

CHAPTER I

INTRODUCTION

A. Problem Background

Until now, zoonoses are still a threat to public health globally, and zoonoses dominate Emerging events infectious diseases (EIDs) with a percentage of 60.3%.¹ Anthrax is a zoonotic disease that can infect humans directly or indirectly through infected animals or contaminated animal products.² *Bacillus anthracis*, the causative agent of anthrax, is a potential agent of bioterrorism, which is included in category A agents or top priority agents because it can threaten national security. The agents can quickly spread or be transferred by individuals, cause high mortality rates and serious public health problems, trigger public fear and social disturbance, and require special efforts for public health preparedness.³

In Central and South America, Sub-Saharan Africa, Central, and Southwest Asia, Southern and Eastern Europe, and the Caribbean, anthrax is common in agricultural areas. Anthrax is more common in developing countries and countries that do not routinely vaccinate animals.⁴ Globally, approximately 2,000 to 20,000 incidents of anthrax in humans occur each year.⁵ An estimated 1.8 billion people live in anthrax-prone areas globally, mostly in rural areas in Africa, Europe, and Asia. There are 1.1 billion animals in anthrax-affected areas, including 320 million sheep, 294.9 million pigs, 268.1 million cattle, 211.2 million goats, and 0.6 million buffalo.⁶

In Indonesia, anthrax is still a health threat to animal and human health. Anthrax is categorized as a zoonotic priority (Decree of the Minister of Agriculture of the Republic of Indonesia Number 4971/Kpts/OT.140/12/2013)⁷ and a strategic infectious animal disease (Decree of the Minister of Agriculture Number 4026/Kpts/OT.140/2013).⁸ Anthrax is also an infectious disease that can cause epidemics based on the Regulation of the Minister of Health of the Republic of Indonesia Number 1501/MENKES/PER/X/2010.⁹

The total number of human anthrax cases from 2011 to 2018 in Indonesia, namely 263, including 17 deaths (CFR=6.5%). Anthrax cases in 2017 and 2018, namely 77 cases and 9 cases with CFR 1.30% and 0.00%. In 2017, 3 provinces reported livestock: South Sulawesi, Yogyakarta, and Gorontalo. While in 2018, South Sulawesi and West Nusa Tenggara reported anthrax animals.¹⁰

In 2013, 2014, 2015, 2017, and 2018, South Sulawesi reported anthrax cases in humans, and reported cases of anthrax in livestock in 2017 and 2018.¹⁰ Cases of anthrax in humans were found in South Sulawesi in 2017, which was one case. Total anthrax in animals in South Sulawesi Province from 2015 to 2018, namely 21 cases.¹²

Maros Regency is one of the areas with a high risk of anthrax disease in South Sulawesi,¹² and is an enzootic and endemic for anthrax. Based on preliminary and literature studies, there is still a high potential for anthrax transmission in Maros Regency.¹⁴⁻¹⁶ Based on a preliminary study at the Maros Health Office, total cases of anthrax in humans from 2010 – 2021, namely 79

cases reported from 7 districts, including 4 cases reported in January 2021 originating from Tanralili Sub-District.

Meanwhile, 55 cases of anthrax in animals were reported in 2010 – 2021 originating from 11 Subdistricts of a total of Subdistricts, including 1 case (Tanralili Subdistrict), which was reported in January 2021, based on a preliminary study conducted at the Maros Animal Health Center. The number of cases may be much greater than recorded because many people or livestock owners still do not report cases of sudden death in animals, based on interviews with Maros Health Center staff in August 2021.

The recurring occurrence of anthrax cases to date in Maros Regency and the reappearance of anthrax cases in animals after seven years, as well as the first-time anthrax in humans had been reported in Tanralili Subdistrict in 2021, based on data from the last twelve years, shows the possibility that anthrax cases will increasingly spread in Maros Regency and the possibility of cases reappearing in areas that have not been found for several years.

