Issue 3 | December 2023

ASEAN BIODIASPORA VIRTUAL CENTER

RABIES

FOCUS REPORT

With Support by:

bluedot

Korea Disease Control and Prevention Agency

In partnership with Canada

Kemenkes

ASSOCIATION OF SOUTHEAST ASIAN NATIONS

ASEAN BIODIASPORA VIRTUAL CENTER

Editorial

PUBLISHER
ASEAN Biodiaspora Virtual Center

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RABIES FOCUS REPORT

RABIES

Introduction

Rabies, a persistent global threat, causes tens of thousands of deaths annually, with 99% resulting from dog bites worldwide. To combat this, awareness, treatment, and animal vaccination are essential. Although 59,000 human deaths are estimated annually, underreporting likely leads to significant underestimation, disproportionately impacting rural poor populations and children under fifteen (1).

Assessing the disease's impact on animal populations and the costs of prevention is crucial. However, expenses often hinder animal vaccination and stray dog elimination programs in developing nations. The United States alone spends over US$300 million yearly on dog vaccinations. Research shows that once dog vaccination rates reach 70%, rabies can be effectively controlled, but vigilance is crucial due to a 25% annual turnover in the dog population and the risk of reintroduction (2).

Managing rabies exposure costs around US$108 per person, imposing a heavy financial burden on those with daily incomes as low as US$1–2. Annually, over 29 million individuals receive PEP, preventing hundreds of thousands of rabies-related deaths. The global economic burden of dog-mediated rabies is estimated at US$8.6 billion per year, with unmeasured psychological trauma for individuals and communities (1).

In the ASEAN region, rabies presents a complex challenge. Despite available vaccines, it continues to claim lives, mainly due to infected dog bites.

As of December 2, 2023, the ASEAN region reported 484 rabies confirmed cases, and 484 deaths caused by rabies, highlighting the ongoing concern (3). Rabies continues to be a significant public health concern in ASEAN Region. The region is considered as one of the hotspots for rabies transmission, and several countries within ASEAN region have reported a considerable burden of the disease due to stray dogs. Collaborative efforts, including widespread dog vaccinations, public awareness, and enhanced surveillance, are crucial in the battle against rabies in the region.

Method

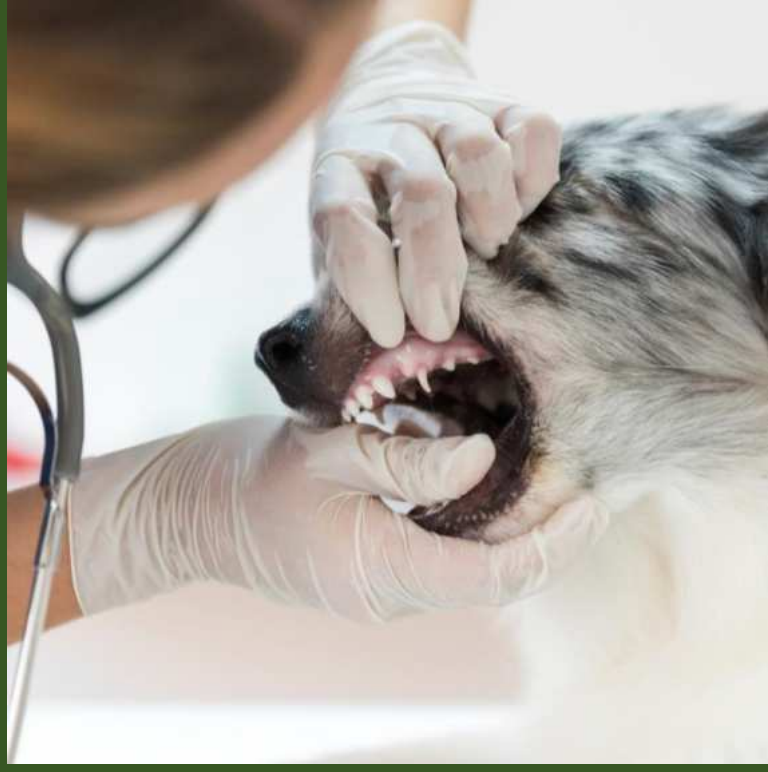
In this report, we thoroughly explore rabies within ASEAN region, following a structured roadmap. We begin by defining the landscape, understanding its prevalence, disease burden, prevention, and treatment in the ASEAN region.

Our insights cover data from 2020 to 2023, sourced from PubMed, Embase, and Scopus using specific keywords like 'rabies,' 'epidemiology,' 'disease burden,' 'public health response,' 'prevention,' and 'treatment.' Real-time data from official reports and news articles on rabies cases in SEA, accessed through the Bluedot platform, enriches our findings.

Data extraction emphasizes study design, sample size, demographics, diagnostic methods, and key discoveries. We present results in a synthesized narrative, highlighting trends, patterns, and gaps in the ongoing fight against rabies in SEA. This methodology offers a

comprehensive overview of rabies, focusing on epidemiology, disease burden, country-level response, and recent advancements in prevention and treatment.

