good indicator should be precise and simple so that different people can apply it in the same settings and get similar results. An indicator should incorporate SMART quality criteria, where possible:

- Specific: capture and clearly and directly relate to the achievement of an objective and only that objective
- Measurable: possible to retrieve the data needed to calculate the indicator with consideration for assessment repeatability, measurement precision, and resources needed
- Achievable: have a target value, which can be attained
- Relevant: answer the information needs
- Time-bound: timeframe linked to the indicator, such as the frequency with which it is collected, measured, or needs to be achieved

An indicator should be well described and defined (how it should be measured) by frequency of measurements, data source (routine or periodic), baseline status, and target. This M&E chapter includes a generic summary of the performance indicators in alignment with the results-chain framework that should be considered for EBS (Annex 8). AU MS are free to contextualise these based on their respective health service delivery system.

Evaluation Methodology and Considerations

Different methodologies can be used to evaluate an EBS system and program. These can be experimental, observational, or quasi-experimental and will often combine both quantitative and qualitative methodologies to measure EBS system attributes (e.g., timeliness, completeness, accuracy, usefulness, simplicity, acceptability, flexibility, sensitivity, specificity, positive predictive value, and representativeness) from both primary and

secondary sources. Several surveillance evaluation protocols[18, 19, 20] exist that can be referenced and modified to suit this purpose.

An evaluation should be conducted shortly after implementation (formative evaluation) to obtain baseline data, at regular short-term intervals (e.g., annually) during implementation (longitudinal / process evaluation) to track outcomes, and at the end of implementation or at longer-term intervals (e.g., every 5 years) (summative evaluation) to track impacts. Where possible, evaluations should be integrated in the annual performance reviews, mid-term reviews and implementation completion and results reviews for sustainability and cost reduction.

Internal evaluations are conducted by the implementing program staff. The objective of internal EBS evaluation is to assist program managers with gaining a better understanding of their program to improve program processes and outcomes. The internal evaluation process promotes utilisation of evaluation findings, reflective practice, and organisational learning. The focus can be to find out to what extent the EBS program vision is being realised; how fully the implementation is being achieved to realise outcomes; or if there are unforeseen emerging events affecting implementation. Benefits to internal evaluations are that they tend to be not as resource dependent or collaboratively intensive. However, internal evaluations may lack expertise, objectivity, and considerations for a broader perspective.

External evaluations are conducted by evaluators from outside of the Member State or through program/activities supported by African Union, WHO, academic/research institutions, or other regional bodies. External evaluation verifies whether the instruments and methods applied in the implementation of the EBS programme are appropriate and viable. The external evaluations are done by experts, objective, and broader in perspectives; however, they are expensive and require collaborations.

A number of conditions and external factors may have effects on the implementation and performance of EBS and should be considered when conducting an evaluation. These can include changing health priorities such as those occasioned by major health emergencies (e.g., COVID-19 pandemic) or other competing or better resourced programmes that can take focus away from the EBS program. Additionally, fluctuations in available resources to support other health-related programs, staffing, and infrastructure that EBS depends upon, such as community health services, can promote or lower EBS performance. Implementers should consider and map out these contextual factors when conducting and evaluation of the EBS program.

M&E Roles and Responsibilities

Monitoring staff, inclusive of EBS program officers, should be identified at each level to ensure the M&E plan is implemented. These staff can also play a part in process evaluation, which may be done internally as part of the routine monitoring activities. However, impact evaluation requires the addition of an external team to work alongside the EBS unit. The external evaluation team should include a principal investigator, evaluation

[18] US CDC: Updated guidelines for evaluating public health surveillance systems; recommendations from the Guidelines Working Group

[19] WHO: Protocol for the evaluation of epidemiological surveillance systems / prepared by Liverpool School of Tropical Medicine and Ministry of Health and Child Welfare, Zimbabwe

[20] Clara, A., Dao, A.T.P., Mounts, A.W. et al. Developing monitoring and evaluation tools for event-based surveillance: experience from Vietnam. Global Health 16, 38 (2020). https://doi.org/10.1186/s12992-020-00567-2

coordinator(s), and evaluation field clerks. See the breakdown of the roles and responsibilities in the table below (Table 7).

Table 7. Key stakeholders and their responsibilities in EBS monitoring and evaluation

Role	Responsibilities	level
	Monitoring	
Program Manager	- Develop M&E framework, SOPs, and tools - Train intermediate-level coordinators - Oversee M&E activities and data collection - Maintain the M&E information system - Produce M&E reports	National
Intermediate Surveillance Coordinator(s)	- Train community and facility EBS FPs on SOPs and tools - Conduct quality monitoring visits - Support the FPs and data collectors	Intermediate
Surveillance FP(s)	Coordinate and oversee healthcare workers (HCWs) at the facility and community level - Train HCWs, CHWs, CAHWs, and other EBS staff - Conduct quality monitoring/support visits to facilities and communities	Facility and Community
Facility and Community Staff	Follow SOPS to collect EBS M&E data on designated tools, mainstreamed into the routine surveillance activities - Conduct data quality checks - Share data - Maintain backup data (permanent)	Facility and Community
	Evaluation	
Principal Investigator	Design the evaluation protocol and tools in coordination with the project team and key stakeholders - Assemble, train, and supervise the evaluation team - Perform or coordinate data analysis, writing, and dissemination to key stakeholders	
Evaluation Coordinator(s)	- Acts as primary liaison between the evaluation team, the program team, and any other stakeholders - Monitors the evaluation implementation and troubleshoots problems - Assists with developing field instruments - Undertakes fieldwork and oversee data collection - Assists the principal investigator with data cleaning, analysis, and writing of the evaluation report	
Evaluation Field Clerks	- Collect evaluation data using the prescribed tools and methods - Deliver datasets to the coordinator and principal investigator	

M&E Resources

All EBS implementation programs must take into consideration and provide for its M&E activities. The government should take leadership in securing funding for M& E. However, agencies funding the implementation could support with additional resources for M&E. This may help in documenting the impact to justify further funding or just to assess return on investments. Other agencies that can provide resources for M&E are researchers who are interested in documenting the performance of the programme to answer research questions.

Analysis and Dissemination of M&E Information

Analysis of M&E data can help monitor processes, identify problems, inform strategic planning, and justify a funding request. Sharing this M&E analysis with stakeholders can help engage stakeholders, advance, or consolidate knowledge on the program, and provide donors, policy makers and technical specialists with information on the effective implementation. Preparation of information for dissemination should consider:

- Purpose: Information to provide may include updates of processes monitoring, strategic plans, funding or regulatory compliance, problem identification, further funding needs, impact evaluation and program data for further action, feedback, and advocacy.
- Frequency: Project managers need frequent information to monitor progress and make decisions while donors, stakeholders, and policy makers require less frequent, periodic evaluation reports to ensure accountability and assess impact.
- Users: Different audiences require varying levels of complexity and technical language, formats, and media.
- Accessibility: Different users require varying user-rights and privileges to health information.
- Dissemination methods channels: Determine appropriate outlets necessary for management and policy makers (e.g., SitReps, SpotReps, etc.); and those for external stakeholder reporting (e.g., public fora, news releases, briefings, and web sites, etc).

