Module 1: Overview of Public Health Surveillance

Introduction

Public health surveillance is the ongoing systematic collection, collation, analysis and interpretation of health data for planning, decision-making, implementation, and evaluation of public health practices, and timely dissemination of information to relevant stakeholders. Surveillance aims to detect health risks as early as possible, and ensures that key stakeholders are made aware of, and receive pertinent information on the situation.

There are many public health events that go unnoticed in Africa. Strengthening countries' disease surveillance and response systems is central to improving public health security in each country and globally.

The aim of this module is to give a learner a highlight of the concept and types of surveillance, and early warning and response

This module contains the following sessions:

Session 1: Integrated Disease Surveillance and Response
Session 2: Epidemic Intelligence
Session 3: Early Warning and Response
Session 4: Event-based Surveillance and One Health

By the end of this module, you will be able to be able to:

- Understand the concept of Integrated Disease Surveillance
- Explain the relationship between IBS and EBS
- Explain the concept of Epidemic Intelligence
- Explain the concept of Early Warning and Response

- Describe the link between EBS, IBS and Epidemic intelligence and Early Warning and Response
- Understand how to conduct EBS using a one health approach

Session 1: Integrated Disease Surveillance

Integrated disease surveillance is an approach that aims at collecting health data for multiple diseases, using standardised tools. To ensure robust early warning and prompt response. Integrated Disease Surveillance and Response (IDSR) is an example of a data collection and analysis system that relies on two main channels of information or signal generation: **indicator-based surveillance (IBS)**; and **event-based surveillance (EBS)**.

Public Health surveillance makes use of two main surveillance mechanisms:

1. Indicator-based surveillance (IBS)
2. Event-based surveillance (EBS)

Indicator-based surveillance

Indicator-based surveillance is a more traditional way of reporting diseases to public health officials. IBS involves reports of specific diseases from health care providers to public health officials. Such information may be described as structured information because the information obtained is standardised. It could be defined as the systematic (regular) collection, monitoring, analysis, and interpretation of structured data produced by many well-identified, mostly health-based, formal sources.

The traditional indicator-based surveillance (IBS) system generally collects routine structured surveillance data mostly from health facilities and may miss public 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. A typical example is the Ebola virus disease outbreak in West Africa in 2014-16 which started late December 2013 but was detected in the year 2014. This indicates that signals that could trigger investigation of the event weren't reported promptly. Event-based surveillance that depends on mainly ad hoc data collected from anywhere at any time could have bridged this shortcoming.

Event-based surveillance

Event-based surveillance (EBS) is an organised collection, monitoring, assessment and interpretation of mainly unstructured, ad-hoc information regarding health events or risks, which may represent an acute health risk. Such information can come from many stakeholders and may include formal and informal sources of information from the human, animal, environment, as well as many other sectors.

Session Summary

- IBS collects routine data with well-defined indicators within defined timelines mostly from health facilities
- EBS collects unstructured data in an ad hoc fashion from diverse sources including health facilities
- Event-based Surveillance and Indicator-based Surveillance are two surveillance approaches that complements each other
- In areas where there is limited accessibility to health facilities or poor health seeking behaviour, early detection of alerts and events is made possible by enhancing event-based surveillance

Quiz

1. Event-based surveillance does not depend on mainly ad hoc data collected from anywhere at any time. (True/False)
2. Event-based Surveillance and Indicator-based Surveillance are two surveillance approaches that complements each other. (True/False)
3. EBS collects routine data with well-defined indicators within defined timelines mostly from health facilities (True/false)
4. Structured information obtained from standardised disease specific reports from health care works is an important source of information for; (Select the most appropriate)
   a) EBS
   b) IBS
   c) Both EBS and IBS
   d) None of the above

Session 2: Epidemic Intelligence

Data from EBS should be a component of epidemic intelligence (EI). Epidemic intelligence is the systematic collection, analysis and communication of any information to detect, verify, assess and investigate events and health risks with an early warning objective. EI spans beyond diseases and pathogens as it is inclusive of all events (e.g., radionuclide, environmental etc.) that could pose a threat to health. EI should integrate both sources of information (IBS and EBS) to efficiently detect acute health events and/or risks. Ideally, a centralised EI unit (which oftentimes can be a surveillance unit) at the national level should be available to collect, collate, and analyse information collected through each type of EBS, or from the designated reporting modalities. Such an EI unit should be able to routinely receive, analyse, and visualise data from both IBS and EBS sources. Where available, an Emergency Operation Centres (EOC) can act as EI hubs by

receiving, analysing, and visualising multiple data streams, including EBS, IBS surveillance data.