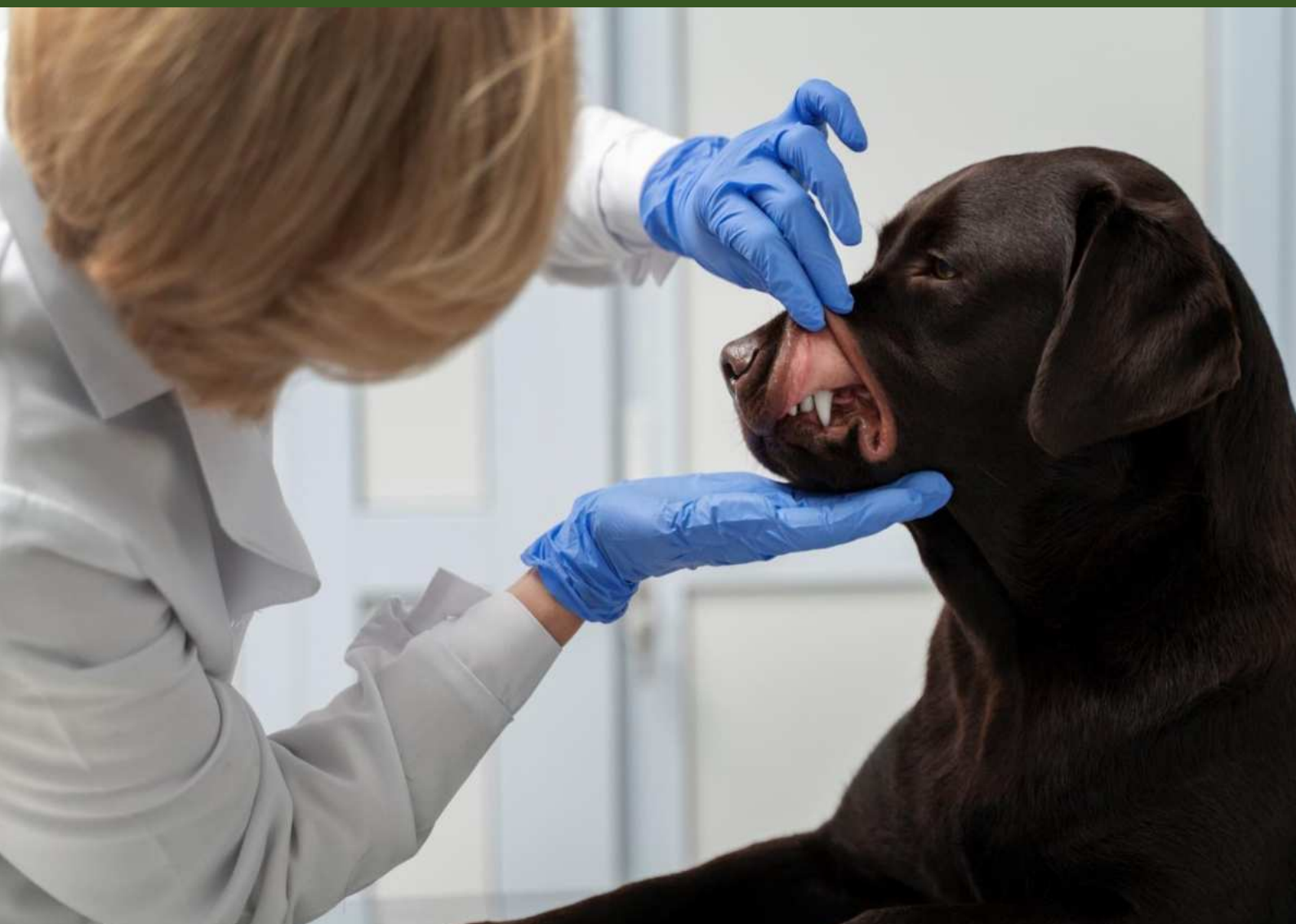
As we navigate the SEA rabies landscape, this report provides valuable knowledge to understand the disease and the strategies used to combat.



Challenges In Controlling Rabies

According to the World Health Organization (WHO), approximately 99% of human rabies cases are acquired from the bite of an infected dog[4]. Controlling rabies in ASEAN poses several challenges, including limited healthcare infrastructure for PEP, resource-intensive canine vaccination programs, inadequate reporting, and the presence of stray dogs[5–7]. Stray dogs are a significant source of human rabies cases, with Indonesia, the Philippines, and Thailand grappling with substantial populations of strays[8,9]. Addressing these challenges through comprehensive rabies control programs, dog vaccinations, and public awareness campaigns is essential to protect both human and animal lives.

Epidemiology of Rabies



Global Situation of Rabies

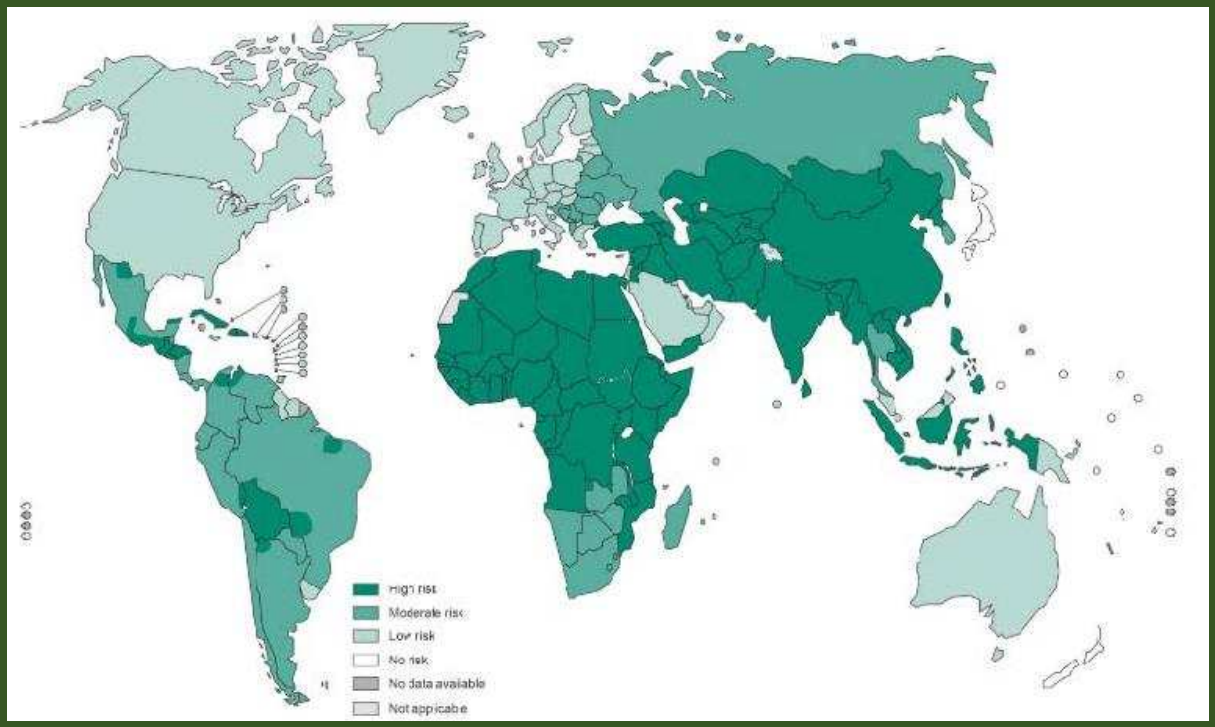


Figure 1 Global risk of rabies infection (WHO,2018)

Rabies is extremely deadly, with nearly a 100% fatality rate [10]. Various African nations, including Algeria, Namibia, Eswatini (formerly Swaziland), Tunisia, Uganda, Zambia, and Zimbabwe, have reported high morbidity and mortality rates due to rabies, ranging from 32.8% to 94% [6,11–14].