A preliminary study conducted by researchers with officers from Maros Animal Health Center and the Maros Health Office regarding possible factors influential to incident anthrax cases in August 2021, there were still many people who did not report to local officials if there were animals that were infected or sudden die and delayed in reporting from the community when someone had symptoms of anthrax cases in humans and animals. In addition, the late detection of anthrax cases in animals and humans that occurred in 2021, and the

implementation of the surveillance program in Maros Regency still needed to be improved.

Therefore, the anthrax surveillance system needs to be optimized immediately in Maros Regency. Optimization of the surveillance system must be integrated to improve surveillance coverage and quality. Implementing integrated surveillance cross-sector aims to support early detection and detection of potential new pathogens such as zoonotic diseases and increase understanding of the situation of epidemiology disease and the zoonoses which potentially have high mortality. The integrated surveillance system framework consists of planning, implementation of integrated surveillance, integrated investigation, and monitoring, as well as evaluation.¹⁷

Application-integrated anthrax surveillance system has been initiated through activity share data/information cross-sector in Maros Regency. However, it is still far from the concept because the program implementation tends to be carried out in each sector separately, human and animal health sectors, including data collection, analysis and interpretation of data, and epidemiology investigations. There is no uniform input and reporting format as well as different reporting systems between both sectors, human health sector; human the “Early Warning, Alert and Response System” (EWARS), while the animal health sector the use “National Animal Health Information System” or *Sistem Informasi Kesehatan Hewan Nasional* (iSIKHNAS), causing surveillance not conducted in an integrated manner in the whole aspect. The information system that integrates data from various sectors, animal and humans

health sectors, known as the “System Information on Zoonoses and Emerging Infectious Diseases” or “*Sistem informasi Zoonosis dan Emerging Infectious Diseases*” (SIZE), is targeted to be ready and reliable by 2024 nationally.¹⁷

Optimization of the surveillance program can be through system evaluation which can produce recommendations on problems that need to be addressed or matters that need to be developed so that the surveillance program can optimally prevent the spread of anthrax and prevent the reappearance of anthrax cases in areas that have not reported anthrax cases or in areas where there have never been cases. One approach to evaluating the surveillance program is logic theory models, which are divided into four components: inputs, activities, outputs, and outcomes.^{22,23}

The input components for surveillance include legislative support,^{20,23} human resources, training, and rapid response teams, logistics, fiscal resources,^{23,24} laboratory presence,²⁵ standards and guidelines,^{20,26} legislative support, and networks and partnerships.²⁷ In addition, the activity component is an intervention or actual effort by the program and its personnel utilizing inputs to achieve health outcomes/objectives.^{28,29} Evaluation of activities includes data collection; data validation; case confirmation; data analysis and interpretation; reporting; epidemic preparedness and early warning, outbreak/epidemic investigation, response and control, dissemination, and coordination.^{20,30}

The effectiveness of surveillance systems depends on the quantity, distribution of human resources, and quality including through surveillance training that officers have joined.^{30,31} Availability of logistics including data

management, transportation, communication, and completeness of personal protective equipment is needed. The more complete the facilities, the easier and more effective the implementation of the surveillance program will be.^{32,33} Evaluation of fiscal resources in the form of funding availability,²⁰ and sources of funds.³⁴ In addition, regulations, and networks are vital and included in the surveillance requirements.³⁵ Evaluation of the surveillance network can be done by evaluating the relationship between implementers and stakeholders,²⁰ including the relationship between surveillance officers or health workers with the local government and farmers,²⁵ networks and their role in implementing the surveillance system,³⁰ and related to the existence of documented agreements.³⁶