Session Summary

- IBS and EBS are essential components of epidemic intelligence.
- Epidemic intelligence spans beyond surveillance of diseases and pathogens

Quiz

1. Epidemic intelligence is the systematic collection, analysis and communication of any information to detect, verify, assess and investigate events and health risks with an early warning objective. (True/False)

2. Where available, an Emergency Operation Centres (EOC) can act as EI hubs by receiving, analysing, and visualising multiple data streams, including EBS, IBS surveillance data. (True/False)

3. EI does not integrate both sources of information (IBS and EBS) to efficiently detect acute health events and/or risks. (True/False)

4. Routine analysis of surveillance data may help in early detection of alerts and events. (True/False)

Session 3: Early Warning and Response

EWAR is the organised mechanism to detect any abnormal occurrence or any divergence from the usual or normally observed frequency of phenomena as early as possible from both structured and unstructured data. In places where health services are not well established; where the use of formal services is limited; and for rare conditions or public health events, indicator-based surveillance would not efficiently

detect all health risks early enough to trigger a timely response. The principle of EWAR is to have in place a surveillance system with the capability to detect all acute public health risks early enough from all available sources to trigger a timely response.

The general objective of EWAR is to rapidly detect and control acute public health events of any origin, with particular attention to nationally prioritised health risks. Data collected through EWAR must aim to inform and trigger public health responses to acute public health events of all origins —human, animal, environmental, radiological, and chemical, food poisoning, or natural calamity. EWAR relies on two main channels of information: IBS and EBS.

EWAR includes the processes of data collection, verification, risk analysis and communication between the relevant sectors for appropriate response. An effective EWAR represents the capacity of a health system to generate and disseminate timely and meaningful warning information that enables responders, at-risk individuals, and communities to prepare and act appropriately and in sufficient time to manage and reduce public health threats. Early detection and reporting are instrumental to the functionality of EWAR system.

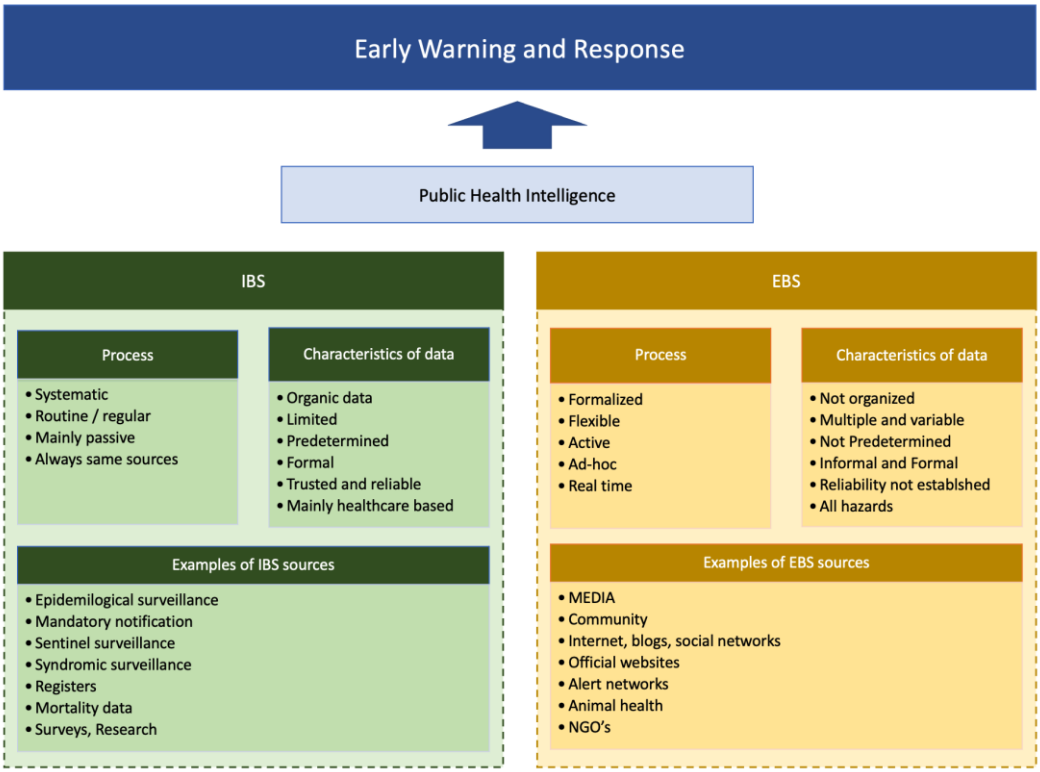

Figure 1: Comparison between IBS and EBS as components of EWAR

Source: WHO/HSE/GCR/LYO/2014.4)

Session summary

EWAR provides information that enables early detection and response to all-hazard events