The prevalence of stray dogs in these regions elevates the risk of dog bites, and access to timely and adequate rabies treatment is often limited, especially in rural areas[15]. Rabies vaccines and essential rabies immunoglobulins are frequently scarce in these poor areas. Lack of public awareness regarding the importance of prompt treatment after a dog bite contributes to high mortality rates, with many rabies cases resulting from neglect or a lack of healthcare services[16,17].

In contrast, high-income countries like the USA have effectively reduced rabies incidence and associated mortality. Over the past decade, there have been only 25 reported human rabies cases in the USA, with 23 deaths[18]. Success factors include robust animal control and vaccination programs, public health infrastructure, diagnostic capabilities, and access to modern rabies treatments. Despite rabies being preventable, cost, limited education, and low awareness hinder post-exposure prophylaxis (PEP) use[4]. Public education and awareness campaigns are essential to reduce rabies-related illness and death.

ASEAN Region Situation of Rabies

Based on historical WHO data on human death caused by rabies, Philippines has been dominating the number for the past decades (Figure 2). Myanmar showing decrease in number death since 2011. Singapore has been rabies-free country since 1953 and Brunei has been rabies-free country since 2010. Malaysia was declared as rabies-free country but new rabies cases reported in 2017 make Malaysia increasing their surveillance and preparedness for any rabies risk factors[19].

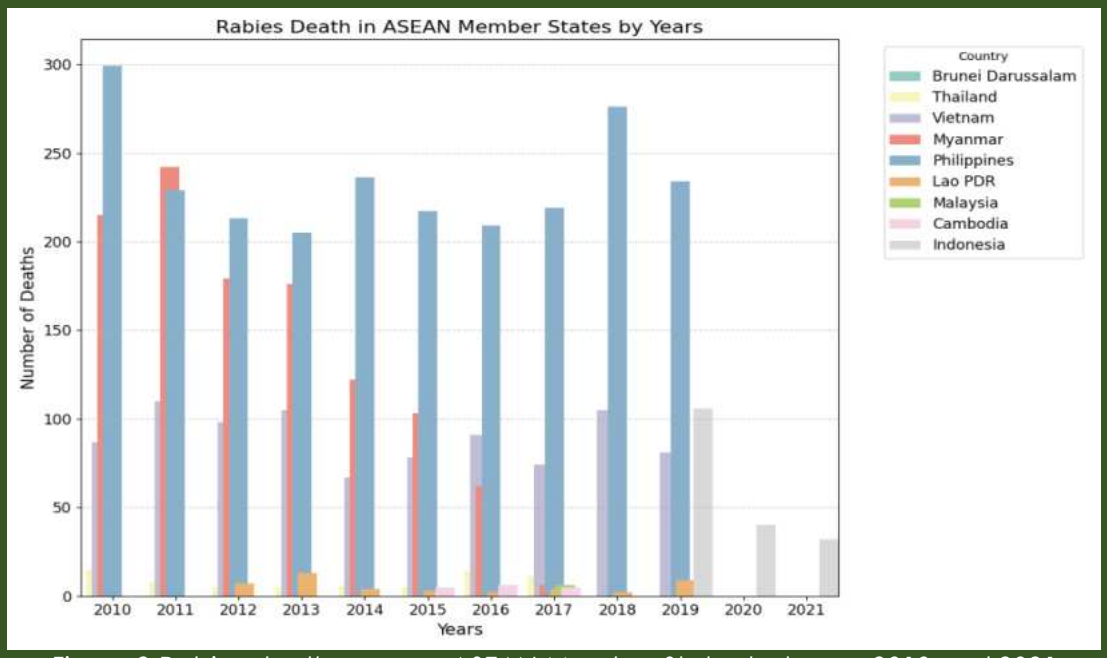


Figure 2 Rabies deaths among ASEAN Member States between 2010 and 2021

Based on ABVC report from January 1 to December 2, 2023, ASEAN region reported 484 laboratory-confirmed cases with 100% case fatality rate (CFR)[3].

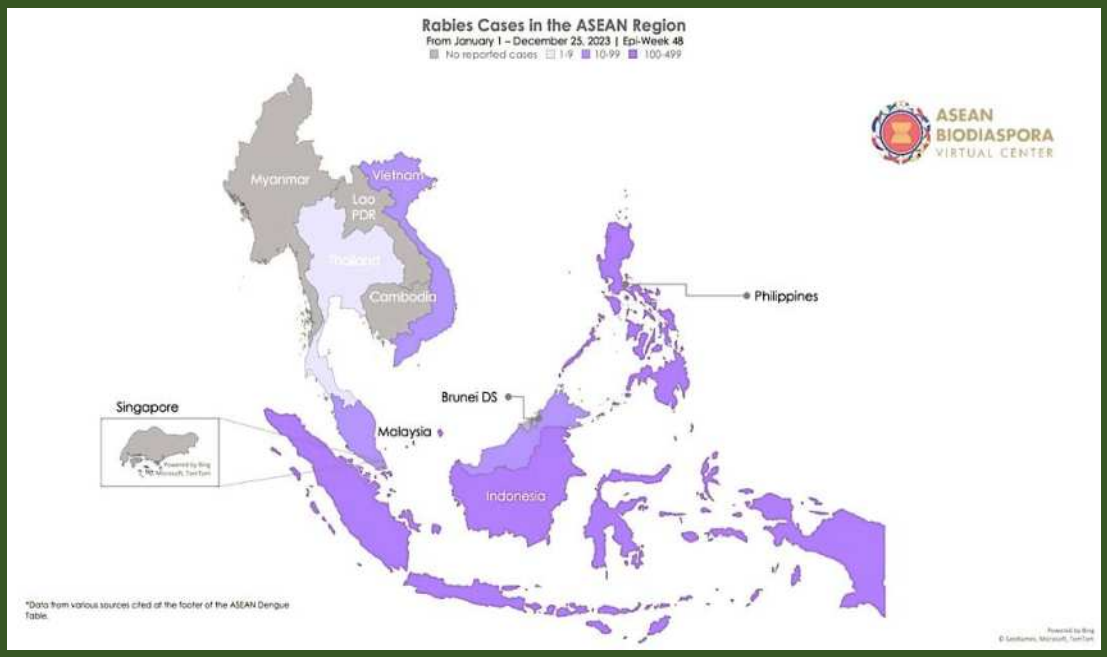


Figure 3 Rabies cases from January 1 to December 2, 2003 (ABVC, Epi-Week 48)