Epidemiological surveillance has three characteristics, namely data collection; analysis, and interpretation of data; and information dissemination.³⁰ Data validation is carried out to ensure that the data submitted is appropriate, including the number of cases reported.³⁷ Evaluation of confirmed cases in the form of evaluation of capacity for sample referral and laboratory confirmation of cases and outbreaks^{20,38} Meanwhile, vigilance and preparedness for outbreaks aim to identify the threat of outbreaks, carry out early warning, increase preparedness, and carry out investigations into suspected outbreaks.³⁹ Response and control efforts aim to treat sufferers, prevent the expansion of events, and reduce or eliminate disease risk factors.^{40,41} Meanwhile, information dissemination aims to provide information that can be utilized in policy formulation.³⁰ Cross-sectoral coordination efforts are needed in the implementation of surveillance systems through synchronization and evaluation

of the implementation of policies, strategies and programs, including in the integration of surveillance data, exchange of information and reports, joint case investigations, and dissemination of health messages.^{5,42-49}

The output component is in the form of an evaluation of surveillance attributes which includes completeness and timeliness.²⁰ The attributes of timeliness and completeness are the factors most frequently considered for the evaluation of surveillance systems.⁵⁰ Improved timeliness allows control and prevention activities to start earlier.²¹

Based on an interview with the officers, evaluation efforts have been carried out by the Health Office but were deemed less optimal, including those related to the evaluation of feedback and community involvement in the implementation of evaluations that have not been carried out. In addition, based on interviews with the Maros Health Center staff, the surveillance was also evaluated. However, it still needs to be further studied regarding the availability of human resources, legislative support, logistic availability, analysis and interpretation of data, early alerts, feedback mechanism, data/information sharing, cross-sectoral collaboration, completeness of reporting, the timeliness of reporting, and related constraints from breeders/community about the reasons that cause the lack and delay of reporting. Evaluation has also yet to be carried out by involving the two sectors simultaneously. This might lead to the implementation of surveillance still needing to be conducted in an integrated manner. An integrated evaluation can improve the capacity of the anthrax surveillance program¹⁷ in Maros District

due implementation can be more coordinated, and both sectors can mutually complete weaknesses in each sector.

In addition, based on a literature search in September 2021 via international journal websites at SAGE Journals, BMC, BMC Public Health, PubMed, MedScape, The Lancet, The New England Journal of Medicine (NEJM), Science Direct, National Library of Medicine (NLM), JAMA Network, Cochrane Library, MDPI, PLOS ONE, PLOS Global Public Health, PMC, The American Journal of Medicine (AMJMED), there was no literature related to anthrax in Maros Regency, especially in the integrated anthrax surveillance program in Maros Regency. In addition, based on a literature search on Google Scholar, no publications specifically describe the evaluation of integrated anthrax surveillance in Maros Regency.

Because there were still some things that still need to be studied in the evaluation of the surveillance system carried out by the relevant agencies, an evaluation of anthrax surveillance involving human and health sectors had yet to be carried out simultaneously, and no publications specifically related to the evaluation of anthrax-integrated surveillance in Maros Regency, the researcher is interested in conducting research by taking the research topic related to "Evaluation of Anthrax Integrated Surveillance Program in Maros Regency, South Sulawesi Province (Studies in the Human Health and Animal Health Sector).

B. Problem Formulation

Based on the description above, it is known that Maros Regency is an vulnerable area to anthrax cases. Cases of anthrax in animals in Maros Regency have existed since 1985, with 54 cases reported from 2010 to 2021 originating from 11 sub-districts, based on Maros Animal Health Center data. Meanwhile, the number of cases of anthrax in humans from 2010 – 2021, namely 79 cases reported from 7 sub-districts, based on data from the Maros Health Office.

Maros Regency has a high potential for anthrax incidents because there are still cases repeatedly reported in animals and humans. Based on the results of the preliminary study, several factors may result in a high potential for transmission, which includes economic factors for livestock owners, lack of compensation, cultural factors, lack of vaccination coverage for livestock, management of livestock rearing, traffic of sick livestock, handling of dead livestock, and the less optimal of the surveillance system.

