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AREA-BASED DISEASE MANAGEMENT ANALYSIS:RABIES OUTBREAK (EXTRAORDINARY EVENT) AT THE LIVESTOCK SERVICE OFFICE OF SOUTHCENTRAL TIMOR REGENCY CENTRAL TIMOR REGENCY

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ABTRACT

Rabies has remained a persistent public health problem in East Nusa Tenggara (NTT) Province since it was first identified as an outbreak on Flores Island in 1997. The disease spread to West Timor, with the first confirmed case in South Central Timor (TTS) Regency on May 30, 2023. Since then, rabies has rapidly expanded across all districts of West Timor, resulting in 35,333 bite cases and 60 deaths throughout NTT, of which TTS Regency accounted for the highest cases (4,787 bites and 19 deaths). This study analyzes the management of the rabies outbreak in TTS Regency using an area-based disease management approach (Manajemen Penyakit Berbasis Wilayah/MPBW). The approach is grounded in Governor Regulation No. 34 of 2024 concerning Rabies Control in NTT, supported by regency-level regulations and coordination with provincial task forces. Data were obtained through document reviews, daily records from the Rabies Emergency Post, and interviews with government officials and community representatives. Findings show that rabies control in TTS Regency faces challenges such as limited vaccination coverage, uncontrolled dog movement, low public awareness, and insufficient cross-sectoral integration. However, coordinated efforts through vaccination campaigns, quarantine measures, community empowerment, and risk management strategies have provided a framework for reducing transmission risks. The study concludes that rabies prevention and control require comprehensive, multi-sectoral, and area-based strategies that integrate technical, institutional, and social responses. Strengthening community participation and ensuring sustainable vaccination programs are essential to achieving long-term rabies elimination in NTT.

Keywords: *Rabies, Outbreak, South Central Timor, Area-Based Disease Management, NTT.*

INTRODUCTION

Background of the Study

Rabies is a contagious animal disease caused by a virus from the Lyssavirus genus (from the Greek word Lyssa, meaning rage or fury). It is an acute disease that attacks the central nervous system of warm-blooded animals and humans. Derived from the Sanskrit word rabhas, meaning violence, the term rabies originates from the Latin word robere, which also means rage. (Ministry of Agriculture of the Republic of Indonesia, 2019).

It is estimated that rabies causes 59,000 human deaths each year worldwide. However, this data is not supported by reports from the World Health Organization (WHO), which records a significantly lower number of rabies-related deaths globally often fewer than 1,000 cases per year. Dogs are the primary hosts in Asia, parts of the Americas, and most of Africa. Oral vaccines can be safely administered to wild animals through baiting, a method that was first implemented on a large scale in Belgium and has successfully reduced rabies in rural areas of Canada, France, the United States, and other regions. For example, in Montreal, bait was successfully consumed by raccoons in the Mount Royal park area (WHO Expert Consultation on Rabies, WHO 2018

This disease is present on almost every continent except Antarctica, and more than 150 countries have been affected. Each year, approximately 55,000 people die from rabies.

The disease can affect both children and adults. Around 40% of all individuals bitten by suspected rabid animals are children under the age of 15. In Indonesia, the first rabies case was recorded in 1883 in West Java Province, and since then, it has spread to other regions. As of April 2023, there have been 31,113 cases of bites from rabies-transmitting animals; 23,211 of those bite victims received anti-rabies vaccination, and there were 11 reported deaths. Currently, 26 provinces in Indonesia are endemic for rabies, while 11 provinces remain rabies-free. The rabies-free provinces include Riau Islands, Bangka Belitung, DKI Jakarta, Central Java, DI Yogyakarta, East Java, West Papua, Papua, South Papua, Central Papua, and Highland Papua (Ministry of Agriculture, Republic of Indonesia, 2019).

Rabies is transmitted through bites, scratches, or licks on open skin or mucous membranes by animals infected with the rabies virus. In Indonesia, the commonly known rabies-transmitting animals are cats, monkeys, and dogs, with dogs accounting for 98% of cases. The incubation period for rabies the time it takes for symptoms to appear ranges from 2 weeks to 2 years, with an average of 30 to 90 days. This variation depends on several factors: the type or strain of the rabies virus, the amount of virus entering the body, the depth and location of the bite wound, the density of nerve endings in the wounded area, and the individual's immune status. Currently, there is no technology available to diagnose rabies at an early stage before clinical symptoms appear. The gold standard for laboratory diagnosis is the Fluorescent Antibody Technique, while other diagnostic methods include PCR (Polymerase Chain Reaction) (Ministry of Health, Republic of Indonesia, 2022).