Table 1 Rabies cases from January 1 to December 2, 2003 (ABVC, Epi-Week 48)

Country	Epi-Week Reported	Laboratory-Confirmed Rabies Cases	Cumulative Deaths	CFR
Brunei Darussalam	Rabies-free country			
Cambodia	-	-	-	
Indonesia (1)	Week 48	109	109	100%
Lao PDR	-	-	-	
Malaysia(1)	Week 38			100%
Myanmar	-	-	-	

Philippines(2)	Week 43			100%
Singapore	Rabies-free country			
Thailand(3)	Week 46	5	5	100%
Vietnam(1)	Week 40	34	34	100%
Total		484	484	100%

Notes:

1. BlueDot Developer Portal accessed October 23, 2023, https://developer-portal.bluedot.global/.
2. Department of Health Website accessed October 23, 2023 "Statistics," https://doh.gov.ph/statistics.
3. Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health Thailand, accessed October 23, 2023, http://doe.moph.go.th/surdata/index.php

Burden of Rabies In ASEAN Region

Here are some key points regarding the burden of rabies in ASEAN region:

1. High Incidence

ASEAN region has a relatively high incidence of human rabies cases compared to other regions (Table 2). Most human rabies deaths in the world occur in Asia, with a significant proportion attributed to countries in ASEAN region. In Vietnam, the incidence of rabies ranged from 1.7 to 1.72 per 100,000 population[20,21]. The cumulative incidence in Sarawak was estimated at 1.7 per 100,000 population[22]. In Indonesia, 104 human rabies cases were reported from 2008 to 2010, while in Thailand, a total of 46 rabies cases were reported in Thailand from 2010 to 2015[23,24]. In the Philippines, the incidence of rabies ranged from 0.1 to 0.3 per 100,000 population[25]. An increased risk of rabies virus infection was associated with a high population density, illiteracy, seasonal patterns, and dog butchers. The case fatality rate was 100%[4].

2. Endemic in Some Countries

Rabies is considered endemic in several countries in ASEAN region, meaning that the virus is consistently present in animal populations and poses a risk of transmission to humans. In the region, only Singapore and Brunei has eradicated canine rabies through the implementation of robust national rabies control programs, while other countries in this subregion are not considered rabies-free[26]. Malaysia was declared rabies-free by the World Organisation for Animal Health in July 2013, but several rabies outbreaks since 2015 have caused Malaysia to lose its rabies-free status[27]. Even though Thailand and Vietnam have not been able to eliminate rabies, there has been a substantial reduction in human rabies deaths through the implementation of dog mass vaccination, intensified PEP in humans, and awareness education[28,29]. The occurrence of rabies in the region is due to the high number of unvaccinated stray and pet dogs, working hazards (dog butchers in Vietnam), the unavailability of the rabies vaccine in rural regions, and misinformation about the significance of seeking treatment after dog bites[29].

3. Main Reservoirs

Dogs are the primary reservoirs and the main source of rabies transmission to humans in most ASEAN Member States. Stray dog populations contribute significantly to the spread of the disease[30]. In Asia, rabies is clearly a major problem: the number of human deaths due to rabies in Asia is higher than in

any other region in the world. Most human rabies deaths occur in Asia (59.6%), followed by Africa (36.4%), while only less than 0.05% of human rabies deaths occur in the Americas. In addition, India alone accounts for 35% of global human rabies deaths, higher than any other country [5]. In Asia, canine rabies is estimated to cause a loss of 2.2 million disability-adjusted life-years per year, while the annual cost of postexposure prophylaxis (PEP) is highest in Asia, estimated at up to US$1.5 billion. The case fatality rate was 100% as mentioned in 2 studies. In Indonesia, Susilawathi et al[24] reported 104 fatalities due to rabies, of which 96 cases had a history of dog bites. Similarly, in the Philippines, 463 people died from rabies infection[25].

4. Limited Access to Healthcare

Rabies is concentrated in Asia and ASEAN region because it is frequently neglected when health and agriculture budgets are set, although the costs and economic benefits of implementing rabies prevention programs have been successfully established in high-income countries[31]. The high number of rabies cases in ASEAN region can also be attributed to the high number of unowned, free-roaming dogs that cannot be controlled without considerable effort and thus are not vaccinated. Access to appropriate medical care and post-exposure prophylaxis (PEP) may be limited in some rural and remote areas, leading to delays in seeking medical attention after animal bites or exposures.