CHAPTER 8: EBS DATA MANAGEMENT AND EVENT MANAGEMENT SYSTEMS

Event-based surveillance generates a large amount of data that needs to be collected, analysed, and disseminated in a manner that allows for timely and effective action. Countries must therefore have a system in place to manage this information which may be an EBS data management approach relying on manual systems or automated event management systems.

NPHIs and other sectors implementing EBS might have several ways of collecting, recording, and reporting signals and events. The management and accuracy of reported signals and events can be improved with implementation of an electronic event management system (EMS). EMS is a system that registers signals from hotlines, media scanning, and other sources. EMS tracks the signals and events from when they are detected and until events are closed or signals discarded.

EBS data management involves data collection, analysis, and dissemination of information to inform decision making. EBS data collection should be undertaken with analysis and use in mind. It is important to consider how EBS reporting data (the process of reporting signals and verifying events) links to systems for tracking events and capturing data on outcomes (e.g., number of cases, hospitalizations).

EBS data should be considered of high quality - meaning that it is accurate, complete, and timely.

- **Accuracy** involves how well the data reflects reality
- **Completeness** considers if it fulfils the expectations of what's comprehensive
- **Timeliness** is about availability of information when needed

EBS data accuracy should be ensured through gathering data from credible and reliable sources including vetting of third-party sources. The accuracy should also be improved by making easy data entry through reducing workload, standardizations, and automation. Limiting access to the database maintains accuracy as it minimizes chances of unauthorized alterations and encourages the reporting of restricted or particularly sensitive signals. The program officers must also endeavour to clean data soon after entry to foster accuracy.

Incomplete data sets yield inaccurate results. Data completeness is critical to ensuring that EBS data and analysis conducted with these data are accurate. Data completeness can be improved by making certain fields in data systems mandatory, and by conducting data quality audits to compare source datasets (e.g., signal logs kept at a facility) to a central data repository (e.g., a dataset of signals received from facilities kept at intermediate or national levels). In automated systems, validation checks and skip patterns can also be included to ensure completeness of data.

Data are only useful in decision making if they are collected and shared in a timely manner to support interventions. Timely notifications and sharing of EBS data can be fostered through supporting communications systems and automations. Timeliness metrics can be used to assess how quickly information is shared between local, intermediate, and national levels as specified in national SOPs.

To improve data accuracy, completeness, and timeliness, data quality assurance - which is the process of routinely reviewing, screening, and determining the quality of the data collected in a particular data

management system[21] - must be undertaken. This process enables development and implementation of data quality checks to ensure the data serves the EBS needs. A key strategy that underpins data quality assurance is securing dedicated resources especially in the form of personnel and tools for data management.

Data Storage and Security

Data security is critical to protecting confidential data, respecting the privacy of subjects, and complying with applicable protocols and requirements. Storage and security of the EBS data will be based on individual MS data laws and regulations. However, it is generally recommended that where data are collected using paper-based tools, they should be secured in closed, locked cabinets. If data are collected and stored on computers, these should be password protected, securely kept, and backed up. Where data are stored in earth or cloud servers, access credentials should be limited to only authorised individuals. Where EBS data must be shared outside the authorised custodians, the data must be de-identified unless express permission is sought from the participants.

Event Management System

The routine collection of EBS data can be automated to reduce costs while repeated EBS evaluations can utilise the same methods to allow comparisons and trend analysis. One type of tool that can be used to store EBS data is an Event Management System (EMS). An EMS can be a simple Microsoft Excel tool or a dynamic web-based platform. EMS can be used to register signals from EBS sources, track the signals and events through the process of triage, verification, and risk assessment, and monitor the status of events in the associated response until they are closed or resolved.

The Africa CDC has developed an EMS built in DHIS-2, which is an open-source web-based platform. DHIS-2 is a tool that can be used for collection, validation, analysis, and presentation of aggregate and patient based statistical data, tailored (but not limited) to integrated health information management activities. The EMS supports registration, routine data entry and tracking of signals and events, analysing data, generation of reports and archiving of reports and other relevant system generated products, for example, outbreaks briefs and situation reports. The system can also link to other media scanning engines for example the EIOS, EpiTweetr (https://www.ecdc.europa.eu/en/publications-data/epitweetr-tool), etc. which allows for signals detected within these engines to be tagged and imported into the EMS for easy data entry. The system also allows additional data storage e.g., information on Africa CDC's agent or syndromes that can be reported on, surveys and seroprevalence related data. It is a generic tool, with an open meta-data model and a flexible user interface that allows the user to design the contents of a specific information system without the need for programming.

Signals can be generated from the monitoring of IBS data when thresholds are exceeded, therefore, MS may also choose to link IBS data with EBS information on an EMS, creating a centralised repository of signals and events from all sources. This may support a MS to align EBS and IBS reporting SOPs and to track all signals and ongoing events.

Ethical Considerations

The EBS process involves gathering information from several entities including local, intermediate, national, and international levels; public and private, government and non-government; among others. Collection of individual

[21] WHO: Data Quality Assurance

level data can also occur, for example, in interviews conducted during the M&E process or contact information from community members reporting signals on a hotline. It is therefore necessary to comply with ethical principles during data collection, analysis, report writing and dissemination from all these sources. Confidentiality of EBS information should be always maintained, following existing country-specific procedures. In addition, it is important to restrict unapproved access to information as this could pose risks to originating entities including restrictions to trade and travel, movement of animals and animal products, among others.

Where participants are involved (e.g., surveys related to M&E), the participants should be allowed to exercise autonomy and make their own decisions whether to or not to participate or to withdraw their participation at any time without any consequence. All participants must provide informed consent, preferably in writing if feasible, before data collection.

Where any personal identifiable information (PII) is being collected (e.g., name, contact information, etc.), those sharing this information are entitled to privacy, confidentiality, and anonymity which requires that PII data collected should be delinked from data (responses) intended for analysis or the use of unique identifiers could be considered instead of individual names or geolocation data. Privacy involves taking responsibility for data to be stored securely with access limited to designated, authorised people.