In implementing the prevention and control of anthrax disease, including anthrax surveillance efforts in Maros Regency, there are several problems and obstacles faced by local officials based on preliminary studies, which include the lack of supervision of livestock traffic, lack of Human Resources (HR), limited budgets, and not local regulations exist. In addition, the lack and delay in reporting the community or breeders to local officials if there are sick animals affect the speed of response to cases or suspected outbreaks. These constraints, both from internal and external agencies, have resulted in the less optimal implementation of the anthrax surveillance program in the Maros Regency.

The reappearance of anthrax cases in animals after seven years and was the first reported in Tanralili Sub-district after ten years, and the late detection of anthrax cases in animals and humans in 2021 indicates that the implementation of the surveillance program in Maros Regency is still not optimal. Besides that, there is a tendency implementation of surveillance in each sector separately, human and animal health sectors, so the implementation of integrated anthrax surveillance is less optimal. Therefore, to make recommendations and suggestions in optimizing integrated surveillance anthrax in Maros Regency, the researcher is interested in conducting research related to the evaluation of the implementation of the integrated anthrax surveillance program and identifying weaknesses that can be improved in the program.

Based on this explanation, the research question can be formulated, namely:

1. General Research Question

How is the evaluation of the integrated anthrax surveillance program in Maros Regency, South Sulawesi Province?

2. Specific Research Question

- a. How to evaluate the input components of integrated surveillance system (human and animal health sectors): a. availability of human resources, b. training, c. rapid response team, d. data management components, e. communication component, f. availability of means of transportation, g. personal protective equipment completeness, h. availability of funding, i., source of funds, j. laboratory. k. completeness of guidelines, l. completeness of forms, m. legislative support, n. implementer relationship

with the government, o. implementer relationship with farmers, p. network and its role, and q. documented plan/agreement?

- b. How to evaluate the activity components of the integrated surveillance system (human and animal health sectors): a. data collection, b. data validation, c. sample refer capacity, d. laboratory confirmation capacity, e. analysis and interpretation of data, f. reporting, g. epidemiological study of the threat of outbreaks, h. outbreak early warning, i. increasing awareness and preparedness for outbreaks, j. rumor verification, k. The investigation, l. response to outbreak, m. information dissemination, n. feedback, o. cross-sectoral collaboration, p. cross-border meetings, and q. data/information sharing?
- c. How to evaluate the output components of the integrated surveillance system (human and animal health sectors): a. reporting completeness, b. case reporting completeness, c. reporting timelines?

C. Research Objective

The purpose of this research is as follows:

1. General purpose

To evaluate an integrated anthrax surveillance program in Maros Regency, South Sulawesi Province.

2. Special purpose

- a. To evaluate the input components of integrated surveillance system (human and animal health sectors): a. availability of human resources, b. training, c. rapid response team, d. data management components, e.

communication component, f. availability of means of transportation, g. personal protective equipment completeness, h. availability of funding, i., source of funds, j. laboratory. k. completeness of guidelines, l. completeness of forms, m. legislative support, n. implementer relationship with the government, o. implementer relationship with farmers, p. network and its role, and q. documented plan/agreement?

- b. To evaluate the activity components of the integrated surveillance system (human and animal health sectors): a. data collection, b. data validation, c. sample refer capacity, d. laboratory confirmation capacity, e. analysis and interpretation of data, f. reporting, g. epidemiological study of the threat of outbreaks, h. outbreak early warning, i. increasing awareness and preparedness for outbreaks, j. rumor verification, k. The investigation, l. response to the outbreak, m. information dissemination, n. feedback, o. cross-sectoral collaboration, p. cross-border meetings, and q. data/information sharing?
- c. To evaluate the output components of the integrated surveillance system (human and animal health sectors): a. reporting completeness, b. case reporting completeness, c. reporting timeliness?