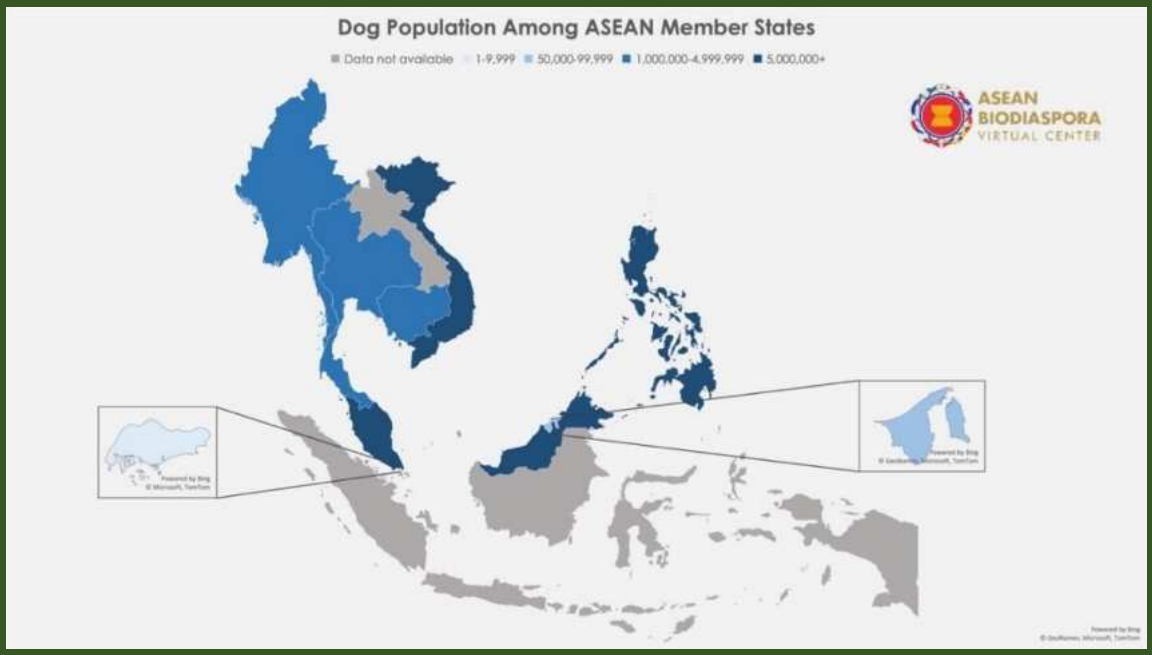
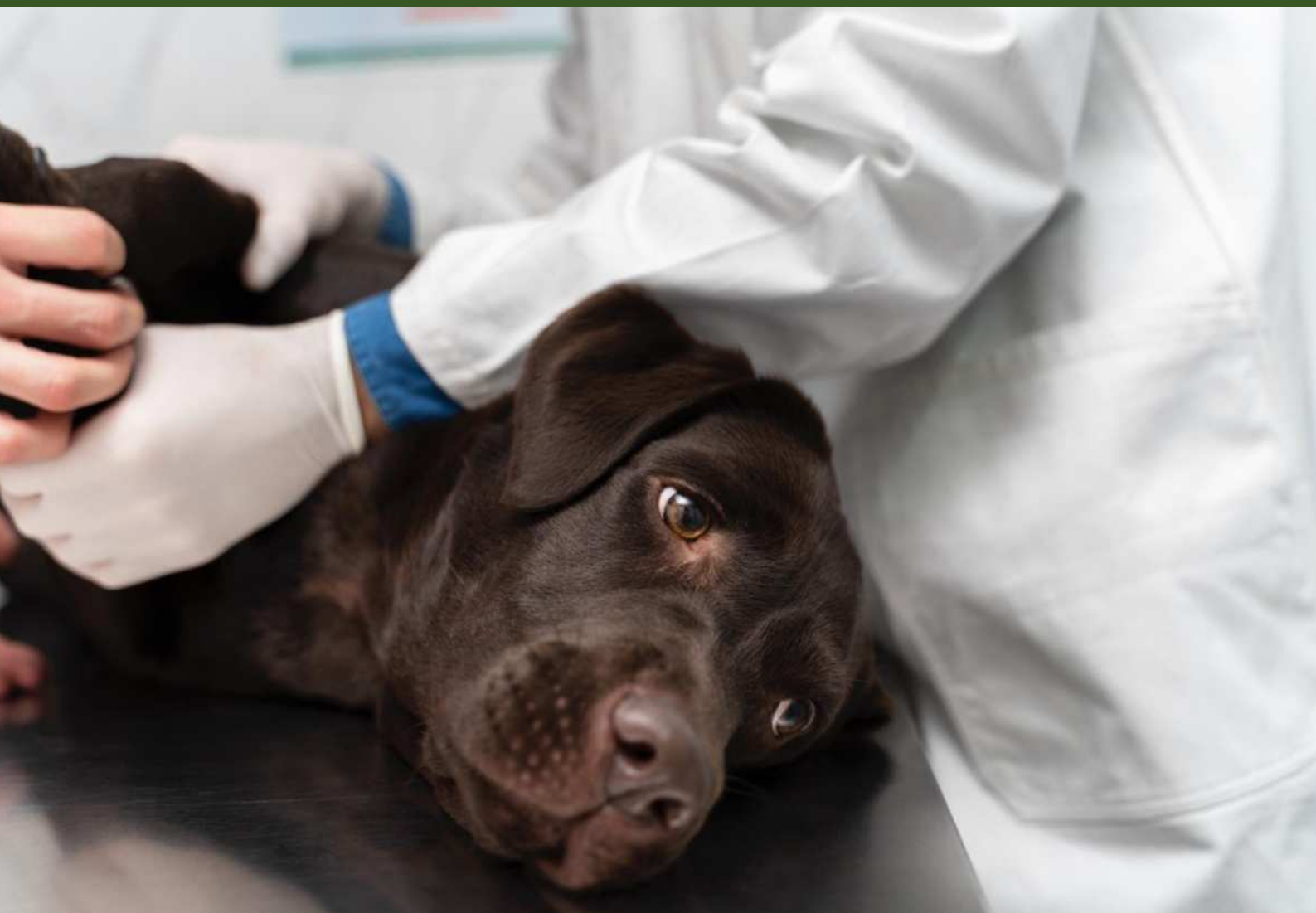


Figure 4 Estimated dog population among ASEAN Member States [32-38]

Case Definition and Management Rabies



CASE DEFINITION OF RABIES IN GLOBAL AND EACH ASEAN MEMBER STATES (AMS)

Case Definitions Global

World Health Organization (WHO)

Human rabies can be confirmed *intra-vitam* and postmortem by various diagnostic techniques that detect whole viruses, viral antigens, or nucleic acids in infected tissues (brain, skin, or saliva)[1].

Center for Disease Control and Prevention (CDC)

A confirmed case is met with confirmatory laboratory evidence such as[39]:

- A positive rabies virus direct fluorescent antibody test; OR
- A positive rabies virus direct rapid immunohistochemical test (dRIT); OR
- A positive rabies virus test by immunohistochemistry (IHC) on formalin-fixed tissue; OR
- A positive pan-lyssavirus probe-based real-time reverse transcription-polymerase chain reaction RT-PCR test; OR
- Detection of lyssavirus nucleic acid by genomic sequencing; OR
- Isolation of rabies virus (in cell culture or in a laboratory animal).

