

CHAPTER II

LITERATURE REVIEW

A. Overview of Anthrax

1. Definition of Anthrax

Anthrax is an acute, acute, or subacute disease that primarily affects herbivores, but all mammals are susceptible, including humans. The term 'anthrax' comes from the Greek '*anthrakos*,' meaning coal, referring to a type of eschar cutaneous anthrax characteristic of humans.^{54.55} Anthrax is a zoonosis,²⁷ caused by *Bacillus anthracis*, which quickly causes fatal septicemia in animals.

2. Transmission

Anthrax is included as a zoonosis,²⁷ caused by *Bacillus anthracis*. Generally, animals can contract anthrax if they ingest spore-contaminated soil while grazing. Meanwhile, carnivores can be infected by eating infected animals.⁵⁶ Generally, spores can enter humans through lesions on the skin (skin or cutaneous anthrax), lungs (inhalation anthrax), or digestive tract (gastrointestinal anthrax) and will then germinate to produce a vegetative form.⁵

B. Surveillance

1. Human Anthrax Surveillance

a. Data collection and surveillance methods

Surveillance data collection can be done by:

1) Passive

In this type of surveillance, officers wait for reports without actively searching for cases, which involves systematic data collection and reporting.

2) Active

In active surveillance, community health workers actively seek reports from participants regularly. Active surveillance is more difficult and expensive to implement.^{57,58}

Surveillance methods include routine reporting systems, sentinel reporting systems, surveys and case studies, case and outbreak investigations, vital registration systems, and censuses.³⁰

b. Data Reporting

If an outbreak occurs, the CHCs outbreak report is sent in stages to the Minister by referring to the outbreak report format (Form W1). The outbreak report form (W1 Form) is the same for CHCs, the regency health office, and the provincial health office, but with a different code.

2. Anthrax Surveillance in Animals

a. Classification of surveillance aids and surveillance methods

One of the ways to classify surveillance is by determining the subjects who make the initial observations, which consist of:

1) Surveillance based on farmer observations

Surveillance based on initial observations by animal owners. This surveillance is classified as passive surveillance.

2) Surveillance based on veterinary observations

Surveillance based on initial inspection or observation by a veterinarian may be considered periodic or ad hoc surveillance.³¹

b. Data Reporting

Currently, the reporting system in Indonesia related to animal health uses the ISIKHNAS system. This system can collect data from the field and provide data immediately to stakeholders. iSIKHNAS combines data management systems from various agencies. ISIKHNAS uses simple spreadsheets from the office and SMS messages from mobile phones in the field to quickly get data as close to its source as possible and make it easy for the users who need it to view and analyze.⁵⁹

3. Surveillance of zoonoses and diseases newly integrated infection cross-sector

Based on the Coordinating Minister for the Republic of Indonesia (2022), *"Integrated Cross-Sectoral Surveillance of Zoonoses and New Infectious Diseases is a systematic, continuous disease observation activity, obtaining and sharing data and information on the occurrence of zoonoses and new infectious diseases in an integrated cross-sectoral manner (public health, animal health, and environmental/wildlife health) community-based, laboratory-based, and in real-time, to recommend effective and efficient measures for the prevention and control of zoonoses and new infectious diseases."*

a. Types of Integrated Surveillance

1) Event-based surveillance or priority syndrome surveillance

- 2) Indicator-based surveillance;
 - 3) Surveillance triangulation; and
 - 4) Death surveillance
- b. Framework for Integrated Cross-Sectoral Surveillance Systems for Zoonoses and New Infectious Diseases, detailed as follows:
- 1) Cross-Sectoral Integrated Surveillance Planning
 - 2) Implementation of Integrated Cross-Sectoral Surveillance Systems for Zoonoses and New Infectious Diseases
 - a) Standardization of disease surveillance at all levels (central and regional);
 - b) Standardization technique diagnostic laboratory;
 - c) Collection, referring sample, and inspection of laboratory specimens;
 - d) Data collection and processing;
 - e) Integrated analysis and interpretation;
 - f) Making report together and dissemination of report;
 - 3) Inquiry/investigation epidemiology integrated cross-sector.
 - 4) Monitoring and evaluation.