Quiz

1. EWAR is the organised mechanism to detect any abnormal occurrence or any divergence from the usual or normally observed frequency of phenomena as early as possible from both structured and unstructured data. (True/False)

2. The following includes EWAR processes in management of Public Health threats (Select the inappropriate)
   a) data collection
   b) verification
   c) risk analysis
   d) communication between the relevant sectors
   e) Treatment

3. EWAR represents the capacity of a health system to generate and disseminate timely and meaningful warning information that enables responders, at-risk individuals, and communities to prepare and act appropriately and in sufficient time to manage and reduce public health threats. (True/False)

4. Data collected through EWAR does not aim to inform and trigger public health responses to acute public health events of all origins (True/False)

5. In places where health services are not well established; where the use of formal services is limited; and for rare conditions or public health events, indicator-based surveillance would not efficiently detect all health risks early enough to trigger a timely response. (True/False)

6. The principle of EWAR is to have in place a surveillance system with the capability to detect all acute public health risks early enough from all available sources. (True/False)

Session 4: Events Based Surveillance and One Health

Increased interaction at the human-animal-environment interface combined with the complex health challenges of zoonotic diseases, antimicrobial resistance, food insecurity, poverty, famine and climate change means that a multisectoral, One Health approach is imperative to effectively prevent and mitigate the effects of these shared challenges.

Over 60% of pathogens that cause human diseases originate from domestic animals or wildlife and 75% of emerging human pathogens are of animal origin[1]. When deforestation

[1] Taylor LH, Latham SM, Woolhouse ME. Risk factors for human disease emergence. Philos Trans R Soc Lond B Biol Sci. 2001 Jul 29;356(1411):983-9. doi: 10.1098/rstb.2001.0888. PMID: 11516376; PMCID: PMC1088493.

and land-use changes impact forest cover, interactions between wild animals, humans and their livestock are more likely and increase the likelihood of disease transmission between these populations[2]. Human actions have severely altered 75% of terrestrial environments, 66% of marine environments, and the climate[3]. Specifically, climate change has also been linked to increased opportunities for viral spill-over from wildlife into humans[4]. Preventing and managing shared health threats is not possible through a single sector approach. To be successful, you need to rely on the full cooperation of the animal, human, and environmental health sectors (Figure 1). One Health, as defined by the tripartite (OIE, FAO, WHO),[5] is a collaborative, multidisciplinary, and multisectoral approach that can address urgent, ongoing, or potential health threats at the human-animal-environment interface at subnational, national, global, and regional levels. This approach includes ensuring balance and equity among all the relevant stakeholders and disciplines. The One Health approach leverages data, expertise and management across different sectors to enhance the understanding of shared health events. One Health is crucial in EBS because:

1. Signals can be detected through a wide variety of sources and surveillance officers (including animal, environmental and human health sectors). Therefore, a One Health approach is needed in the development of a signal list, integrating all possible sources, and coordinating across sectors for the reporting of multisectoral signals captured for prompt action.

[2] Dobson AP, Pimm SL, Hannah L, Kaufman L, Ahumada JA, Ando AW, Bernstein A, Busch J, Daszak P, Engelmann J, Kinnaird MF, Li BV, Loch-Temzelides T, Lovejoy T, Nowak K, Roehrdanz PR, Vale MM. Ecology and economics for pandemic prevention. Science. 2020 Jul 24;369(6502):379-381. doi: 10.1126/science.abc3189. PMID: 32703868.

[3] The IPBES Global Assessment Report on Biodiversity and Ecosystem Services: https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/

[4] Carlson, C.J., Albery, G.F., Merow, C. et al. Climate change increases cross-species viral transmission risk. Nature (2022). https://doi.org/10.1038/s41586-022-04788-w

[5] A guide developed by FAO, OIE and WHO: https://trello.com/b/Nft0bj8P/tripartite-zoonoses-guide-tzg

2. Verification of multisectoral signals requires support from different sectors or stakeholders in the field. Thus, the One Health approach facilitates the involvement of all relevant stakeholders when needed.

3. Risk assessment requires a multisectoral and multidisciplinary team, especially for health events that negatively impact multiple populations and species.

4. Health events that impact multiple sectors, require a coordinated, multisectoral response to minimise the overall impact of the event. Acting early to implement prevention and control measures within one population can minimise the possibility of spill-over or impact to another population, especially when an event involves a zoonotic disease or other shared health threats.