Annexes

Annex 1. Example Media Scanning/Hotline Form

Variables	Response	
Source of information	☐ CEBS ☐ FEBS ☐ Media Scanning ☐ Hotline ☐ Other: _____	
Reporter information (e.g., general public, CHW/CAHW, healthcare worker, etc)		
Date/time of detection/receiving signal		
Reference/contact (e.g., URL, email, phone #)		
Signal type	☐ Human ☐ Animal ☐ Environment ☐ Other: _____	
Location of signal		
Date of event start (e.g., date of symptom onset, date first case seen by health facility, date of lab diagnosis, etc.)		
Number of cases reported		
Number of deaths reported		
Description of signal/event		
Follow-up Activities		
Triage results	☐ Discard ☐ Monitor ☐ Verify	Date/time:
Sent for verification	☐ Yes ☐ No	Date/time:
Verified	☐ Yes ☐ No	Date/time:
Risk assessment	☐ Low ☐ Moderate ☐ High ☐ Very High	Date/time:
Alert sent for response	☐ Yes ☐ No	Date/time:
Response status	☐ Not started ☐ Ongoing ☐ Completed	Date/time:

Annex 2. Example Signal Register for Community and Facility Event-based Surveillance

This Signal Register may be completed by CEBS supervisors upon receiving reports of signals detected at the community-level. Note: all dates should be recorded in the DD-MM-YYYY format.

TABLE INFORMATION KEY

1. 'Date identified' is the date that the person reporting became aware that a person (or persons) showed signs/symptoms of one or more of the signals.
2. 'Date reported' is the date that the reporter informed a local-level supervisor about the signal.
3. 'Source of report' is the individual reporting to the local-level supervisor. A source may be a community health or animal health worker (CHW/CAHW), a veterinarian, schoolteacher, traditional healer, community resident, healthcare professional, etc. Include both the name of the individual and source type.
4. 'Contact of source' asks for the contact information of the reporting party, which may be needed later for any follow-up information regarding verification of the signal.
5. Please state the location of the patient's home, hospital, farm, or place where the incident is occurring, as precisely and exactly as possible. If an address is available, please record it. If an address is not available, please describe the relationship between the patient's location and a landmark. If necessary, please describe the appearance of the setting. For example, a patient's home might be the brown house with a red door that is four buildings away from a specific church.
6. Please refer to the country's pre-defined and coded signal list to populate this field.
7. 'Number affected' is the number of individuals who show signs of the signal being reported. Any deaths should be included in this value, but a case that dies should not be counted twice.
8. 'Reported by multiple sources?' asks the local-level supervisor to state whether the signal has been reported by other individuals at any level of the surveillance or health system.
9. 'Signal verification' asks the local-level supervisor to authenticate the report and record the date of report authentication in the next field (see below). If the information is from a credible/official source and meets one or more predefined signals, it is an event; otherwise, it is false. All events should be reported immediately (within 24 hours) to the sub-national jurisdiction.
10. 'Date verified' is the date that the local-level supervisor verified the signal.
11. 'Date event reported' is the date that the local-level supervisor communicated events (i.e., signals verified as true) to the local or intermediate-level health authority responsible for risk assessment.

Annex 2 cont.: Signal Register for CEBS/FEBS

Name of Local-level Supervisor: _____ **Date (DD-MM-YYYY):** _____

Health Facility (if applicable): _____ **Location (e.g., lowest administrative level):** _____

#	Date identified1	Date reported2	Source of report3	Contact of source4	Location of signal5	Signal code6	Number affected7	Reported by multiple sources?8 (Y/N)	Signal verification9 (T/F)	Date verified10	Date event reported11

Annex 3. Example Community Health Worker Signal Notebook

General Information

Name: _____ Telephone: _____

Name of CEBS Supervisor: _____ Telephone: _____

Instructions

When you detect one or more signals in your community, please report immediately to your local-level supervisor. Use this notebook to record the following information and communicate it to the local-level supervisor:

Date/time the signal began	
Date/time the signal detected	
Description of the signal, including the number of people/animals affected	
Location of the signal	
Contact information of those affected, if applicable:	

List code/description for signals to be reported (examples)	**Image**
Other	

Please refer to the country's pre-defined and coded signal list to populate the signals being reported. Pictures or images of the signals can be included to assist in detection at the community-level.

Annex 4. Example Intermediate-level Event Log

This Event log was adapted from the IDSR District Log of Suspected Outbreaks and Rumours. Signal information should not be entered in this logbook. Note: all dates should be recorded in the DD-MM-YYYY format.

TABLE INFORMATION KEY

1. **'**Condition, disease, or event' should be completed with a brief description of the event (e.g., suspected measles, cluster of suspected cholera, earthquake).
2. 'No. of cases initially reported' indicates the number of cases reported when the initial signal was reported.
3. 'Location' is where the event is occurring. Please list this as precisely and exactly as possible. If an address is available, please record it.
4. 'Date intermediate level notified' is the date that the intermediate-level health authorities were notified about the event.
5. 'Date event began' is the date that the event began, or the date of symptom onset of the index case. Depending on the event occurring, this may also be the date the threshold was crossed for a seasonal disease, or the date the first cluster of cases was recognized.
6. 'Date first case seen at facility' is the earliest known date that a case sought medical care at a health facility.
7. 'Date and level of risk assessment' is the date the first risk assessment was performed and the level of risk that was characterized (e.g., low, moderate, high, very high).
8. 'Date investigation started' is the date that the intermediate-level health authorities began investigating the event reported.
9. 'Investigation results' asks health authorities to state whether the event was ruled out or confirmed as a suspected outbreak requiring a response, or whether the status is still unknown.
10. 'Date of first intervention' is the date a response was initiated.
11. 'Type of intervention' asks health authorities to describe what was conducted as part of the response.
12. 'Date national level notified' is the date that the intermediate-level health authorities communicated with higher levels about the occurrence of an outbreak.
13. 'Date national response started' is the date that intermediate-level health authorities received response support from the national-level.
14. 'Comments' - Please enter any further comments in this field.

Annex 4 cont.: Example Intermediate-level Event Log

Condition, disease, or event1	No. of cases initially reported2	Location3	Date intermediate level notified4	Date event began5	Date 1st case seen at facility6	Date and level of risk assessment7	Date investigation started8	Investigation results9	Date of 1st intervention10	Type of intervention11	Date national level notified12	Date national response started13	Comments14

Annex 5. Example Signals for Detection Listed by Sector and EBS Methodology

Public Health Community Signal List

- Cluster of deaths in a village/community construction site, mine, school, prisons, orphanage
- Cluster of disease of unknown aetiology in a village/community, construction site, mine, school, prison, orphanage, or other institution over a defined period (e.g., two weeks)
- Any unusual event or occurrence in the community which may affect human health
- Any public health event that raises concern, fear, and alarm in the community
- Any event/occurrence which may have a known, suspected, or possible impact on human health