C. Program Evaluation

1. Definition

Evaluation is a systematic and objective assessment of all aspects of a program (e.g., design, implementation, and results) to determine the value or relevance of the program as a whole. ¹⁹ Evaluation is a systematic method of

learning from experience and leveraging lessons learned to improve current efforts and encourage better planning, which requires a critical review of the program's various components.⁶⁰

2. Evaluation Method

Two approaches are commonly used in surveillance evaluation: qualitative and quantitative. Evaluation of surveillance using this aims to provide an overview and assessment of several characteristics of the surveillance system. Evaluation using a quantitative approach to the surveillance system is carried out by assessing the performance of the surveillance system, while the evaluation using a qualitative approach does not use a scoring system but written options to evaluate the surveillance characteristics.²⁵

3. Theory of Evaluation Logic model

One approach to program evaluation is the logic model, which evaluators commonly use. The logic model visually represents the relationship between program activities and expected results.²² The logic model is a program evaluation model that has existed since the 1970s and was later defined by Bickman (1987) in the late 1980s as a method and is the basis for program evaluation.^{61,62} CDC (2006) guides an overview of the logic model and its elements; the following is a picture:

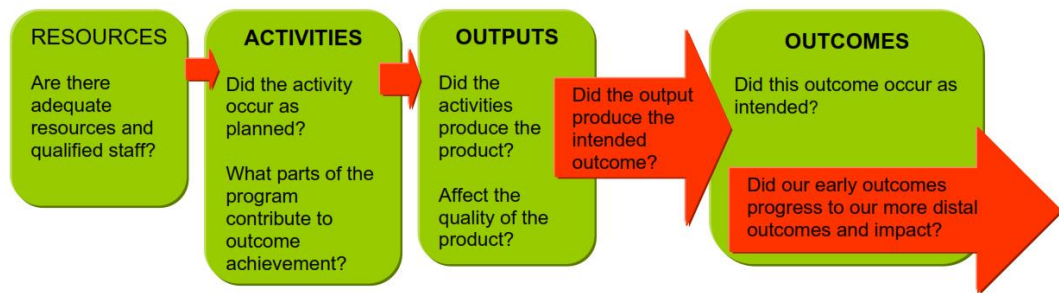


Figure 2.1. Elements of the Logic model²³

Logical models link issues (conditions) with interventions (inputs and outputs) and outcomes. Logic models help define program components that provide valuable assessment data and identify appropriate data collection and progress measurement sequences.²⁴ The following components of the logic model:

a. Input: available resources to implement an activity or program implementation²⁸

1) Human resources include staff, volunteers, partners, and local communities. Are they sufficient yet to evaluate resources in terms of the number (quantity) and quality of human resources? The quality of human resources can be assessed from the aspects of knowledge, skills, expertise, and education.²³

2) Fiscal resources, including allocated funds, special grants, endowments, and user fees;²⁴

3) Facilities and equipment;²⁴

4) Regulation²³ and guideline⁶³

- b. Activity/ process: actual intervention or effort by the program and its personnel using available inputs to achieve health outcomes/goals.^{28,29}
- c. Output: direct product obtained from program activities.²⁸
- d. Outcomes: changes, effects, results of program implementation (activities and outputs), or benefits that may be short, medium, or long-term, either during or after program implementation.^{28,63}

D. Evaluation of anthrax surveillance programs

There are five components in the surveillance system for evaluation targets: priority diseases targeted for surveillance; system structure; core function; support function; and the quality of the surveillance system. The below Figure regarding the surveillance components for evaluation:

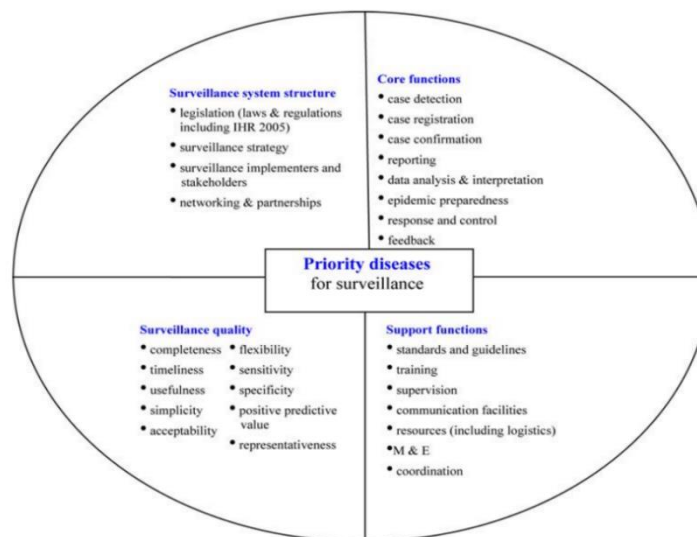


Figure 2.2. Components of a surveillance and response system for M&E ²⁰

Based on the logic model and components of surveillance and response system for Monitoring & Evaluation (Fig. 5. WHO, 2006),²⁰ The evaluation of the anthrax surveillance program includes evaluation of inputs, activities,

outputs, and outcomes.²⁴ In doing the evaluation is also necessary to conduct component identification of context, which refers to aspects outside the program that affect the way the program operates and is affected by the program.⁶⁴

1. Inputs

Input in conducting surveillance includes surveillance strategies,^{20.35} human resources,^{20.24} logistics,²⁰ laboratories,²⁵ fiscal resources,²⁴ legislative (regulatory and statutory) support,^{20.35} standards and guidelines,²⁰ networks and partnerships,^{20.35} implementers and stakeholders.^{20.35}

a. Surveillance strategy

The results of the meta-regression analysis show that strategic planning has a positive, moderate, and significant effect on organizational performance.⁶⁵ An effective human resource management strategy systematically manages all individual human resource management actions to influence officers' attitudes and behavior directly.⁶⁶ The existence of a strategy can positively impact surveillance officers in facilitating work to consolidate surveillance systems, guide programs, and surveillance activities, and improve data availability, quality, and timeliness for all stakeholders.⁶⁷ Evaluation refers to the existence of a strategic and operational plan for the implementation and strengthening of the infectious disease surveillance and response system.²⁰

b. Human Resources

The surveillance system's effectiveness depends on the quality and quantity of human resources.³¹ The evaluation carried out on human

resources in surveillance consists of evaluating the availability/amount of human resources and whether the quality of human resources is sufficient. The quality of human resources can be assessed from the aspects of knowledge, skills, expertise, and education.²³ Factors that influence the performance of surveillance officers are the length of work, level of education,⁶⁸ multiple workloads, level of knowledge, attitudes, motivation, skills, and expertise. Compensation (incentives) influences the motivation and performance of surveillance officers.⁶⁹

Adequate human resources are a factor that influences the decision to activate a rapid response team.⁷⁰ The surveillance system also requires a rapid response team²⁰ that can respond to suspected outbreaks.²⁰ Rapid action teams need to be formed at the district/city level (based on the regulation of the Minister of Health of the Republic of Indonesia number 1501/Menkes/per/X/2010)⁹ and CHCs to respond quickly when there is a suspected outbreak at the CHCs and district levels⁷¹ and assist in efforts to deal with outbreaks.⁹

c. Logistics

Surveillance officer performance is affected by surveillance activity supporting facilities.⁷² In addition, logistics such as facilities related to surveillance implementation activities are available. The more complete the facilities, the more accessible and more supportive the implementation of the surveillance program will be.³² Components in logistics in the form of evaluation on data management, communication, means of

transportation, personal protective equipment, and availability of adequate equipment in sampling.^{20,30}

d. Laboratory

A well-functioning laboratory is essential for confirming the clinical diagnosis and the reliable performance of surveillance of infectious diseases by staff.⁷³ Laboratories are urgently needed by officers and are essential for surveillance programs that allow early detection of cases.⁷⁴