The control and management of animal diseases involve the implementation of animal and environmental health measures, including observation and identification, prevention, protection, elimination, and/or treatment. Animal health issues are addressed through a comprehensive, harmonious, and stable approach that includes conservation, health promotion, disease prevention, treatment, and health recovery, according to specific needs. This is in accordance with Law Number 18 of 2009 concerning Animal Health and Welfare, as amended by Law Number 41 of 2014. To protect and improve the quality of animal resources, enhance public, animal, and environmental health, and promote good veterinary and animal health practices in accordance with existing laws and regulations, the South Central Timor (TTS) Government particularly the livestock and animal health services carries out its duties under applicable legislation. In support of this, the Governor of East Nusa Tenggara issued Regulation Number 34 of 2024, which is aimed at Rabies Control. (Livestock Service Office of South Central Timor, 2024)

Rabies first became an outbreak in East Nusa Tenggara, specifically on Flores Island in East Flores Regency, in 1997, and it has remained a Red Zone for rabies to this day. The disease has since spread to the western region of Timor Island in East Nusa Tenggara, with the initial emergence in South Central Timor (TTS) Regency recorded on May 30, 2023. This regency is centrally located in the West Timor region, bordering North Central Timor (TTU), Belu, Malaka, Kupang Regency, and Kupang City. (Rabies Outbreak Emergency Post Data, East Nusa Tenggara, 2024)

According to daily data from the Rabies Response Post in East Nusa Tenggara (NTT), there have been 35,333 bite cases caused by rabies-carrying animals across 15 regencies in the province. In West Timor, South Central Timor (TTS) Regency recorded the highest number of bites with 4,787 cases and also had the highest number of rabies-related deaths—both in West Timor and across NTT as a whole. Out of the total 60 reported rabies-related deaths in the province, TTS accounted for 19 of them. (Rabies Outbreak Emergency Post Data, East Nusa Tenggara, 2024)

The Livestock and Animal Health Office of South Central Timor (TTS) Regency is striving to create a conducive environment for the implementation of livestock and animal

health services, with a focus on the prevention and control of rabies in the region. South Central Timor Regency officially declared a Rabies Outbreak (Extraordinary Event) status following the first confirmed case in Fenun Village, South Amanatun Subdistrict, on May 30, 2023. This case in Fenun Village marked the first rabies case on Timor Island, specifically in West Timor. Since that initial case in late May 2023, the outbreak has spread across all areas of West Timor and the entire island, including Kupang City, Kupang Regency, TTS, North Central Timor (TTU), Belu, and Malaka. Previously, East Nusa Tenggara Province (NTT) had been designated as an endemic or red zone area for rabies on Flores Island for 26 years. (Rabies Outbreak Emergency Post Data, East Nusa Tenggara, 2024)

The fundamental guidelines for implementing rabies outbreak (Extraordinary Event/KLB) prevention and control based on area-based disease management in South Central Timor (TTS) Regency are grounded in Governor Regulation No. 34 of 2024, which has been revised concerning Rabies Control in East Nusa Tenggara (NTT). These efforts are also supported by regent regulations and circular letters related to territorial status. The Livestock and Animal Health Office serves as the main control and technical agency for rabies outbreak management in TTS, operating under the coordination of the provincial task force, which includes the Regional Disaster Management Agency (BPBD) and the Provincial Livestock Office.

Based on interviews conducted by the researcher to complement the background of the study, the Head of the Livestock Office, Drh. Ari, stated that various prevention and emergency response efforts have been carried out by the local government within the framework of the regional Rabies Task Force. These efforts include the vaccination of rabies-transmitting animals (HPR) — approximately 69,000 animals across all areas of South Central Timor Regency — in pursuit of the herd immunity target (70% vaccination coverage), which has currently reached 65%. However, the number of rabies-related deaths continues to increase. Several factors may contribute to this, such as issues with vaccine cold chain maintenance, public awareness regarding HPR vaccination, uncontrolled animal movement, and other technical challenges. These issues clearly require thorough analysis. So far, both the provincial and regency governments have received attention and support from the Australian government and the World Organisation for Animal Health (WOAH) through an Australia–Indonesia Health Security Partnership in the form of vaccine grants.

Based on the problem description and the data presented above, the researcher is interested in examining the extent to which area-based disease management for the rabies outbreak is implemented by the Livestock and Animal Health Office of South Central Timor Regency.

RESEARCH METHODOLOGY

This research is a descriptive study with a qualitative approach, which is a technique or method used to explore a phenomenon in depth by searching for, obtaining, collecting, and recording data, both primary and secondary, and then analyzing the factors related to the main problems, so that answers to the research questions can be revealed.

Qualitative descriptive research aims to describe, portray, explain, clarify, and answer research problems in greater detail by studying as thoroughly as possible an individual, a group, or an event. In qualitative research, the researcher serves as the primary instrument, and the results are presented in the form of words or statements that reflect the actual situation.