Public Health Facility Signals List

- Occurrence of one or more cases or deaths of a severe, unusual, or unexplained disease, based on clinician's professional judgement and failure to respond to standard treatment
- One or more healthcare worker(s) with severe illness after attending to patients with similar symptoms
- Large, unexpected, sudden increases in admissions for any illness of the same type, including patients in intensive care units
- Two or more people presenting with similar symptoms with a history of recent travel
- Cluster of deaths in a healthcare facility
- Cluster of disease of unknown aetiology in a healthcare facility
- All immediately notifiable diseases, especially those to be reported immediately (e.g., for IDSR) and any event that poses a public health risk

Laboratory Facility Signal List (Human and Animal):

- Detection of a pathogen that has not been detected for a long time in that country, a new pathogen, or a new / unreported strain of an already known pathogen (increase in positivity rate, new genetic variation, novel resistance profile, etc)
- Detection of a pathogen in an unusual species (e.g., avian influenza in a mammal)
- Large/sudden unexpected increase in numbers of specimens with the same testing request, or positive for the same pathogen (including pathogens that are resistant to multiple antibiotics)
- Any pathogen on the immediately notifiable list
- Un-subtypeable or new influenza strain from a patient with severe acute respiratory infection

Animal Community Signal List

- Sudden increase in animal deaths
- Cluster of animal deaths in a wildlife or domestic animal population
- Cluster of disease of unknown aetiology in a wildlife or domestic animal population over a defined period (e.g., two weeks)
- Any unusual event or occurrence in the community which may affect animal health
- Any animal health event that raises concern, fear, and alarm in the community
- Any event/occurrence which may have a known, suspected, or possible impact on animal health

Animal Facility Signal List

- Cluster of animal deaths in an animal clinic, farm, game reserve/park, zoo
- Unexpected change in morbidity and / or mortality in domestic animals and / or wildlife

- Cluster of animals presenting with unusual signs or behaviours (e.g., aggression, bleeding, dizziness, weight loss, isolation from other animals, diarrhoea, body swellings, lameness, loss of hair or limbs, coughing, excessive drooling, blindness)
- Cluster of animals exhibiting production losses (e.g., milk, eggs, abortions)
- Severe illness in veterinarian, wildlife staff, or community members after contact (e.g., culling, feeding, treating, vaccinating) a sick or dead animal
- All immediately notifiable zoonoses
- Commonly reported lesions during meat inspection from abattoirs
- Sudden increase in vectors population from entomological surveillance

Environment Community and Facility Signal List

- Any unusual event or occurrence in the community which may affect environment health
- Any environmental health event that raises concern, fear, and alarm in the community
- Any event/occurrence which may have a known, suspected, or possible impact on environmental health
- Massive growth of algal bloom (green growth) or water weeds in water bodies (e.g., lakes, rivers, streams)
- Improper waste disposal, leakage, or spillage on land, in air or water bodies
- Unusual change in physical water quality parameters of drinking water sources (e.g., colour, taste, odour, suspended solids, turbidity)
- Occurrence of an environment hazard (e.g., flood, landslide, earthquake, frequent and more intense earth vibrations, release of gases, cracks on the ground)
- Unexplained death of aquatic animals (e.g., fish, hippos, etc.)
- Sudden increase in average atmospheric temperature noticed for two days

Annex 6. Example Supervisory Checklist for EBS at the Intermediate Level

The following checklist **is to be used by the intermediate-level** during supervisory visits of community event-based surveillance (CEBS) and facility event-based surveillance (FEBS) on a quarterly basis. Supervisors are encouraged to provide support during these visits and help resolve any challenges or difficulties where possible.

Intermediate level administrative name: _____	**Local level administrative name:** _____
Local/Facility-level employee name: _____	**Supervisor name:** _____
Date of supervisory visit (DD-MM-YYYY): _____	**Date of last supervisory visit (DD-MM-YYYY):** _____

ACTIVITY	SUPERVISORY QUESTION	ANSWER	COMMENTS
Tools and Guidelines	1. Does the local/facility-level have the following: a. Community/facility list of priority signals b. Signal/Event logbook? c. EBS training manual and SOPs? d. EBS monitoring and evaluation tool? 2. Inspect the available reporting tools. Are these tools filled out and up to date? a. Signal/Event logbook? b. Other: _____ 3. Does the local/facility-level have a database (including contact information) of all facility and community focal points within your jurisdiction? Verify that database is up to date.	 Yes No Yes No Yes No Yes No Yes No Yes No Yes No	

ACTIVITY	SUPERVISORY QUESTION	ANSWER	COMMENTS
	4. Has the local/facility-level conducted data analysis in the last quarter? Verify availability a frequency table showing the number of signals detected and verified, and number of events reported by event type.	Yes No	
Report	5. At the local/facility-level, have you received reports from community members, CHWs/CAHWs, and facility staff on any events in the last quarter? a. If yes, how many? Verify: i. Is this information reflected in the Local/Facility- level Signal/Event Log? ii. Is this information reflected in the event management system? iii. Is this information reflected in any other forms (e.g., IDSR Weekly Monthly reporting forms/District Log of Rumours/Outbreaks)? Which forms: _____ b. For all events reported to you in the last quarter, i. How many did you verify? ii. How many did you report to the intermediate level? iii. Have you received feedback from the intermediate level? iv. Have you given feedback to the following: 1. Facility staff 2. CHW/CAHW 3. Community members	Yes No Number_____ Yes No Yes No Yes No Number_____ Number_____ Yes No Yes No Yes No	

ACTIVITY	SUPERVISORY QUESTION	ANSWER	COMMENTS
Supervision and Feedback	6. Have you conducted supervisory visits for any CHWs/CAHWs or facility staff in the past three months? a. If yes, how many? Verify with completed 'Checklists for Supervision of CEBS/FEBS at the local level'. 7. In the past three months, have you convened a Review Meeting? 7. In the past three months, have you convened a Review Meeting? a. If yes, when was the last Quarterly Review meeting? Verify with meeting minutes and/or report.	Yes No Number_____ Yes No Date (DD/MM/YY) __/__/__	
Challenges	8. Do the local/facility-level staff face any challenges or difficulties in performing their duties? a. If yes, what are they?	Yes No Challenges:	
9. Summary of key findings			
10. Key recommendations			

Annex 7: EBS Scorecard

The EBS scorecard is organised by NPHI function and links to the existing NPHI scorecard. Under each function there is a set of high-level indicators that enable users of this EBS framework to assess their existing EBS capacity and progress toward framework implementation. Each indicator can be scored as 0 (No), 1 (Partial) or 2 (Yes), depending on the current EBS capacity. The scorecard also describes the type of documentation needed to justify the scores.

Scoring the scorecard

During a self-assessment or an external independent assessment, assessors should score all the indicators in the scorecard. This will ensure that final scores accurately reflect the capacity of the EBS programme. Based on the current capacity, each indicator in the scorecard receives a unique score ranging from 0–2. Assessors should score an indicator 0 if the EBS programme has absolutely no capacity in the area being assessed by that indicator – if the key attributes are completely absent. If the programme has some capacity and meets some of the attributes specified in an indicator, but not all, they should receive a score of 1. The assessors should score an indicator 2 if the programme completely meets all the requirements and key attributes specified in the indicator. The programme will be required to provide documentation that supports the scores awarded to a specific indicator. Please refer to the scorecard below for proposed documentation per indicator.