A well-functioning laboratory is essential for confirming the clinical diagnosis and the reliable conduct of infectious disease surveillance. Biosafety Level (BSL) and test capabilities that can be performed in the diagnosis of anthrax by related laboratories. A laboratory with a BSL-2 level is recommended for the diagnosis of anthrax.³⁸

e. Fiscal resources

Inadequate funding availability significantly affects the reporting of outbreaks by officials.⁷⁵ Input on fiscal resources includes funding availability and the origin/source of funds.^{76,77 30}

f. Legislative support (regulations and legislation)

Officers need legislative support so that surveillance can be carried out effectively.³⁵ Information regarding the existence or absence of regulations, legislation, or decrees (SK) supports the anthrax surveillance program.^{20,26}

g. Standards and guidelines

Research show absence factor form influential to the performance of surveillance officer.⁷⁸ Lack of surveillance form significantly associated with reporting of outbreaks by officials.⁷⁵ Standards and guidelines function as supporter officers in the execution of surveillance activities that include surveillance guidelines and reporting forms.²⁰

h. Network work and partnerships^{20,79}

Evaluation of networks and partnerships in the form of:

- 1) Framework for cross-border/country collaboration²⁰
- 2) Networks and their roles in the implementation of surveillance systems³⁰
- 3) There is a documented agreement made, such as a contingency plan, risk reduction/ mitigation action plan, Memoranda of Understanding (MOUs), Standard Operating Procedures (SOPs), or other agreements that support coordination, networking, and partnership activities.^{20,36}

i. Implementers and administrators interest^{20,25}

A surveillance program is operational with solid commitment and support from all stakeholders.⁸⁰ This aspect includes how is the relationship between implementers and stakeholders.²⁰ Information dissemination must be clear and known by implementers and stakeholders' interests, and mechanisms response must be well coordinated. Stakeholder, including parties related in surveillance evaluation. Stakeholders include breeders, technicians, health animals, officials and staff health society, officials of

government, and other parties interested/related in conditions under surveillance.^{25,81}

2. Activity

The core surveillance activities include data collection/detection, registration cases, case confirmation, data analysis and interpretation, reporting, epidemic preparedness and early warning, outbreak/outbreak response and control, and dissemination of information (including feedback).^{20,30} The core surveillance activities are supported by supervision, monitoring and evaluation, and coordination.²⁰ Activity according to WHO (2006) entry category in evaluating the components activity /process.²⁰

a. Data collection³⁰

Information on how to collect case data, what is done actively and passively, and data sources for data collection.⁷⁹

b. Case registration²⁰

Case registration is the process of registering identified cases.²⁰ Evaluation on case registration:

- 1) Correct filling of the register
- 2) There is routine data validation²⁰

c. Confirmed case²⁰

Case/outbreak confirmation refers to epidemiological and laboratory capacity for confirmation.

- 1) Capacity for timely sample referral to a reference laboratory for rapid confirmation²⁰

2) Internal and external quality control²⁰

3) Laboratory confirmation of cases and outbreaks^{20,38}

d. Data analysis and interpretation^{20,30}

Data analysis refers to data processing that produces tables, graphs, and maps based on grouping based on time, place, and person and comparisons between past and present periods for early detection of epidemics (outbreaks).^{20,30}

e. Reporting^{20,30}

Reporting refers to how the system reports surveillance data (outbreaks and cases) and the constraints encountered in its implementation. Information on how the system reports surveillance data (outbreaks and cases) to related units.³⁰ Notification or reporting of suspected outbreak/epidemic to the next higher level within²⁰ no later than 24 hours of detection/receiving information or report^{9,34,82} or within two days of detection.²⁰

f. Epidemic preparedness and early warning^{20,30}

Evaluation of epidemic preparedness and early warning includes

1) Epidemiological Studies of Outbreak Threats

Epidemiological studies are carried out continuously and systematically on developing diseases with the potential for outbreaks and their risk factors to identify the threat of outbreaks in an area. The performance indicator on "epidemiological studies of outbreak threats" is carried out regularly, at least every month (Regulation of the Minister of Health of

the Republic of Indonesia Number 949/Menkes/SK/VIII/2004 concerning Guidelines for Implementing an Early Warning System of Outbreaks).⁸³