The main focus of this research is on the variable of management of rabies outbreak prevention and control (KLB Rabies) based on territorial approaches within the Livestock

Department of South Central Timor Regency.

RESULT AND DISCUSSION

1. Region Based Control Management

The Head of the Livestock Department of South Central Timor Regency explained that territory-based disease control management (MPBW) includes efforts to control disease cases in a specific area along with the control of various risk factors carried out in an integrated manner. These efforts can be conducted prospectively and retrospectively.

Prospective efforts prioritize the control of disease risk factors integrated with case detection and case management of the disease. Retrospective efforts prioritize the management of a particular disease first, which is then integrated with the control of its risk factors, either planned and implemented simultaneously. This is characterized by planning and resource allocation that are also carried out in an integrated manner.

In principle, disease risk factors are all factors that play a role in the occurrence of disease at both the individual and community levels. Various environmental and population variables, including healthy lifestyle behaviors, represent the main risk factors for disease. Thus, environmental health promotion and community empowerment are the main efforts in controlling various disease risk factors within a specific area.

Within a region, MPBW must be designed based on evidence that is collected periodically, systematically, and in a planned manner, and implemented by an "integrated health team." Like an orchestra, this integrated team consists, on one hand, of skilled "musicians" (professionals in their fields), and on the other hand, shares the same vision represented by playing the same "song" in harmony.

The team may consist of leaders and/or staff of the health office in partnership with hospital doctors, all health workers at community health centers (puskesmas), health-related NGOs, non-health departments within the local government, as well as the community. Thus, MPBW represents a harmonious collaboration between doctors in health service units such as puskesmas and hospitals and community health workers. In facing the same disease, both groups must align their vision and perception. The diseases considered as priorities are those that exist or are endemic in a given area.

The implementation of management does not necessarily have to be led by the head of the health office; rather, the Head of the Livestock and Animal Health Department, hospital doctors, and sanitation clinic officers at puskesmas are all part of the "orchestra" who must share the same vision, as well as think and act collectively to control specific diseases within a region.

2. Public Health Perspective on Communicable Diseases

Base on interviews conducted with community representatives, in this case the affected community organized under the Rabies Alert Cadres (KASIRA), it was revealed that the community has not fully understood the rabies outbreak currently occurring. As a result, when experiencing rabies symptoms or being bitten, people do not immediately go to health facilities. The community tends to perceive dog bites as common incidents, and once specific symptoms such as hydrophobia, aerophobia, and other typical signs appear, families often prefer to keep the patient at home to be prayed for by a respected elder believed to be capable of healing them.

The occurrence of disease is essentially a spatial phenomenon, a process that has taken place on the earth's surface for thousands of years. A single disease event is influenced by various spatial factors, including altitude, soil type, climate, temperature, surrounding vegetation, population density and behavior, housing conditions, cultural practices, wind direction and speed, among others. In short, disease occurrence is an event rooted in a

territorial basis, encompassing ecosystems within spatial and temporal dimensions, including environmental, demographic, and administrative variables. According to their designation, areas can also be delineated as work areas, tourism areas, border areas, sub-districts, or villages.

The occurrence of any disease, whether communicable or non-communicable, is always area-based and characterized by local specificity. It must also be understood that curative measures, such as the identification and treatment of patients with communicable diseases, are also part of prevention efforts. By conducting early diagnosis and timely treatment, sources of infection can be reduced or even eliminated. Without a source of infection, transmission will not occur even if vectors or potential carriers are abundant.

Disease occurrence, apart from being rooted in socio-cultural and ecosystem factors, is also cross-boundary in nature. Therefore, disease events will continue to recur endlessly if efforts are limited to equalizing treatment services without addressing the control of risk factors.

3. Disease Occurrence Model

Based on interviews conducted with community representatives, namely the affected community organized in the Kader Siaga Rabies (KASIRA), it was revealed that the community does not fully understand the rabies outbreak currently occurring. As a result, when they experience rabies exposure or dog bites, people do not immediately seek medical services at health facilities. The community tends to perceive dog bites as something common, and when symptoms such as hydrophobia, aerophobia, and other specific signs appear, they often keep the patient or victim at home to be prayed for by a traditional elder who is believed to have the ability to heal.

Disease occurrence is essentially a spatial phenomenon, a process that has existed on the earth's surface for thousands of years. The occurrence of a disease is influenced by various spatial factors, including altitude, soil type, climate, temperature, surrounding vegetation, population density and behavior, housing type, culture, wind direction and speed, among others. In short, the occurrence of disease is a phenomenon rooted in territorial bases, encompassing ecosystems in spatial and temporal dimensions, including environmental variables, demographic conditions, and administrative boundaries. Depending on its use, a territory may also be defined in specific terms, such as a working area, a tourism zone, a border area, a district, or a village.