Table 2. Case Definition among AMS

Case Definitions among AMS		
Sources	**Case Definitions**	**Symptoms**
Brunei Darussalam	Follow WHO definition	• Hyperactivity • Excitable behavior • Hallucinations • Lack of coordination • Hydrophobia (fear of water) • Aerophobia (fear of drafts or of fresh air) • Paralytic muscles • Weakness or discomfort • Fever • Headache
Cambodia	Follow WHO Definition	
Indonesia[40]	The term "Rabies Susceptible Animal Bite Case (RSABC)" refers to cases of animal bites that have the potential to transmit the rabies virus, particularly bites from dogs, cats, monkeys, or other warm-blooded animals. A "Human Rabies Case" is defined as a case presenting with symptoms and signs of acute brain inflammation (encephalitis), such as hyperactivity, seizures, or paralysis (paresis/paralysis), leading to a coma and usually resulting in death due to respiratory failure on the 7th to 10th day after the onset of initial symptoms.	

	Additionally, there must be a history of being bitten by a Rabies Susceptible Animal (RSA).	• Prickling • Itching sensation at the site of the bite last for days • Hyperactivity • Seizures • Paralysis • Dysphagia • Hydrophobia • Convulsions • Hydrophobia • Aerophobia • Attacks of apnea • Mild sensory disturbance • Paraplegia • Paralysis of the respiratory • Pharyngeal muscles Symptoms then progress: • Cerebral dysfunction • Anxiety • Confusion • Agitation As the disease progresses: • Delirium • Abnormal behavior • Hallucinations • Hydrophobia (fear of water) • Insomnia
Lao PDR[41]	Rabies reports are only generated when samples are sent to the laboratory following a dog's bite incident. In the absence of a biting incident, no report is initiated.	
Malaysia[42]	Rabies is an acute neurological syndrome (encephalomyelitis) dominated by forms of hyperactivity or paralytic syndromes that almost always progresses towards coma and death, usually by respiratory failure, within 7-10 days after the first symptom if no intensive care is instituted. A confirmed is laboratory-confirmed.	
Myanmar[43]	While it is widely acknowledged that dog bites are the main source of infection in countries with endemic rabies, the data showed a significant underreporting of laboratory-confirmed rabies cases in animals. Over the last five years (2009-2018), an average of 200 human rabies cases has been confirmed and reported annually, in stark contrast to the meager average of just 7 confirmed and reported animal rabies cases per year.	
Philippines[44]	Rabies primarily spreads through bites from infected animals, including dogs, cats, and wildlife like bats, but not from animals such as rats, rabbits, or birds. While less common, non-bite transmissions should be considered, like contact with an infected animal's saliva on intact mucous membranes (e.g., eyes, nose, mouth, genitalia), licking on broken skin, or inhaling aerosolized virus in enclosed environments (e.g., caves with rabid bats or diagnostic laboratories).	
Singapore[45]	Rabies is a fatal disease caused by the rabies virus that affects mammals, including humans. The virus can be transmitted when the saliva of an infected animal encounters an open wound or mucous membranes (e.g., eyes, nose, and mouth) of another	

	mammal. For instance, the rabies virus is transmitted to a human when a rabid dog bites a person or licks a person's exposed skin or mucosa.	
Thailand	Follow WHO Definition	
Vietnam[46]	According to the Ministry of Health report from the rabies prevention and control committee, more than 400,000 people receive post-exposure prophylaxis (PEP) annually. Human fatalities resulting from rabid dog bites are increasing, with an annual average of approximately 100 people succumbing to rabies.	

Table 3. Clinical Definition

Clinical Definition	
Criteria	**Description**
Neurological Symptoms[47]	Acute onset of neurological symptoms - Includes agitation, hallucinations, and paralysis - Disease is almost always fatal.
Incubation Period[1]	Symptoms develop after exposure to the virus - Incubation period varies (usually 1 to 3 months) - Shortest incubation: 4 days; Longest: over 6 years - Duration depends on wound and virus factors
Progressive Course[47]	Symptoms progress rapidly, leading to coma and death within days to weeks - Initial prodromal period (2 to 10 days) with nonspecific symptoms - unusual behaviors may occur - Recovery from rabies is extremely rare.

Diagnostics

1. **Direct Fluorescent Antibody Test (dFAT)**

   Laboratory confirmation of rabies infection is essential. This is usually achieved by detecting the presence of rabies virus antigens in brain tissue using the direct fluorescent antibody test (dFAT). Because rabies is present in nervous tissue (and not blood like many other viruses), the ideal tissue to test for rabies antigen is the brain[48]. The most important part of a dFA test is fluorescently labeled anti-rabies antibody. When the labeled antibody is incubated with rabies-suspect brain tissue, it will bind to rabies antigen. The unbound antibodies can be washed away and areas where the antigen is present can be visualized as fluorescent-apple-green areas using a fluorescence microscope. If rabies virus is absent there will be no staining.

2. **Reverse Transcription-Polymerase Chain Reaction (RT-PCR)**

   Alternatively, detection of rabies virus RNA using RT-PCR in brain tissue or cerebrospinal fluid can also confirm the diagnosis. Rabies RNA can be copied into a DNA molecule using reverse transcriptase (RT). The DNA copy of rabies can then be amplified using a polymerase chain reaction[49]. This technique can confirm dFA results and can detect rabies virus in saliva and skin biopsy samples. The use of RT-PCR and other molecular methods in antemortem human rabies diagnosis overcomes the low sensitivity of viral antigen detection methods. Rabies virus antibody is detected in only 20 percent of unvaccinated rabies patients tested within 1-26 days after the disease onset[50]. Antibody-positive serum samples can be obtained within 9 days after the disease onset. Antibodies appeared in CSF later or were not detected at all. Rabies virus antigen in neural innervations of hair follicles can be demonstrated by the fluorescence antibody technique on a frozen section of a skin biopsy from the nape[51].

Pre-exposure to Rabies

Pre-exposure prophylaxis (PrEP) for rabies according to the WHO serves as a preventative measure aimed at reducing the risk of contracting rabies before potential exposure to the virus[52]. This approach is typically advised for individuals who face an elevated risk of rabies exposure, either due to their occupation or travel to regions within the ASEAN region where rabies prevalence is notably high. This concern is particularly pronounced in countries with substantial stray dog populations and inadequate healthcare infrastructure.