D. Research Authenticity

Related research that has been done:

Table 1.1. Relevant Research

No	Title	Author	Year; and Study Locations	Research design	Research focus	Results	The difference between previous research and current research
1	An evaluation of surveillance system for anthrax disease in Gunungkidul Districts 2020 51	Asmi Rizal Abdillah	2021; and Gunungkidul Regency, Yogyakarta	descriptive study	· Input: HR, Guidelines · process, · surveillance attribute	· Input: Health Center HR nurses 76.67%, epidemiologists 20%, and midwives 3.33%. The health service is an epidemiologist. 23.33% of surveillance officers had participated in zoonoses surveillance training. Manual for anthrax handling, epidemiological investigation form, and SOP were not available in all health centers. · Process: data collection (100%). data processing (87.5%) and analysis of anthrax case data (62.5%) from a total of Community Health Centers. Recording and reporting anthrax cases from the health center 100% of cases. .	- Differences in research locations - The research did not involve Animal Health Officers, Laboratories, Breeders and Local Government. - Evaluation had not been carried out in the agency responsible for animal health
2	Evaluation of the Measles Surveillance	Risma Dian Anggraini, Chatarina	2015; and in Bangkalan Regency	Study Descriptive	Input: Man, Material, Method, Funding, Guidelines	<u>Inputs:</u> - Man: 3 officers in the Health Office, one officer in each community health center	- This study evaluated a non-anthrax measles surveillance system

System at the Health Office Bangkalan Regency ⁵²	Umbul W, Bambang WK	Process: Data collection, data editing, data compilation, and data analysis Output: Information, and information dissemination	<ul style="list-style-type: none"> - Material: all reporting forms are available at the District, at the CHCs level (95.5%), - Funding: Health Office (100%), CHCs (55.5% available) - Methods: active surveillance and passive surveillance - Guidelines: there was a technical manual and regulations regarding the implementation of surveillance. <p><u>Process</u></p> <ul style="list-style-type: none"> - Data collection: data sources at the district level from health centers in Bangkalan Regency, RSUD and BBLK Surabaya. Sources of reports at the CHCs come from village midwives/pustu/polindes, MCH, inpatient care, BP - Data analysis: The analysis process was carried out by district officers, and 45.5% of CHCs conducted an analysis based on place (56.3%) and time (43.8%) - Data interpretation: 45.5%, <p><u>output</u></p> <ul style="list-style-type: none"> - Amount Outbreak 11 handled events < 24 hours. <p>Completeness of CHCs reports >90% accuracy <80%. It was found that 86.4% did not have the same data on the</p>
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						number of cases between the Health Office and the CHCs	
						- Information Dissemination: Reporting to the head of the health office through meetings and performance evaluation meetings for health center surveillance officers. Feedback to all related CHCs every six months.	
3	Evaluation of Dengue Hemorrhagic Fever Surveillance in Bangli Regency Year	Ni Wayan Sri Widyantari, Made Pasek Kardiwinata, Ni Luh Putu Suariyani	2017; and Bangli Regency	evaluation study	<u>Surveillance</u> Input: personnel, facilities, funds, data sources, frequency of data collection Process: Data collection, data compilation, data interpretation and analysis, information dissemination	<u>Inputs</u> - Personnel: surveillance staff at the Bangli Regency Health Office, in terms of the number of staff and their qualifications, were still inadequate, they had never received special training on surveillance. - Facilities: DHF surveillance reference was not yet available. - Funds: Available but not sufficient - Frequency of data collection: weekly reports (100%), Integrated Disease Surveillance (W2) (100%), Outbreak reports (W1) (0%) <u>Process</u> - Data Collection: The midwife went to the health center then to the Bangli Health Office - Data compilation: Surveillance officers at both the Health Office and CHCs check the data	- This study evaluated the DHF surveillance system instead of the anthrax surveillance