The occurrence of any disease, whether communicable or non-communicable, is always territorially based and possesses local specificity. It should also be understood that curative efforts, namely the search for and treatment of communicable disease patients, are also part of preventive measures. By conducting early diagnosis and prompt, appropriate treatment, we can reduce or even eliminate the source of disease transmission. Without a source of transmission, no transmission process can occur, even when vectors are abundant. Disease occurrence, apart from being rooted in socio-cultural and ecological contexts, is also transboundary in nature. Thus, disease events will continue to recur endlessly if we only focus on equitable treatment distribution without simultaneously controlling the risk factors.

4. Importance Level

In the context of decentralization, the Livestock and Animal Health Office of TTS explains that global commitments in partnership projects such as the Australia–Indonesia Health Security Partnership, which have already become a national commitment, should also be adopted as a commitment by autonomous districts/municipalities. Considering that disease occurrences are locally specific, each district should have the authority to determine its own health problem priorities based on locally specific evidence. Disease occurrences

are closely related to risk factors, which are essentially all factors that play a role in each locally specific disease event. Therefore, disease control must be carried out comprehensively, including: (a) detecting and treating cases fairly, equitably, and with quality; and (b) identifying risk factors of various diseases and striving for their elimination. The ability to conduct prevention is strongly determined by the ability to understand the theory of disease occurrence that integrates various risk factors. However, in reality, disease management and program implementation are often not comprehensive and fail to integrate case management with risk factor control. In the implementation of various disease control programs, the allocation of resources does not always align with case control activities and the management of various risk factors.

Providing modern medical services free of charge is not the right solution if it is not accompanied by risk factor control for the related diseases. It is like filling a leaky bucket, leading to wasteful spending that is not educative and yields little benefit. Comprehensive control can only be achieved if every effort in disease control is accompanied by risk factor management. Without this, as seen in tuberculosis, malaria, and diarrhea, the diseases persist for a long time and repeatedly result in extraordinary outbreaks. Risk factors are various elements that play a role in every disease event, including the condition of residential environments as well as population-related factors such as culture, behavior, density, education, and others.

In a region, disease on one hand, and the environment and human behavior on the other, are like two sides of the same coin that cannot be separated. Solving health problems cannot be achieved by only addressing environmental factors, nor solely by treating patients. When facing any disease, a health manager must take comprehensive and integrated actions by mobilizing all components of the public health system within the jurisdiction of the district/municipality or health centers. Popularly, this approach is referred to as area-based disease management.

5. Implementation

Based on the results of interviews with the Regional Disaster Management Agency (BPBD) as the Chair of the Task Force, it was stated that the implementation of Rabies Outbreak (KLB) control has been carried out by involving technical agencies and international partners such as the Australia–Indonesia Health Security Partnership.

This implementation is outlined in the Governor's regulation as well as the Regent's circular on Rabies control, which grants both the government and the community at the regency level broad authority in development, including in the health sector.

The Regent, assisted by the Head of the Health Office, the Head of the Department of Animal Husbandry, and the Regional Disaster Management Agency (BPBD) at the regency level, together with the Rabies Preparedness Cadres (KASIRA) and all community components, are obliged to carry out programs for disease eradication and environmental health improvement.

6. Activity Plan

Based on interviews with the Regional Disaster Management Agency (BPBD), serving as the Chair of the Task Force, it was revealed that the implementation of Rabies Outbreak (KLB) control has been carried out with the involvement of technical agencies and international partners, such as the Australia–Indonesia Health Security Partnership.

This implementation is regulated through the Governor's decree as well as the Regent's circular on Rabies control, granting both the government and the community at the regency level broad authority in development, including within the health sector.

The Regent, supported by the Head of the Health Office, the Head of the Department of Animal Husbandry, and the Regional Disaster Management Agency (BPBD) at the

regency level, along with the Rabies Preparedness Cadres (KASIRA) and all community stakeholders, is mandated to implement programs for disease eradication and environmental health improvement.

7. Evidence Informed Priority Setting

The first step is to determine the priorities of the regency and each administrative unit, such as community health centers (puskesmas), urban villages (kelurahan), or rural villages (desa). These priorities may focus on risk factors for disease occurrence, such as the management and treatment of dog bites, bites from rabies-transmitting animals (HPR), or rabies vector animals. Priorities may also be selected based on specific diseases, population age strata, risk factors, or particular regions.

Priorities based on population age strata, for instance, may include toddlers and groups of productive-age mothers. Certain risk factors may include smoking, healthy diet and exercise, poverty, and healthy housing. Particular regions may include specific sub-districts (kecamatan) or the working areas of community health centers (puskesmas). If unhealthy housing is chosen as a selected risk factor, it is necessary to consider disease outcomes, the availability of diagnostic tools, and medicines. All of these priority determinations must be carried out based on evidence.