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

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

EBS performance score by NPHI function

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

The overall performance score is calculated in the same way as each function score, and is simply the total score, and total score percentage, for all functions.

EBS overall performance score

1) X = Sum of total points from all functions
2) Y = Sum of maximum possible points for EBS programme
3) Overall EBS programme score (%) = X/Y x 100

Colour-scoring system

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

- Minimal Performance (**Red**): <60%
- Average performance (**Yellow**): 60–80%
- Optimal performance (**Green**): >80%

EBS Scorecard Indicator	Possible Score	JEE Indicator
1. Surveillance and Disease Intelligence	**14**	
1.1) Has the National EBS TWG prepared and agreed upon a list of priority events for EBS? Note: Score "0" if no EBS is in place for priority events; Score "1" if EBS established for at least one priority event; Score "2" if EBS is functional for all priority events AND signal definitions are in place at all levels (National, intermediate, local, facility, and community) to improve EWAR. Documentation Required: List of priority events (e.g., IDSR list), TORs of national EBS TWG	2	D2.1
1.2) 80% or more of events detected by EBS in the last 12 months were detected within 7 days of emergence/event start*. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% ***Date of emergence/event start:** the date of symptom onset in the index case, but can also be the earliest date associated with the start of an event (e.g., symptom-onset of first reported case; first visit to healthcare facility; date of suspected primary case; most likely exposure date; first exposure date; latest exposure date; outbreak start date; date of death of first reported case; first report of the outbreak) Documentation Required: M&E framework or data, 717 metrics	2	D2.1/ D2.3
1.3) 80% or more of events detected through EBS in the last 12 months were notified within 24 hours of being verified. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% Documentation Required: M&E framework or data	2	D2.3
1.4) 80% or more of signals/events reported through EBS channels in the past 12 months had no missing information. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% **Key variables dates to review include:** event start, detection, verification, risk assessment, response Documentation Required: Event management system (e.g., DHIS-2, SORMAS, EWARS, etc)	2	D2.3
1.5) 80% or more of signals in the last 12 months were verified within 24 hours of being detected by EBS. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% Documentation Required: M&E framework or data	2	D2.2

EBS Scorecard Indicator	Possible Score	JEE Indicator
1.6) 80% or more of events detected through EBS in the last 12 months underwent a risk assessment within 24 hours of being verified. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% Documentation Required: M&E framework or data	2	D2.3/R1.1/D2.2
1.7) 80% or more reports regarding EBS events in the last 12 months were disseminated and shared back to reporting entities. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%. Score "2": if ≥ 80% Documentation Required: reports include situation reports and spot reports	2	D2.3
2. Information Systems	**6**	
2.1) Country has an electronic event management system (EMS) to manage (e.g., collect, analyse, and disseminate) EBS data Note: Score "0" if there is no EMS in place; Score "1" if the EMS is in development or partially in use; Score "2" if the EMS is in place and managing data for all levels and types of EBS in the country. Documentation Required: EMS use guidelines/SOPs	2	D2.3
2.2) The EMS systematically monitors the performance of EBS. Note: Score "0" if the EMS does not monitor the performance of EBS; Score "1" if the EMS monitors the performance of EBS ad hoc; score "2" if the EMS monitors the performance of EBS systematically and continuously. Performance can be monitored by assessing completeness and accuracy of data entered into the system. This also includes the ability to integrate M&E indicators and key variables associated with EBS performance (e.g., timeliness indicators and key dates) Documentation Required: EMS SOP, M&E plan, key performance indicators, 717 plan	2	D2.2/ D2.3
2.3) The EMS is inter-operable and interconnected within (lab, IBS, etc.) and with other sectors and countries to support coordinated multisectoral, One Health and cross-border surveillance. Note: Score "0" if the EMS is not interoperable or interconnected; Score "1" if the EMS is partially connected within the public health and with other sectors and countries; Score "2" if the EMS is fully connected within the public health sector and with other health sectors and countries to support coordinated and cross-border surveillance. Documentation Required: EMS use guidelines/SOPs	2	D2.3/ PoE1
3. Laboratory Systems & Networks	**2**	
3.1) Country's laboratory network has the capacity to test for at least 80% of pathogens associated with the priority EBS events. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80% Documentation Required: Laboratory data; M&E framework or data	2	D1.3

EBS Scorecard Indicator	Possible Score	JEE Indicator
4. Preparedness and Response	**4**	
4.1) 80% of events in the last 12 months have completed an effective initial response within 7 days of notification. Note: Score "0" if NPHI/MoH responded to 0-50% of notifications within 7 days; Score "1" if NPHI/MoH responded to >50%-<80% of notifications within 7 days; Score "2" if NPHI/MoH responded to ≥ 80% of notifications within 7 days. **Date of effective initial response**: date when all of the following 7 actions are completed: initiate investigation/response, epidemiological investigation, laboratory confirmation, initiate case management, initiate countermeasures, initiate communications and community engagement, establish response coordination mechanism (see 717 for more details) Documentation Required: M&E plan, 717 metrics for "effective initial response" see 717 supplemental materials.	2	D2.2
4.2) 80% or more of staff in the rapid response units in the past 12 months participated in at least one training to improve their EBS response coordination knowledge and skills. Note: Score "0" if actual percentage is 0-50%; Score "1" if >50%-<80%; Score "2": if ≥ 80%. Documentation Required: Training reports	2	D3.4
5. Public Health Research & Institutes	**2**	
5.1) The EBS programme systematically uses operational research evidence from EBS data to improve the country's early warning and response (EWAR) capacity. Note: Score "0" if operational research evidence is not used; Score "1" if operational research evidence is used but not systematic; Score "2" if operational research evidence is systematically used to improve EWAR capacity. Documentation Required: Reference to EBS data publications and reports	2	D2.3
6) Legislation	**4**	
6.1) The EBS program has legal authority or a policy in place that authorises the collection, sharing, and use of data collected across multiple sectors to conduct coordinated surveillance. Note: Score "0" if no multisectoral legal authority or policy is in place; Score "1" if legal authority or a policy is in place between at least two sectors for coordinated surveillance; Score "2" if legal authority or policy is in place between all relevant coordinated surveillance stakeholders. Documentation Required: Multisectoral data sharing policy/MoU	2	P1.1