2) Early Warning of Outbreak

Extraordinary event early warning provides information on an outbreak threat in an area within a certain period. The performance indicator on "Early Warning Outbreaks of Outbreaks" is carried out regularly, at least every month, by the District/City Health Office (Regulation of the Minister of Health of the Republic of Indonesia Number 949/Menkes/SK/VIII/2004 concerning Guidelines for Implementing an Early Outbreak Alert System).⁸³

3) Increasing Awareness and Preparedness for Extraordinary Event.⁸³

This activity includes early detection of conditions that are vulnerable to outbreaks; increased surveillance activities for early detection of outbreaks; epidemiological investigation of suspected outbreaks; carrying out counseling; local area monitoring; and preparedness for outbreaks, including preparing an investigation and response team for outbreaks.⁸³ There is a need to increase awareness of anthrax disease, especially just before the celebration of Eid al-Fitr/Adha, especially in specific locations for slaughtering animals and when the seasons change (from dry to rainy).^{41.71}

g. Outbreak Response and Control²⁰

Extraordinary event response and control includes verification, case referral, investigation, and response to outbreak management.⁸⁴

1) Rumour verification

Rumour verification confirms the truth of signals or information obtained from reliable sources.⁸⁵ Verifying rumours about an suspected outbreak can be done through communication media (telephone, sms, electronic mail) or even by field visits. Verify rumours to ensure that rumours are true or not accurate so that control can be carried out as soon as possible to minimize the spread of cases.⁸⁶ The existence of *alerts* received by the District Office through EWARS also needs to be verified at the CHCs < within 24 hours.⁷⁷

2) Referring case

3) Investigation

Information regarding whether an investigation was carried out on an outbreak or whether there was a suspicion of an outbreak to ensure there was an outbreak, find out the causes, epidemiological features, sources of spread, and factors that influence it, and determine effective and efficient management methods.³⁰ This focus indicator is the implementation of an suspected outbreak investigation conducted by the relevant agency with an indicator of fewer than 24 hours.³⁹

4) Notifications

5) Outbreak response

Information regarding the process of preventing the spread and handling carried out when an outbreak/ extraordinary event is suspected.^{30,39} The indicators in the outbreak control program are that no significant outbreaks occur.^{30,39,41} The response/measurement needs to be carried out in less than 24 hours from the identification of an outbreak/suspected outbreak.^{30,39}

h. Information dissemination³⁰

Information dissemination in the form of bulletins, circulars, periodical reports, and meeting forums, including⁷⁹ scientific publications and district/city epidemiological surveillance profiles, including information related to anthrax cases. Evaluation of information dissemination in the form of:

1) Information dissemination

Evaluation related to the information dissemination mechanism and the percentage of implementation of the distribution of surveillance activity reports, including to the surveillance network by health facilities regularly.^{20,30}

2) Feedback

Evaluation related to the existence of a feedback mechanism, and the proportion of feedback reports/bulletins that are disseminated based on the data they have reported over the past year (feedback).^{20,30}

i. Supervision

Evaluation of supervision in the form of evaluating the proportion of supervision visit activities carried out according to plan with checklists and feedback reports carried out by different supervisory units throughout the year can be monitored.²⁰

j. Monitoring and evaluation

Evaluation on monitoring and evaluation is in the form of how the monitoring and evaluation process has been carried out, including the frequency of its activities in one year.^{20,30}

k. Coordination

Evaluation of coordination in the form of:

- Planned cross-border meetings²⁰
- scheduled surveillance coordination meetings (integrated surveillance and response)²⁰
- Evidence of sharing of resources/activities between different surveillance programs²⁰
- Data/information sharing in the implementation of surveillance systems^{20,30}
- Cross-sectoral collaboration²⁰
- Capacity to share outbreak-related information²⁰

l. Prioritize disease²⁰

This evaluation refers to whether diseases have been prioritized for surveillance using specific criteria.²⁰

3. Output

Output on surveillance includes evaluation of surveillance attributes. Attribute of surveillance in the form of quality and output from activities in the core surveillance function.²⁰ Attributes of surveillance include:

a. Completeness surveillance system

Completion in surveillance can have different dimensions and can include:

1) Completeness of reporting surveillance

Completeness of reporting surveillance forms refers to the proportion of reporting sites that submit surveillance reports regardless of the time the reports were submitted.

2) completeness of case reporting

The completeness of case reporting refers to the correspondence between the number of reported cases and actual cases.

3) Surveillance data completeness

The completeness of the surveillance data is the conformity between the minimum expected data requirements and those reported.²⁰

Completeness of reporting is the proportion of all expected reports that are received, which is usually expressed in %; for example, if there are 50 cases of anthrax while there are only 40 reports, the completeness of the report is 80%.⁸⁷

b. Timeliness of surveillance system

Evaluation on timeliness refers to the percentage of healthcare facilities reporting surveillance data on a timely basis;³⁰ Timeliness reflects the

delay between steps in the surveillance system and the availability of information for disease control under the surveillance system when needed. Evaluation of timeliness in the form of:

- 1) Timely submission of surveillance reports: proportion of surveillance units that submit surveillance reports (immediately, weekly, monthly) to the next higher level on time.
- 2) Timeliness of receipt of surveillance reports: the proportion of surveillance reports expected (weekly or monthly) to be received on time.
- 3) Timely notification of suspected outbreak: the proportion of outbreaks (by number of observed cases > threshold value) notified to the next higher level within 48 hours of detection.
- 4) Response timely to the suspected outbreak: the proportion of suspected outbreaks verified within 48 hours of detection.²⁰

c. The simplicity of the surveillance system

Simplicity refers to the system structure and ease of operation.²⁰

d. Acceptability of the surveillance system

Acceptability is the willingness of people and organizations to participate in the system, including those who operate the system, report cases of the disease, or use data.²⁰

e. Surveillance system flexibility

Flexibility refers to the capacity of a system to adapt to changing information needs and operational situations at minimum additional cost.²⁰

f. Surveillance system sensitivity

Sensitivity refers to the case percentages identified by the surveillance system and the system's capacity to track changes in the number of cases.

- 1) Sensitivity case definition surveillance
- 2) Sensitivity of event detection for public health *response*
- 3) Notification system sensitivity²⁰

g. Surveillance system specificity

The percentage of people with no disease classified as not having the disease by the surveillance system is specificity.²⁰

h. Positive Predictive Value (PPV) surveillance system

Positive predictive value (*PPV*) is the percentage of people identified as having the disease by the surveillance system.

- 1) PPV case definition
- 2) PPV case detection
- 3) PPV outbreak detection²⁰

i. Representation of surveillance systems

Representativeness refers to the extent to which the system accurately describes disease occurrence over time and its distribution in the population by place and person.²⁰

4. Outcomes

Evaluation of the outcome is an evaluation of the usefulness of the surveillance data.²⁰ Attribute system supervision influence the ability system to fulfill its purpose and use generated information.⁸⁸ Usefulness can be

affected by all surveillance attributes: improve sensitivity chance to improve detection epidemic; increase accuracy time chance at speed activity control; increase probable positive predictive value for officers health focus on productive activities; a representative surveillance system will better characterize the epidemiological characteristics; and systems that are simple, flexible, and acceptable can be more helpful.²¹

5. Context

Surveillance systems do not operate in isolation and their operations depend on external factors such as the legal framework, political and policy environment, work environment that supports the performance of officers.^{69,89,90}