8. Audit dan Metode

Disease management audit based on territorial (area-based) management is a complementary effort that essentially serves as monitoring and evaluation to assess the accuracy of the implementation of Area-Based Disease Management (MPBW), the appropriateness of risk factor management, as well as population management and health impact.

Area-based surveillance is an essential method that integratively supports MPBW. Surveillance efforts are carried out simultaneously on environmental and population risk factors as well as on diseases. Both are conducted in an integrated, cross-sectoral manner through the following steps:

1. The surveillance parameter objects must include risk factors and related diseases. The parameters used should reflect the disease occurrence process within both human and environmental components.
2. An initial meeting attended by cross-sector stakeholders, including NGOs, aims to determine the type of data and the personnel responsible for data collection, based on available funding, sampling methods, and data collection techniques.
3. Periodic stakeholder meetings should be held at least once a year to discuss various aspects of the collected data.
4. A final meeting is intended to present the results and information. Beyond that, surveillance should follow standard principles and methods, with a focus on priority diseases and/or risk factors.

9. General Strategy and Technical Strategy for Eradication

1. General Strategy

a. Bite Management

The Bite Management Program or TAKGIT is a national program that must be implemented regardless of the Rabies status in a given area. It must be accompanied by other strategies such as responses to suspected animals, vaccination, and Communication, Information, and Education (CIE).

The technical agency, in this case, the Department of Animal Husbandry and Health of South Central Timor Regency, has carried out these measures, both internally within each agency and in collaboration under the Rabies Control Task Force (SATGAS), chaired by the Regional Disaster Management Agency (BPBD) in handling non-natural disasters.

Human deaths from rabies can be prevented by increasing access to health centers, affordable and timely medicines, and vaccines. Currently, post-bite treatment with VAR (Anti-Rabies Vaccine) and SAR (Anti-Rabies Serum) is nearly 100% effective in preventing rabies deaths (WHO, FAO, OIE, GARC 2018). Rabies control programs involve many sectors, including the animal health sector and the public health sector, requiring the implementation of the One Health approach (WHO 2018).

TAKGIT is one of the implementations of this approach. TAKGIT, or Integrated Bite Case Management (IBCM), is a form of coordination and technical collaboration between human and animal health workers in managing bite cases and serves as the foundation of the general rabies eradication strategy in Indonesia. With TAKGIT, it is expected that every bite case reported to health workers will be followed up with field investigations according to standards by animal health workers. From this activity, feedback information will be obtained for health workers to continue administering VAR to bite victims or discontinue VAR based on the diagnosis of animal health officers.

TAKGIT will function if there is a report of bite cases (targeted passive surveillance) from human health workers (health centers/health offices) to animal health workers (Department of Animal Husbandry/Animal Health), and animal health workers provide confirmation of suspected animal cases to human health workers for discontinuation of VAR administration. TAKGIT is expected to detect cases through reporting so that there will be follow-up actions by animal health workers for all bite cases reported by health workers.

b. Communication, Information, and Education (CIE)

The community, as the government's partner and the beneficiary of rabies eradication programs, is the most important stakeholder in program implementation. Active community involvement in program implementation is the key to the success of rabies eradication. Therefore, awareness-raising activities that are comprehensive and well-structured are needed as an integral part of the rabies eradication program.

Communication, Information, and Education (CIE) is one of the key components of a comprehensive rabies eradication program. CIE can pave the way for active community participation in supporting government efforts, such as active participation in vaccination programs, early reporting processes, and more responsible attitudes of dog owners toward their dogs. CIE is necessary to ensure that the community understands the meaning and importance of government-led rabies control and eradication programs.

In comprehensive rabies eradication efforts, CIE should be integrated into the eradication program and given adequate funding. Often, CIE is considered merely a supplementary component of rabies eradication programs. This perception is incorrect because CIE has a significant impact in supporting the main eradication strategies, namely vaccination and TAKGIT. Increased awareness, involvement, and participation of the community can help improve mass vaccination implementation, cost-effectiveness, sustainability efforts, surveillance systems, and rabies case management (WHO 2018).

c. Regulatory Support

In essence, rabies eradication programs require strong and clear regulatory and policy support. The Government of Indonesia, particularly the Directorate General of Animal Husbandry and Animal Health, Ministry of Agriculture, must make eradication policies a primary target with rabies-free status by 2030 as the ultimate goal. The eradication strategy must be an integral part of the overall development of the animal health sector. Full implementation of current legislation is necessary in the implementation of rabies eradication programs, along with continuous review and, if necessary, proposals for amendments to such legislation.