EBS Scorecard Indicator	Possible Score	JEE Indicator
6.2) The EBS has legal authority or a policy in place that authorises the collection, sharing, and use of data collected across multiple countries to conduct cross-border surveillance.	2	P1.1/ PoE1
Note: Score "0" if no multi-country cross-border legal authority or policy is in place; Score "1" if legal authority or a policy is in place between ≥2 bordering countries; Score "2" if legal authority or policy is in place between all neighbouring countries for effective cross-border surveillance.		
Documentation Required: Cross-border surveillance data sharing policy/MoU		
7) Finance	**4**	
7.1) EBS funding mechanism. Who is currently funding EBS in the country?	2	P2.1
Note: Score "0" if 0-50% of the funding is provided by the country; Score "1" if >50%-<80% of the funding is provided by the country; Score "2" if ≥ 80% of the funding is provided by the country (2)		
Documentation Required: Annual work plan specifying source of funding		
7.2) Is the annual work plan / implementation plan for EBS fully funded for the current year?	2	P2.1
Note: Score "0" the EBS plan is not funded; score "1" the plan is partially funded; score "2" the plan is fully funded.		
Documentation Required: Annual work plan specifying source of funding		
8) Workforce	6	
8.1) Does the NPHI/MoH have a surveillance workforce development strategy/plan inclusive of EBS?	2	D3.1
Note: Score "0" if the EBS programme does not have a workforce development strategy; Score "1" if the EBS programme is in the process of developing a workforce development strategy/plan; score "2" if the EBS programme has a workforce development strategy/plan		
Documentation Required: Surveillance workforce development strategy/plan		
8.2) Are the EBS staff at national level trained on all recommended competencies?	2	D3.3
Note: "0" no training provided on EBS, "1" national level staff competent in some but not all competencies, "2" All National-level EBS staff are competent in all EBS training competencies National level training competencies include: 1) types of EBS (e.g., media, hotline, facility, community); 2) M&E (e.g., knowledge of indicators); 3) innovation (e.g., EMS, analytics)		
Documentation Required: EBS training report/records		
8.3) The EBS program provided supportive supervision to at least 80% of sub-national reporting entities in the last 12 months to improve data collection and timeliness.	2	D2.3
Note: Score "0" if actual percentage is 0-50%, "1" if >50%-<80%; Score "2": if ≥ 80% Key dates to review include: date of event start, detection, verification, risk assessment, response.		
Documentation Required: Support supervision reports		

EBS Scorecard Indicator	Possible Score	JEE Indicator
9) Strategic Plan	**6**	
9.1) The surveillance programme has a strategic plan inclusive of EBS? Note: Score "0" if there is no strategic plan; Score "1" if the strategic plan is in development; score "2" if a plan has been developed and is in place. Documentation Required: Surveillance program strategic plan	2	D2.1
9.2) Is there an annual work plan/implementation plan for EBS? Note: Score "0" none; score "1" in development; score "2" there is well-developed annual plan Documentation Required: EBS annual work plan	2	D2.1
9.3) Is there an EBS monitoring and evaluation plan in place? Note: Score "0" no M&E plan established; Score "1" plan is reviewed in ad-hoc bases; "2" plan is tracked/monitored regularly Documentation Required: EBS monitoring and evaluation plan, IDSR guidelines	2	D2.2
10) Structure	**2**	
10.1) How is the EBS structured in the country? Note: Score "0" if EBS doesn't have multi-level, multisectoral, or cross-border linkages; Score "1" EBS has initiated multi-level, multisectoral, and cross-border linkages; Score "2" if EBS has well-established multi-level, multisectoral, and cross-border linkages **Multilevel:** EBS is implemented at the national, intermediate, facility, community levels **Multisectoral:** EBS is inclusive of the One Health approach and includes linkages to all relevant sectors (e.g., human, animal, environment) **Cross-border:** EBS includes linkages with neighbouring countries, taking a regional approach Documentation Required: EBS SOPs, work plans/implementation plans.	2	PoE1
TOTAL	**50**	

Annex 8: Proposed Monitoring and Evaluation Indicators for Event-based Surveillance[22]

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
Impact								
Reduced mortality	Mortality rate in a specified population for a priority event under surveillance is reduced compared to the previous year(s)	Deaths in specified population for priority event	Number of persons in specified population	EBS reporting tools, EMS, all-cause mortality reports	Quant	Every 5 years	E	N
Reduced morbidity	Morbidity rate in a specified population for a priority event under surveillance is reduced compared to previous year(s)	Persons in specified population with morbidity due to priority event	Number of persons in specified population	EBS reporting tools, EMS	Quant	Every 5 years	E	N
Reduced spill over	Proportion of zoonotic events (initially detected in the animal population) that spilled over into, or led to human cases is reduced in comparison to previous year(s)	Number of zoonotic events detected in the animal population that spilled over into the human population	Total number of zoonotic events detected in the animal population	EBS reporting tools, EMS	Quant	Every 5 years	E	N
Reduced spread of events	Proportion of events that impacted more than 1 district is reduced compared to previous year(s)	Number of events that spread to >1 district	Total number of events detected	EBS reporting tools, EMS	Quant	Every 5 years	E	N, I

[22] C: community level; CHW: community health worker; E: evaluation; EBS: event-based surveillance; EMS: event management system; F: facility level; I: intermediate level; L: local level; M: routine monitoring; Mixed: mixed, qualitative and quantitative methods; N: national level; N/A: not applicable; POE: point of entry; Qual: qualitative methods; Quant: quantitative methods; SOP: standard operating procedures; TWG: technical working group

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
Reduced event response costs	Event response costs is reduced in comparison to previous year(s)	Event response costs	N/A	EMS, budgetary reports, costing analysis.[23]	Mixed	Every 5 years	E	N
Cost-effectiveness of EBS	Cost effectiveness of outbreak detection and response using event-based surveillance	Cost of investments in the event-based surveillance system	Costs of outbreak detection and response activities for events under surveillance in jurisdictions not implementing event-based surveillance	Cost-effectiveness analysis	Quant	Every 5 years	E	N
Increased country support for EBS	Proportion of funding from the government for EBS programme has increased, as a result of improved EWARN, compared to prior year(s)	Funding allocated to EBS from government	Total EBS budget	EMS, budgetary reports, EBS annual workplan	Quant	Every 5 years	E	N
Outcomes								
Timely event detection	Proportion of events detected within 7 days of event start	Number of events detected within 7 days of event start (e.g., onset of symptoms of	Total number of events detected	EBS reporting tools, EMS, 717 related data	Quant	Quarterly	M	N, I, F, L, C

[23]Bodenham RF, et. al. Multisectoral cost analysis of a human and livestock anthrax outbreak in Songwe Region, Tanzania (December 2018-January 2019), using a novel Outbreak Costing Tool. One Health. 2021 Apr 30;13:100259. doi: 10.1016/j.onehlt.2021.100259. PMID: 34013015; PMCID: PMC8113743.