						<ul style="list-style-type: none"> - Data interpretation and analysis: Data processing was carried out and presented in tabular form, comparative analysis was carried out, and data was analyzed by region (only once a year) - Information dissemination: one CHC(16.67%) did not disseminate epidemiological information, 	
4	Surveillance System Evaluation Japanese Encephalitis in Bali Province	Komang Ayu Kartika Sari, Putu Cintya Denny Yuliyatni, Ida Bagus Wirakusuma	2015, and Bali Province	Cross-sectional design with qualitative study	Structure: legal, strategy, surveillance network Functions: Case detection, recording system, reporting, analysis and interpretation, preparedness, response and feedback Quality: completeness, acceptability, sensitivity	<p><u>Structure:</u> Legal: There is a Circular Letter from the Indonesian Ministry of Health and a Governor's Decree concerning the Formation and Composition of the M&E Team and the Implementation of JE Surveillance in the Province of Bali. Strategy: Each stakeholder plays a role according to the tasks agreed in thupon e circular letter and SK. Surveillance network: The network that has been formed has been adapted to the existing guidebooks and decrees. Several District Health Offices have taken the lead in working with private hospitals and involving CHCs, although surveillance activities at CHCs are still very limited to investigation activities if there is an AES case as a result of a RSUD report.</p>	- This study evaluated the Japanese surveillance system for Encephalitis, not surveillance for anthrax

specificity, PPV
representative
Components of
support: guidelines &
standards, training,
communication
facilities, support
facilities, Monitoring
& evaluation,
coordination

System function: case detection was not uniform in all
networks, including sampling times that still vary
System quality : Almost all reporting networks did not
report completely.
Support
Ultimately bisincreased support from the c enter.

The difference between the previous studies in the table and what the researchers did:

1. There had been no previous research related to surveillance evaluation in Maros Regency, South Sulawesi.
2. There was previous research by Asmi Rizal Abdillah entitled "An evaluation of surveillance system for anthrax disease in Gunungkidul District 2020," However, it had not involved officers responsible for animal health yet.
3. Several previous studies related to surveillance evaluation but not related to the surveillance of anthrax. Based on literature studies, there was still limited research on anthrax surveillance.

E. Scope

1. Time scope

This research was conducted for six months, from January 2022 to June 2022.

2. The scope of the place

The locations of this research were the Maros Regency Health Office, Regional Technical Implementation Unit of Animal Health Center (Maros Agriculture and Food Security Service), Maros Veterinary Center (BBVet Maros), and several Community Health Centers (CHCs) in Maros Regency. Based on a preliminary study at the Maros Health Office, officers suggested conducting evaluations at CHCs whose working areas had cases of anthrax in humans in 2010-2021 in a total of 7 sub-districts, namely Mandai, Marusu, Tompobulu, Simbang, Cenrana, Camba, Tanralili Sub-districts so that the CHCs that were used as research locations were the Mandai, Marusu,

Tompobulu, Simbang, Cenrana, Camba, and Tanralil CHCs. In addition, research was also held at the Mandai, Marusu, Tompobulu, Simbang, Cenrana, Camba, Tanralili Subdistrict offices, and Allaere Village offices. The research was also conducted in villages with a history of cases of anthrax in humans and/or animals which included Cenrana Village (Camba Sub-district), Labuaja Village (Cenrana Sub-district), Tenrigangkae Village (Mandai Sub-district), Tellumpocoe Village (Marusu Sub-district), Allaere Village (Tanralili Sub-district), Village of Damai (Tanralili Sub-district), Village of Tompobulu (Tompobulu Sub-district), Village of Jenetaesa (Simbang Sub-district), and one Slaughterhouse in Maros Regency.

3. Scientific scope

This research focuses on Zoonoses Management and Control; One Health Fundamentals and Applications; Outbreak Investigation, Surveillance, and managerial Epidemiology to evaluate the anthrax surveillance program, which includes cross-sectoral coordination and engagement efforts.