Regulations are needed to support other strategies, especially related to vaccination implementation. These regulations must align and exist at the levels of the Central Government, Province, and Regency/City. Regulations at the Central level, whether in the form of laws, Government Regulations in general, or specifically in the form of Minister of Agriculture Regulations, must serve as the basis for drafting related regulations on rabies control and management at the provincial and regency/city levels.

d. Community Involvement

Community involvement, which may come from hunting organizations, animal traders, and the general public, including pet owners, is very important in rabies eradication. To make community involvement effective, CIE must be conducted for officers or the community, especially regarding clinical signs of suspected cases, rabies prevention methods, ways of treating rabies-transmitting animal bites, proper handling of biting animals, case reporting procedures, and how to be a responsible pet owner (Directorate of Animal Health, 2015).

2. Technichal Strategy

More than 95% of human rabies cases are transmitted through dog bites; therefore, rabies control and eradication programs targeting dogs are the most effective approach (WHO 2018). The concept of rabies eradication in animals has become a necessity, considering that managing human rabies bite cases requires very high costs, particularly in providing Rabies Vaccine (VAR) and Rabies Serum (SAR) (Haesler B et al. 2012). Considering Indonesia's cultural conditions, the government's general rabies control strategy will be implemented with a local area–specific (LAS) approach.

a. Vaccination

Vaccination is the main technical strategy for rabies eradication (WHO, FAO, OIE, GARC 2018). In principle, vaccination is an effort to increase immunity by introducing weakened or inactivated pathogens into the body to stimulate the immune system. The main goal of rabies vaccination is to immunize susceptible animals within a population to establish herd immunity, thereby reducing the infection rate among the susceptible population. Eradication efforts focusing on the source through dog vaccination require far lower costs compared to human vaccination, making source-based interventions financially most effective and sustainable for rabies control (ASEAN 2016; Haesler B et al. 2012; WHO, FAO, OIE, GARC 2018).

Several countries that have initiated dog vaccination programs to eradicate rabies have successfully reduced cases significantly and even eliminated rabies virus from their territories. Latin American countries such as Mexico, Chile, and Argentina, as well as Caribbean nations, have successfully reduced rabies cases in both animals and humans through mass dog vaccination campaigns (Ministry of Health 2017; WHO 2013; WHO 2018).

Planning effective mass vaccination must be based on the rabies epidemiological situation in the target area and knowledge of dog ecology including ownership status (owned and confined, owned but free-roaming, community dogs, and stray dogs) which must be documented. A detailed and logical approach should be developed and documented. Adequate financial support, infrastructure, and technical capacity are essential for implementing vaccination programs. In addition, documentation of post-vaccination coverage monitoring and proper program evaluation is necessary (ASEAN 2016).

b. Surveillance and Epidemiological Analysis

Rabies is a neglected disease. In many countries, rabies-related data is scarce due to poorly organized control programs and surveillance systems. Inadequate surveillance, underreporting, frequent misdiagnosis, and lack of inter-sectoral coordination are major

reasons behind the underestimation of rabies disease burden (WHO 2018).

A country must have adequate surveillance capacity to detect rabies cases in both animals and humans. Rabies surveillance is a key eradication procedure for continuous detection of the disease and identification of rabies-positive animals. Rabies surveillance is essentially virus surveillance, based on the sensitivity of program implementation (ASEAN 2016).

Rabies surveillance is a key index of the success of any intervention program. It involves collecting crucial data to (1) understand rabies epidemiology at program onset, (2) monitor and evaluate progress and impact of interventions, (3) manage potential human exposure (bite cases), and (4) calculate the cost-effectiveness of control measures. If surveillance measures are not in place initially, they must be implemented quickly and strategically. Efficient data reporting is equally important as data collection, as timely analysis can directly influence subsequent policy decisions, such as outbreak declarations that require urgent interventions.

c. Diagnostic Evaluation

Rabies is an acute progressive encephalitis caused by lyssavirus. Diagnostic evaluation based on clinical signs in animals is difficult; therefore, laboratory confirmation through the Fluorescent Antibody Test (FAT) is the only definitive diagnostic method and serves as the gold standard. Every country must have at least one national reference laboratory with capacity for rabies diagnosis using recommended techniques (WHO 2018).

Diagnostic evaluation is usually performed post-mortem on animals that bite humans or show clinical signs suggestive of rabies, posing transmission risks. This testing is vital for rabies prevention and control, especially in humans. A positive diagnostic result can guide the administration of VAR or SAR to bite victims, preventing infection. In the animal health sector, positive results guide decisions on dog population management, whether vaccination or euthanasia. Conversely, negative results help reduce unnecessary VAR or SAR use, improving cost-effectiveness (Trimarchi CV and Nadin-Davis SA 2012).