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
		the earliest case identified)						
Timely event verification	Proportion of events which were verified within 24 hours after detection	Number of events verified within 24 hours of detection	Total number of events detected	EBS reporting tools, EMS	Quant	Quarterly	M	N, I, F
Timely risk assessment for events	Proportion of events for which the first risk assessment was conducted within 24 hours of verification	Number of events for which the first risk assessment was conducted within 24 hours of verification	Total number of events verified	EBS reporting tools, EMS	Quant	Quarterly	M	N, I
Timely event notification	Proportion of events which were notified within 24 hours after verification	Number of events notified within 24 hours of verification	Total number of events verified	EBS reporting tools, EMS, 717 related data	Quant	Quarterly	M	N, I, F
Timely initial effective response	Proportion of events for which an initial effective response was completed within 7 days of notification	Number of events responded to within 7 days of notification to the responsible authority	Total number of events where a notification was issued	EBS reporting tools, EMS, data from Response Unit, 717 related data	Quant	Quarterly	M	N, I
Usefulness and Quality of EBS data for decision-making	Proportion of responders who responded with an average	Number of responders whose scores across four key criteria averaged >=4	Total number of responders	Questionnaires, interviews, focus groups	Mixed	Yearly	E	N, I, F, L, C

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
	score >=4 across four key criteria (on Likert scale of 1-5).[24]							
Sensitivity	The proportion of health events that were detected through EBS out of all health events that were detected by any means over the past year	**Number of events detected through the EBS system**	Total number of unique events reported through both IBS and EBS	EBS and IBS reporting tools and databases, EMS, other surveillance databases	Quant	Yearly	E	N
Positive predictive value (PPV)	The probability a signal detected corresponds to a genuine health risk (verified event)	**Total number of events**	**Total number of signals**	EBS reporting tools, EMS	Quant	Yearly	E	N
EBS system utility	Proportion of community leaders and government stakeholders who find the EBS system useful Likert scale rating from community leaders and government decision-makers surveyed on utility of EBS for their jurisdiction	Number of community leaders and government stakeholders who find the EBS system useful	Total number of community leaders and government stakeholders surveyed	Questionnaires; semi structured interviews including focus groups with all staff and supervisor/mentor interviews.	Mixed	Yearly	E	N, I, C

[24] Likert scale rating from EBS staff and key decision-makers on four key criteria (1) how useful are EBS data for outbreak detection and response (1=not at all useful; 5=very useful); (2) whether EBS system in their site/jurisdiction is sensitive enough (1=not at all sensitive, 5=very sensitive); (3) whether EBS system in their site/jurisdiction is specific enough (1=not at all sensitive, 5=very sensitive); (4) how well EBS data are trusted and considered accurate (1=not at all trusted, 5=very well trusted).

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
EBS workforce motivation	Proportion of EBS workforce with improved motivation to implement EBS functions Likert scale rating from surveillance workforce surveyed on self-assessed motivation levels, and self-assessed competency in implementing EBS functions	Number of EBS workforce with improved motivation to implement EBS functions	Total number of EBS workforce surveyed	Questionnaires; semi structured interviews including focus groups with all staff and supervisor/mentor interviews	Mixed	Yearly	E	N, I, F, L, C
EBS workforce competency	Proportion of surveillance staff with improved competency in analysis and interpretation of EBS data for early warning surveillance	Number of EBS staff with improved competency in analysis and interpretation of EBS data	Total number of EBS workforce assessed	Questionnaires; semi structured interviews; focus groups with all staff; and supervisor/mentor interviews	Mixed	Yearly	E	N, I, F, L
EBS workforce capacity	Proportion of trained EBS staff actively engaged in EBS activities	Number of trained EBS staff actively engaged in EBS activities	Total number of trained EBS staff	National data base of trained EBS staff (compiled from attendance list of all EBS trainings conducted)	Mixed	Yearly	E	N, I, F, L, C
EBS workforce improved knowledge	Proportion of EBS staff with improved knowledge and skills in EBS from pre to post test	Number of EBS staff with improved	Total number of trained EBS staff	Pre and post test	Mixed	Yearly	E	N, I, F, L, C

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
		knowledge and skills from pre to post test						
Outputs								
Personnel trained to conduct EBS	Proportion of personnel trained in EBS at each level, by role and by EBS type	Number of EBS staff trained	Total number of EBS staff	EBS annual workplan, EBS training reports	Mixed	Quarterly	M	N, I, F, L, C
Personnel equipped to conduct EBS	Proportion of personnel equipped with the appropriate materials/resources at each level, by role and by EBS type	Number of EBS staff equipped	Total number of EBS staff	EBS annual workplan, EBS training reports	Mixed	Quarterly	M, E	N, I, F, L, C
Signals detected and reported for triage	Proportion of signals detected and reported for triage by each EBS source	Number of signals detected and reported for triage by EBS source	Total number of signals detected by EBS source	EBS reporting tools, EMS	Quant	Weekly	M	N, I, F, L, C
Signals triaged	Proportion of signals triaged	Total number of signals triaged	Total number of signals detected	EBS reporting tools, EMS	Quant	Weekly	M	N, I, F, L, C
Signals undergoing verification	Proportion of triaged signals that undergo verification	Number of signals verified	Number of signals that passed triaged	EBS reporting tools, EMS	Quant	Weekly	M	N, I, F
Signals verified as events	Proportion of signals verified as events	Number of signals verified as events	Number of signals that underwent verification	EBS reporting tools, EMS	Quant	Weekly	M	N, I, F

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
Events are characterized by risk level	Proportion of events that undergo risk assessment	**Number of events assessed for risk**	**Total number of events**	Risk assessment tool	Quant	Weekly	M	N, I
Events of medium to high risk responded to	Proportion of events responded to, characterised as medium to very high risk level, for which a response was initiated	**Number of medium to very high risk events responded to**	**Total number of events assessed as medium to very high risk**	EBS reporting tools, EMS	Quant	Weekly	M	N, I, F, L, C
EBS site timely reporting	Proportion of EBS sites reporting monitoring data within prescribed timeframe	Number of sites reporting monitoring indicators within prescribed timeframe	Total number of EBS sites	EBS monitoring tool, EMS	Quant	Monthly	M	N, I, F, L, C
EBS site level data available	Proportion of surveillance units within each administrative level routinely reporting EBS data	Number of surveillance units per administrative level where EBS data is available to inform surveillance activities	Total number of surveillance units conducting EBS per administrative level	EBS Monitoring Tool; Surveillance Reports/Bulletins	Quant	Quarterly	M	N, I, F, L, C
Activities								
EBS trainings conducted	Number of EBS trainings conducted at national, intermediate, and local levels, by role and by EBS type	N/A	N/A	EBS annual workplan, EBS training reports	Mixed	Quarterly	M	N, I, F, L, C