Pre-exposure rabies vaccination entails a series of administered shots distributed over a specific duration to bolster immunity against the rabies virus. This proactive measure offers a degree of protection should an individual encounter the virus, potentially affording additional time to seek medical intervention before the onset of symptoms.

The recommendation for pre-exposure rabies vaccination can vary based on factors such as the individual's occupation (veterinarian, animal handler, laboratory worker) and travel plans to areas where rabies is endemic or common. Travelers who plan to engage in activities that might put them at risk of animal bites, like working with animals or spending significant time in rural areas might also be advised to receive a pre-exposure rabies vaccination.

It's important to note that even with pre-exposure vaccination, post-exposure treatment (such as receiving rabies immune globulin and additional doses of rabies vaccine) is still necessary if an individual is bitten by a potentially rabid animal. Pre-exposure vaccination helps extend the window during which post-exposure treatment can be administered

Table 4. Rabies PEP Modalities

Rabies PEP Modalities[1]		
Category of Exposure	**Description**	**PEP modalities**
Category I	Touching or feeding animals, animal licks on intact skin (no exposure)	Washing of exposed skin surfaces, no PEP
Category II (require PEP)	Nibbling of uncovered skin, minor scratches, or abrasions without bleeding (exposure)	Wound washing and immediate vaccination
Category III (require PEP)	Single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with saliva from animal licks, exposures due to direct contact with bats (severe exposure)	Wound washing, immediate vaccination, and administration of rabies immunoglobulin/monoclonal antibodies

ASEAN AND AMS STRATEGY FOR RABIES PREVENTION AND CONTROL

ASEAN Rabies Elimination Strategy (ARES)

ASEAN region has developed an ARES framework that could be followed by ASEAN Member States in Rabies elimination within their country[53]. The goals of the framework are to:

1. Increase dog vaccination coverage in the region through advocacy for mass dog vaccination and dog population management.
2. Develop a regional preparedness plan on rabies for humans and animals, focusing on capacity-building activities and human rabies vaccine advocacy and stockpiling.
3. Promote Integrated Bite Case Management.
4. Develop a regional platform for regular information sharing and monitoring and evaluation for rabies in ASEAN.

ARES based on STOP (Socio-Cultural, Technological, Organizational and One Health, and Policy and Legislative) Pillars as described below:

Table 5 STOP Pillars for ASEAN Rabies Elimination Strategy[54]

Socio-Cultural	Technological	Organizational and One Health	Policy and Legislative
• Communication on rabies and rabies control efforts • Responsible pet ownership • Behavior change towards control of rabies in both animal and human health • Support the celebration of World Rabies Day	• Vaccination • Surveillance and epidemiology • Laboratory diagnostic capability • Access to quality pharmaceuticals including vaccines and immunoglobulin • Dog population management • Monitoring and control of animal movements • Research	• Regional, National and Sub-National coordination • Inter-sectoral coordination • Public-private partnership	• High-level political support • Legislation and Enforcement • Resource mobilization

Government-Initiated or Private-Initiated Approaches to Rabies

This table describe the government and/or private initiative on rabies eradication in each ASEAN Member States.

Table 6 Matrix of rabies eradication program in each AMS

AMS	Government Initiated	Private Initiated	Project
Brunei Darussalam[32,55]	Yes. Ministry of Health, Ministry of Home Affairs and Ministry of Primary Resources and Tourism	-	Ban on Pet Import and Transit from Neighboring Countries
Cambodia[56]	No, National Government Programs are not yet implemented in Cambodia	Yes, Institute Pasteur since 1995 (Partnership with Cambodian Government)	Rabies Prevention Centers for subsidized Anti-rabies vaccines
Indonesia[57]	Yes. The Ministry of Health, Ministry of Agriculture, Ministry of Environmental and Forestry, Ministry of Internal Affairs, and Coordinating Ministry of Human Development and Culture joined forces for rabies prevention and control	-	Program DHARMA
Lao PDR[41]	Yes. Ministry of Agriculture and Forestry, Department of Communicable Disease Control, National Centre of Laboratory and Epidemiology	-	Annual World Rabies Day Vaccination Drive
Malaysia[58]	Yes. Ministry of Health Malaysia and Department of Veterinary Services Malaysia	-	Massive Program on Anti-Rabies Vaccination, Dog Licensing &

			Microchip Installation Program & Immune Enforcement Teams (IBET)
Myanmar[43]	Yes. Department of Public Health, Ministry of Health and Sports, and Ministry of Agriculture, Livestock, and Irrigation (In partnership with FOUR Paws)	-	Mass Dog Vaccination, Dog Bite Management and Awareness & Education
The Philippines[59]	Yes. Department of Health, Research Institute of Tropical Medicine, and Department of Agriculture	-	Oplan RED (Rabies Elimination Disease) Program
Singapore[45,60]	Yes. Ministry of Health Singapore and National Centre for Infectious Diseases	-	Trap-Neuter-Release-Manage (TNRM) program
Thailand[61,62]	Yes. Ministry of Public Health Thailand, The Bureau of Health and Strategy, Bureau of Epidemiology	-	Thailand Expanded Program on Immunization and Chiang Mai Model
Vietnam[46]	Yes. Ministry of Agriculture and Rural Development and Ministry of Health	-	ONE HEALTH World Rabies Day

Specific Prevention Program in Each AMS

Table 7 Information o specific prevention program in each AMS

ASEAN Member States	Surveillance	Prevention & Control
Brunei Darussalam[55]	• Rabies surveillance system put on top five priority zoonotic diseases • Routine information sharing across animal and human sectors	• Prevention effort focus on importation of rabies • Developed Joint Framework for Preparedness and Response to Zoonotic Diseases by MoH and Ministry of Primary Resources and Tourism
Cambodia[63]	• Increasing surveillance sensitivity	• Provide Post-exposure Prophylaxis (PEP) to over 500,000 patients wounded by animals • Raising awareness through education and community engagement • Expanding access to vaccination with new prevention centers
Indonesia[40]	• Increasing surveillance sensitivity	• Achieving adequate vaccination coverage • Raising public awareness • Decreasing incidence of rate • Managing stray dogs populations • Controlling animal trafic
Lao PDR[41]	• Rabies surveillance system put on top five priority zoonotic diseases	• Over 8,000 people treated with post-exposure prophylaxis. • Rabies-focused lessons for primary and secondary school children
Malaysia[64]	• Increasing surveillance sensitivity	• Successful mass vaccination of over 90% of the dog population • Early post-rabies management saved two lives • Control measures include mandatory notification, active surveillance, annual dog licensing, awareness programs, and movement control regulations.
Myanmar[43]	• Increasing surveillance sensitivity	• Plans include a rabies communication strategy, awareness week, school-age children's education, communication