Another important value of diagnostic evaluation is surveillance data collected from the field, which provides insights into rabies epidemiology in both animals and humans. Such data are crucial for technical policy-making regarding VAR and SAR stockpiles, detailed clinical management of bite victims, vaccination targets, and other regional interventions (Trimarchi CV and Nadin-Davis SA 2012).

d. Rapid Response and Management of Suspected Animals

For rabies eradication and vaccination program success, rapid response to bite case reports and handling of suspected animals is critical. Reported suspected animals must be correctly identified and, if they show at least two clinical signs of rabies, humanely euthanized to prevent further suffering and minimize transmission risks (WAP 2015).

A suspected animal is one indicated as rabies-infected based on bite cases and observed clinical signs. Animals are classified as “highly suspected” if they die or show more than two typical rabies signs. Other animals in the same environment are also considered suspected (secondary spread), as they may have been exposed to the high-suspect animal. Handling suspected animals requires extreme caution, assuming all are potentially rabies-infected (WAP 2015).

Rapid response to suspected animals showing clinical signs should ideally involve euthanasia to reduce transmission risks to other animals or humans and to enable case confirmation. Suspected animals should be observed for up to 14 days. If they show at least two rabies signs, euthanasia and brain sampling for laboratory confirmation should be conducted. If laboratory results are positive, emergency vaccination across the entire village is essential (WAP 2015).

Every reported bite case must be followed by investigation to confirm whether it is rabies-related and requires immediate action for both animals and humans involved. Investigations should identify suspected animals, capture them if possible, and trace other bite victims to ensure all receive VAR (WAP 2015).

e. Animal Movement Control

According to WHO (2018; 2012), animal movement plays a critical role in public health, as it can introduce rabies into new areas or countries. Monitoring of animal movement across borders, islands, provinces, or districts is essential to prevent rabies spread, particularly from endemic to rabies-free areas.

Animal movement control is mandatory. Movements across national borders and between islands are managed by quarantine authorities, while movements within an island, across provincial or district borders (checkpoints), are overseen by livestock and animal health authorities. According to ASEAN (2016), given Indonesia's current situation, necessary measures include:

1. Optimization of quarantine measures, especially at official entry/exit points.
2. Revitalization and optimization of checkpoints at provincial and district borders.
3. Strict law enforcement at official entry/exit points.
4. Quarantine procedures at borders should include reviewing rabies vaccination history and, if necessary, serum sampling of animals transported across areas.
5. While animal quarantine and movement control are primarily the responsibility of animal quarantine agencies, support from local authorities and communities is also critical for effective and efficient enforcement.

f. Dog Population Management

Dog population size is a significant factor in rabies control, particularly in achieving and maintaining the required 70% vaccination coverage. High carrying capacity and high fertility rates lead to high turnover in dog populations. In areas where dogs can reproduce more than twice a year, dog population management (DPM) programs are urgently needed to support rabies control efforts. DPM approaches combine general and technical strategies that must be implemented comprehensively and sustainably to maximize impact and maintain vaccination program effectiveness. Since dogs are the main rabies hosts, unmanaged populations increase transmission risks to humans and cause other issues, such as (1) animal welfare concerns, (2) rabies and other diseases, (3) traffic accidents, and (4) social problems, including community complaints and fear of dog bites. Comprehensive DPM programs include eight components:

1. Education
2. Legislation
3. Registration and identification
4. Sterilization and contraception
5. Temporary shelter and animal return centers
6. Control of food source access
7. Vaccination and other treatments
8. Euthanasia

Depending on specific contexts, several components can be implemented simultaneously, without requiring sequential steps. Further details on the eight DPM components are provided in the Dog Population Management appendix.

10 Risk Management Approach in Handling Rabies Outbreaks in South Central Timor Regency

Risk management is a systematic process used to identify, assess, manage, and communicate risks within a system or activity. In the context of a Rabies Outbreak (Kejadian

Luar Biasa / KLB) in South Central Timor Regency (TTS), the risk management approach is highly relevant for analyzing the effectiveness of institutional, technical, and social responses to the rabies epidemic, which has resulted in thousands of bite cases and dozens of deaths.

The Covello-Merkhofer Model is used as the framework in this analysis, which includes:

1. Hazard Identification
2. Risk Assessment
3. Risk Management
4. Risk Communication

1. Hazard Identification

Bahaya utama The main hazards identified in handling the Rabies Outbreak (KLB) in South Central Timor (TTS) include:

1. The spread of the rabies virus through bites from Rabies-Transmitting Animals (RTA), particularly unvaccinated dogs.
2. The movement of domestic and stray dogs across regions without adequate control and quarantine.
3. Low rabies vaccination coverage in RTAs, below the herd immunity target (70%).
4. Limited vaccine logistics and cold chain storage capacity.
5. Low public awareness and literacy regarding the dangers of rabies.
6. Lack of cross-sectoral integration in response systems and event information management.