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
Equipment and reporting tools for EBS are procured and available	The acquisition or development of equipment and reporting tools for EBS implementation in each setting and at each administrative level	Number of sites implementing EBS with equipment and reporting tools	Total number of sites implementing EBS	EBS annual workplan, EBS budget	Mixed	Yearly	M	N, I, F, L, C
Multisectoral TWG meetings held	Proportion of multisectoral TWG meetings regularly held to guide EBS implementation	Number of TWG meetings held	Total number of TWG meetings planned	Questionnaires, interviews, focus groups	Mixed	Yearly	E	N
Simulation exercises conducted	Number of EBS-related simulation exercises conducted	N/A	N/A	EBS annual workplan, EBS training records	Quant	Yearly	E	N, I, F, L, C
Surveillance units that establish EBS within jurisdiction	Proportion of surveillance units (or equivalent) at each administrative level that establish EBS	Number of surveillance units that establish EBS	Total surveillance units	EBS annual workplan	Quant	Quarterly	M	N, I, F, L, C
Facilities that establish EBS	Proportion of facilities within country that establish EBS	Number of facilities that establish EBS	Total facilities	EBS annual workplan	Quant	Quarterly	M	F
Supportive supervision visits conducted	Proportion of planned supportive supervision visits conducted to EBS sites	Number of supportive supervision visits conducted to EBS sites	Total number of planned supportive supervision visits	Program Records	Quant	Quarterly	M	N, I, F, L, C
EBS evaluation site visits conducted	Proportion of sites implementing EBS where evaluation site visits are	Number of sites implementing EBS evaluated	Total sites implementing EBS	EBS annual workplan, EBS evaluation report	Mixed	Yearly	E	N, I, F, L, C

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
	conducted (including data review, focus groups, and key informant interviews, as appropriate)							
Frequency of EBS signal updates	Frequency that EBS signals are reviewed and/or updated	Number of times per year that EBS signals are reviewed and/or updated at the national level	N/A	Program records	Mixed	Yearly	E	N
EBS reporting units using digital systems	Proportion of reporting units using digital systems for EBS	Number of sites utilizing digital systems for EBS	Total sites implementing EBS	Program records	Quant	Yearly	E	N, I, F, L, C
Inputs								
Establishment of a Multisectoral TWG	A functional multisectoral TWG is established at the national level to guide EBS implementation	**N/A**	**N/A**	EBS workplan, EBS TWG meeting minutes and roster	Mixed	Yearly	M	N
Equipment and reporting tools for EBS are procured and available	Number of sites implementing EBS that received equipment and reporting tools	Number of sites implementing EBS with equipment and reporting tools	Total number of sites implementing EBS	EBS workplan, EBS annual budget	Quant	Yearly	M	N, I, F, L, C

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
EBS priority events are determined	Priority events to be included in EBS are identified and signal definitions drafted	N/A	N/A	EBS annual workplan	Qual	Yearly	M	N
Existence of EBS signals for all sources/sites	EBS signals are defined for detection of priority events at all levels and in all settings	N/A	N/A	EBS evaluation reports	Mixed	Quarterly	M, E	N, I, F, L, C
EBS implementation sites and sources identified	Administrative levels and EBS types identified for EBS implementation	N/A	N/A	EBS annual workplan, EBS evaluation reports, EBS reporting tools, EMS	Mixed	Yearly	M, E	N, I, F, L, C
EBS technical guidelines and SOPs are approved and available for use	Proportion of sites (by EBS type and administration level) implementing EBS that have the EBS technical guidelines and SOPs available	Number of sites implementing EBS with guidelines and SOPs	Total number of sites implementing EBS	Guidelines, SOPs, EBS evaluation reports	Mixed	Yearly	M, E	N, I, F, L, C
EBS staff and key stakeholders available to implement EBS	Identification of EBS-related staff for each setting and administrative level	Number of staff and key stakeholders available to implement EBS	N/A	Staffing roster, EBS annual workplan	Quant	Yearly	M	N, I, F, L, C
EMS established	Electronic event management system that captures, analyses, and reports event-related data is in place	N/A	N/A	EMS, EBS evaluation reports	Mixed	Yearly	M	N, I, F

Indicator	Definition	Numerator	Denominator	Data Source	Methods	Freq.	Type	Level Measured
National EBS focal point established	National EBS focal point established	N/A	N/A	Program records	Mixed	Yearly	E	N
EBS implementation workplan available	National EBS implementation workplan developed and available	N/A	N/A	Program records	Mixed	Yearly	E	N
EBS training materials available	EBS training modules and training materials developed, approved and available for use	N/A	N/A	EBS Training Materials; Program records	Mixed	Yearly	E	N
EBS M&E tools available	EBS monitoring and evaluation tools are developed and available for use	N/A	N/A	Program records	Mixed	Yearly	E	N
EBS M&E Plan available	Availability of an M&E plan agreed to by stakeholders and regularly updated	N/A	N/A	Program records	Mixed	Yearly	E	N
Amount of EBS budget available	Amount of budget allocated to EBS implementation	N/A	N/A	Program records	Quant	Yearly	E	N

Annex 9. Example Evaluation Plan[25]

Evaluation Topic	Question	Results	Indicator	Data Collection Method	Data Source	Analysis Method
Surveillance system	What is the surveillance system data picture?	Counts, proportions	Person, place, and time characteristics	Data abstraction	Abstraction tool	Quantitative
	How are the performance of the surveillance system attributes?	Counts, proportions	Simplicity, completeness, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness	Data abstraction	Abstraction tool	Quantitative
	Are there adequate and well-trained staff in place to implement the EBS system?	Counts, proportions	Percentage of staff needed both in place and trained	Surveys, data abstraction	Questionnaires, abstraction tool	Mixed
	Is the annual budget adequate and routinely funded to implement EBS?	Proportion	Percent of annual budget funded	Surveys, data abstraction	Questionnaires, abstraction tool	Quantitative
User experience	What worked well, what were the challenges and what require improvements?	Scale	Level of satisfaction, feedback, perceptions, views	FGDs & KIIs	FGD & KII tools	Qualitative
Community (stakeholder) experiences	Was the surveillance system beneficial? What can be improved?	Scale	Level of satisfaction, feedback, perceptions, views	FGDs	FGD tool	Qualitative
Impact of the surveillance system	Was there a change in the number of health emergencies?	Proportions	Percentage decrease in health emergencies	Surveys	Questionnaires, abstraction tool	Mixed
	Was there a change in morbidities from health emergencies?	Proportions	Percentage (proportionate morbidity) decrease in morbidities from health emergencies	Surveys	Questionnaires, abstraction tool	Mixed
	Was there a change in mortalities from health emergencies?	Proportions	Percentage (proportionate mortality) decrease in mortalities from health emergencies	Surveys	Questionnaires, abstraction tool	Mixed

[25] FGD: focus group discussion; KII: key informant interviews; Mixed: Qualitative and Quantitative

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