		networks, and a monitoring and evaluation framework.
Philippines[44]	• Increasing surveillance sensitivity	• Animal Bite Treatment Centers (ABTCs) provide human anti-rabies vaccines and immunoglobulin for post-exposure prophylaxis • Components of the program mandated by RA 9482 (Anti-Rabies Act of 2007) include PEP and PrEP, health promotion, dog vaccination, dog population management, and responsible pet ownership
Singapore[45]	• Singapore has been free from rabies since 1953 • The Animal Quarantine Center (AQC) plays a crucial role in disease surveillance	• Preventive strategies include a contract with a rabies vaccine manufacturer for rapid vaccine supply, a rabies contingency plan, and a focus on the sustainable management of stray dogs. - Programs like Trap-Neuter-Release-Manage (TNRM) aim to reduce the stray dog population.
Thailand[65]	• Initiated a Chiang Mai model for rabies monitoring, emphasizing prevention, rabies vaccination, controlling free-roaming dogs, continuous monitoring, education, and new laws	• Over 90% of persons who died of rabies either did not receive or inappropriately discontinued post-exposure prophylaxis (PEP)
Vietnam[46]	• Rabies recognized as a high-priority zoonotic disease. • Support from international partners, such as OIE, WHO, FAO, and CDC, increased awareness, effective dog population management, and enhanced surveillance and diagnostics.	• Interventions include expanding post-exposure prophylaxis centers, introducing or revising legislation, and improving multisectoral One Health collaboration.

Policy Recommendations for Rabies Prevention and Control In ASEAN Region

In May 2023, ASEAN leaders issued a Declaration on the One Health Initiative to combat rabies, which has been declared in Indonesia. This initiative is currently in the planning stage for the prevention, control, eventual elimination, and eradication of vulnerabilities in the region. It is supported by the ASEAN Secretariat and is in line with the Sustainable Development Goals (SDGs). With a special emphasis on best practices, guiding investment, and research and development, its aim is to enhance the ability to optimize health by preventing, predicting, and detecting health threats through a management system of surveillance[66].

The following 10 health strategies proposed by the ASEAN, aims to push the plans for public health situations and address emergency emerging diseases in the region.

1. One Health Approach coordination
2. Capacity Building for joint surveillance and outbreak response
3. Sharing of data and best practices
4. Animal and human vaccine security and stockpiling
5. The Operationalization of Vaccination Drives
6. Risk Communication and Public Awareness
7. The Alleviation of Socio-economic issues related to increased zoonoses risks
8. The Harmonization of Relevant Policies and Legal Frameworks
9. Joint Strategic Planning
10. Performance Monitoring and Evaluation

With these given health approaches, the ASEAN Rabies Elimination Strategy (ARES), in partnership with the ASEAN senior officials on forestry have agreed to develop ASEAN strategy for preventing transmission of zoonotic diseases through policy recommendations. The following are policy recommendations to the ASEAN member countries to implement the following priority activities to expedite the achievement of the goals of ARES[53]:

1. Increase dog vaccination coverage in the region through advocacy for mass dog vaccination and dog population management.
2. Develop a regional preparedness plan on rabies for humans and animals, focusing on capacity-building activities and human rabies vaccine advocacy and stockpiling.
3. Promote Integrated Bite Case Management
4. Develop a regional platform for regular information sharing and monitoring and evaluation for rabies in ASEAN.

With these recommendations being planned to be implemented, the ASEAN aims at improving the present holistic approaches of different ASEAN health clusters for infectious diseases, re-emerging disease preparations for a pandemic, disease surveillance, and monitoring management with the hope to be achieved through the suggested policy recommendations in national,

regional, and global health security by 2030.

Importance of Health Approach

Rabies control and prevention in ASEAN region require a coordinated One Health approach, involving collaboration between human health, animal health, and environmental sectors. Rabies control and elimination in low-endemic rabies countries such as Malaysia and Singapore have been made possible by the strict enforcement of dog registration, vaccination, and population management measures. Malaysia shares a border with Thailand, and the notion of an immunological belt has been developed through dog licensing, required vaccination of dogs, and the systematic extermination of unvaccinated dogs in a buffer zone to prevent rabies from entering the country[31]. Perhaps other middle and high-endemic rabies countries could follow this rabies control strategy implemented by their ASEAN region. Public information and education are important to increase awareness and enhance community participation and support in rabies prevention programs. Dissemination of important information such as the high fatality rate of rabies, its epidemiology, its prevention and control, and the disease control program, in general, is vital for program implementation and responsible pet ownership. By recognizing rabies' influence on people's daily lives and the fact that dogs can be a source of human infection, community, and school-based rabies prevention initiatives will be easier to establish. The involvement of stakeholders is crucial, and by bringing together key stakeholders from the corporate and public sectors, health security and the need to form public–private partnerships, which are critical in rabies prevention programs, can be addressed[6]. National government agencies can maintain standardized approaches for rabies management and elimination and advocate on how to begin public–private cooperation to ensure long-term intervention. All stakeholders can benefit from such technical and administrative efforts as they provide credibility and quality assurance to the prevention program's effectiveness[53]. Various examples of public–private partnerships that aid in implementing public programs, research, and policy formation can be seen in Indonesia, India, Sri Lanka, the Philippines, Thailand, and Vietnam.

It is important to note that the rabies situation may vary among different countries in the ASEAN region. Some countries may have successfully reduced the burden of rabies through sustained efforts in prevention and control, while others may still face challenges in managing the disease. Efforts to control rabies in ASEAN region include widespread animal vaccination, responsible pet ownership, improved surveillance and reporting systems and increasing access to post-exposure prophylaxis (PEP) for people exposed to potentially rabid animals. Regional collaboration and sharing of best practices are essential to address the burden of rabies effectively in the ASEAN region.

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