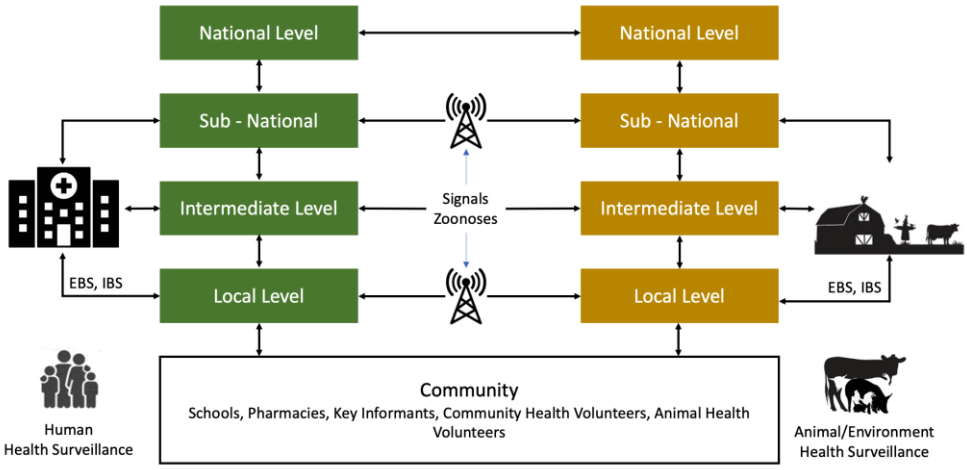

Figure 2: Illustration of the establishment of EBS using One Health Approach

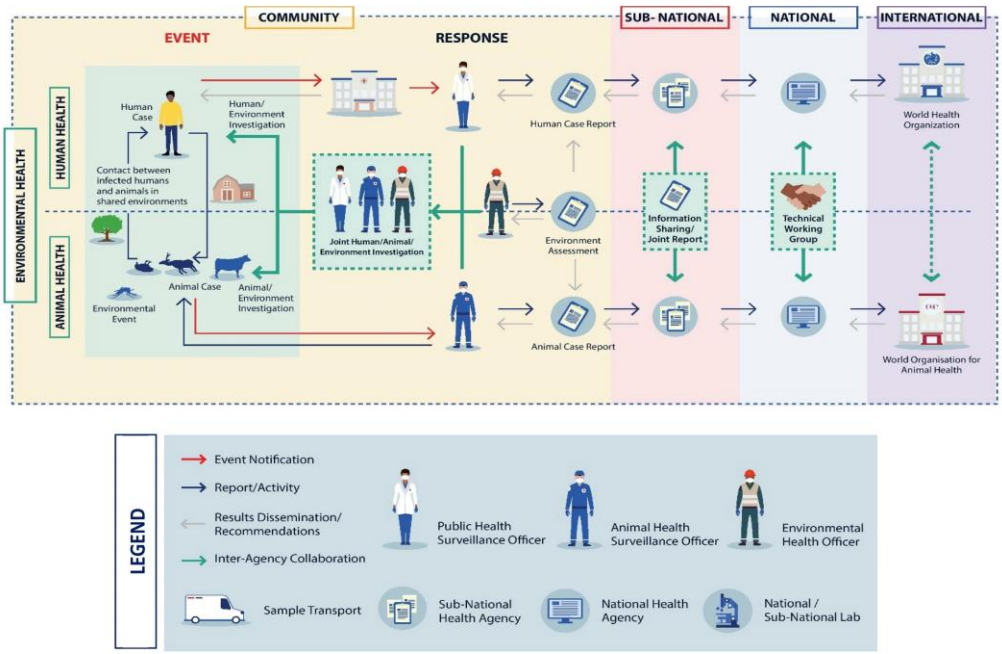

Figure 3: Illustration of the establishment of EBS using One Health Approach

Session Summary

Event-based surveillance is key in strengthening one-health collaboration on surveillance and response to human, animal and environment related events at local, intermediate and national levels.

Quiz

1. Over 60% of pathogens that cause human diseases originate from domestic animals or wildlife and 75% of emerging human pathogens are of animal origin. (True/False)

2. Verification of multisector signals requires support from different sectors or stakeholders in the field. Thus, the One Health approach facilitates the involvement of all relevant stakeholders when needed. (True/False)

3. One Health does not involve collaboration of multidisciplinary, and multisector approach that can address urgent, ongoing, or potential health threats at the human-animal-environment interface (True/False).

4. One Health works at the following levels (Select all that applies)

   a) Subnational
   b) National
   c) Global
   d) Regional levels
   e) All of the above
   f) None of the above

5. Climate change has not been linked to increased opportunities for viral spill-over from wildlife into humans (True/false)

6. Signals can be detected through a wide variety of sources and surveillance officers including animal, environmental and human health sectors. (True/False)

7. One Health approach is not needed in the development of a signal list (True/False)

8. Risk assessment requires a multisector and multidisciplinary team, especially for health events that negatively impact multiple populations and species. (True/False)