2. Risk Assessment

1. Release Assessment

The risk of rabies virus release occurs through the movement of unvaccinated Rabies-Transmitting Animals (RTAs) freely within densely populated settlements. Based on data from the TTS Livestock Service in 2024, out of a total population of 69,000 RTAs, only 65% have been vaccinated. This means that approximately 24,150 RTAs still have the potential to serve as sources of infection.

2. Exposure Assessment

The groups most at risk of rabies exposure are children, livestock farmers, and rural communities who have direct contact with Rabies-Transmitting Animals (RTAs). Within six months since the first case, a total of 4,787 RTA bite cases were recorded in TTS. The spread has also extended to neighboring districts on Timor Island.

3. Consequence Assessment

The impacts of rabies are multidimensional:

a. Health: 19 human deaths due to rabies, delays in medical treatment, and psychological trauma.
b. Economic: Costs of treating bite victims, vaccine procurement, and farmers' losses due to animal elimination.
c. Social: Increased fear and stigma toward dogs and their owners, as well as conflicts among community members.

4. Risk Estimation

Considering the high number of bite cases, the low vaccination coverage, and the uncontrolled mobility of rabies-transmitting animals (HPR), the level of rabies risk in TTS is categorized as high and has the potential to spread across administrative boundaries.

3. Manajemen Risiko (Risk Management)

1. Prevention Strategies
   a. Mass vaccination of rabies-transmitting animals (HPR) with a target of 70%

coverage: currently only 65% achieved.
   b. Elimination and capture of unvaccinated and aggressive stray dogs.
   c. Development of village-based rabies risk zoning maps.
   d. Establishment of integrated rabies task force posts at the sub-district and village levels.
2. Cross-Sector Strengthening
   a. Cross-sector coordination with the Health Office, BPBD, Community Health Centers (Puskesmas), and villages.
   b. Technical mitigation in collaboration with international partners (Australia–Indonesia Health Security Partnership).
   c. Integration of rabies data into the regional surveillance system.
3. Case Management and Supply Chain
   a. Ensuring the availability of Anti Rabies Vaccine (VAR) and Anti-Rabies Serum (SAR) in all health facilities.
   b. Improvement of vaccine distribution systems, including cold chain equipment.
   c. Training of technical staff and village cadres on rabies diagnosis and first response.
4. Stamping Out and Quarantine
   a. Establishment of quarantine zones in infected villages and buffer zones.
   b. Monitoring the movement of HPR in and out of endemic villages.
   c. Enforcement of local regulations (perda) on zoonotic disease management.
5. Risk Communication
   a. Risk communication has not yet been optimal. The TTS Livestock Department and partners have developed:
   b. Education and outreach in schools, places of worship, and traditional markets.
   c. Collaboration with religious and traditional leaders in delivering rabies prevention messages.
   d. Use of social media and banners in strategic village locations.

   However, the main challenges include:

1. Misconceptions about rabies vaccination and treatment.
2. Low literacy regarding the importance of reporting bite cases.
3. Dependence on one-way communication from the government to the community.

6. Strategy Evaluation and Recommendations
   1. Based on the above analysis, the following recommendations are proposed:
   2. Strengthening of regional-based rabies risk management SOPs.
   3. Expansion of emergency vaccination coverage and active surveillance using digital technology.
   4. Capacity building of village cadres for early identification and case reporting.
   5. Active involvement of local leaders and community media as risk communication agents.
   6. Revision and enforcement of regional policies prohibiting the circulation of unvaccinated HPR.

KESIMPULAN

1. Regional health development can be carried out by referring to the concept of Area-Based Disease Management (MPBW) and the SKK design of each autonomous government region. More specifically, it is necessary to formulate district and municipal MPBW guidelines that can serve as a reference for planners and implementers. MPBW is expected to gradually and sustainably improve the health of the population in a given district or city. Finally, and equally important, the implementation of MPBW must

adhere to the principles of Public Health.

2. The processing of epidemiological surveillance data on potential outbreak-prone diseases carried out at the Karanganyar District Health Office begins with data collection and data processing, which includes:

1. Determining the groups or categories of the population that have the highest risk of contracting the disease,
2. Identifying the type of agent,
3. Recording the occurrence of the disease as a whole,
4. Ensuring the basic characteristics of the outbreak, its source, mode of transmission, and spread.

Recommendation

1. Data collection is still experiencing delays; strict sanctions should be given to the Surveillance Officers.
2. Health education should be provided to the community regarding the dangers of potential outbreak-prone diseases and their management, as well as other related diseases.
3. Human resource constraints can be addressed by providing continuous training for surveillance officers at community health centers (puskesmas).

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