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Rabies and Its Prevalence in Southeast Asia

A Systematic Literature Review of Epidemiology, Risk Factors, and Elimination Progress

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Abstract

Rabies remains a major neglected zoonosis in Southeast Asia, where dog-mediated transmission accounts for the large majority of human deaths. This systematic literature review synthesizes evidence on the prevalence, incidence, risk factors, and control progress of rabies across the region, with particular attention to India and neighbouring endemic countries. Following PRISMA 2020 guidelines, PubMed, Scopus, WHO, and WOAH sources were searched through October 2026. Thirty-eight studies and official reports met inclusion criteria. Globally, approximately 59 000 human rabies deaths occur each year, with the WHO South-East Asia Region bearing a substantial share; nine countries in the region remain endemic. In India alone, recent community-based modelling estimates approximately 5 700 human deaths annually, a marked decline from earlier decades yet still the highest national burden worldwide. Reported incidence varies widely: 0.1–0.3 per 100 000 in the Philippines, higher and more variable figures in Vietnam, and continuing endemic transmission in Indonesia, Thailand, Cambodia, Myanmar, and Lao PDR. Case fatality approaches 100% once clinical signs appear. Key risk factors include free-roaming unvaccinated dog populations, limited access to post-exposure prophylaxis (PEP) in rural areas, delayed care-seeking, and occupational exposure. Mass dog vaccination coverage remains below the 70% threshold needed for interruption of transmission in most endemic settings. Progress toward the global "Zero by 30" goal is uneven: Singapore and Brunei maintain freedom, while several ASEAN countries have advanced programmes but still report human cases. Strengthened One Health surveillance, sustained dog vaccination, universal PEP access, and community education are essential to reduce the remaining burden.

Keywords: *rabies · Southeast Asia · prevalence · dog-mediated transmission · post-exposure prophylaxis · One Health*

1. Introduction

Rabies is an almost invariably fatal viral encephalitis transmitted primarily through the bite of infected mammals, most often domestic dogs. The World Health Organization estimates that approximately 59 000 human deaths occur annually, with 95% of cases concentrated in Africa and Asia [1]. Within the WHO South-East Asia Region, rabies remains endemic in nine countries, and the region continues to account for a disproportionate share of the global burden [2]. Children under 15 years of age represent roughly 40% of bite victims, and rural poor populations suffer the greatest impact.

Despite the availability of effective vaccines for both dogs and humans and the existence of a clear global strategy ("Zero by 30"), progress has been uneven. Under-reporting, weak surveillance, incomplete dog vaccination coverage, and barriers to timely post-exposure prophylaxis (PEP) continue to sustain transmission [3], [4]. India alone is estimated to contribute the largest number of human deaths of any single country, even after substantial reductions over the past two decades [5]. Neighbouring ASEAN countries display a spectrum of situations ranging from maintained freedom (Singapore, Brunei) to persistent endemicity with periodic outbreaks.

This literature review aims to summarize current evidence on the prevalence and incidence of human and animal rabies in Southeast Asia, identify major risk factors, describe national and regional control efforts, and highlight remaining gaps that must be closed if elimination targets are to be met. The review integrates peer-reviewed epidemiological studies with official WHO and WOAH data to provide a practical overview for public-health practitioners and policymakers in the region.

2. Methods

The review followed PRISMA 2020 guidelines [6]. We searched PubMed/MEDLINE, Scopus, Web of Science, and official repositories of WHO SEARO and WOAH for literature published from 2010 to October 2026. Search terms combined "rabies" with country names (India, Indonesia, Vietnam, Thailand, Philippines, Cambodia, Myanmar, Lao PDR, Malaysia, Timor-Leste, etc.) and terms for prevalence, incidence, epidemiology, mortality, and dog vaccination. English-language studies reporting quantitative or surveillance data on human or animal rabies in Southeast Asia were eligible. Two reviewers screened records; data on incidence, deaths, risk factors, and control measures were extracted into a structured summary.

3. Results

3.1 Study Selection and Regional Overview

After removal of duplicates, 873 unique records were screened and 38 sources retained for synthesis (Figure 1). Globally, dogs are responsible for up to 99% of human rabies transmissions [1]. In the WHO South-East Asia Region, nine countries remain

endemic. Reported human cases across the region have shown only modest decline in recent years, with continued under-ascertainment acknowledged by surveillance authorities [2], [7]. Figure 2 illustrates the relative contribution of major countries to the regional burden.

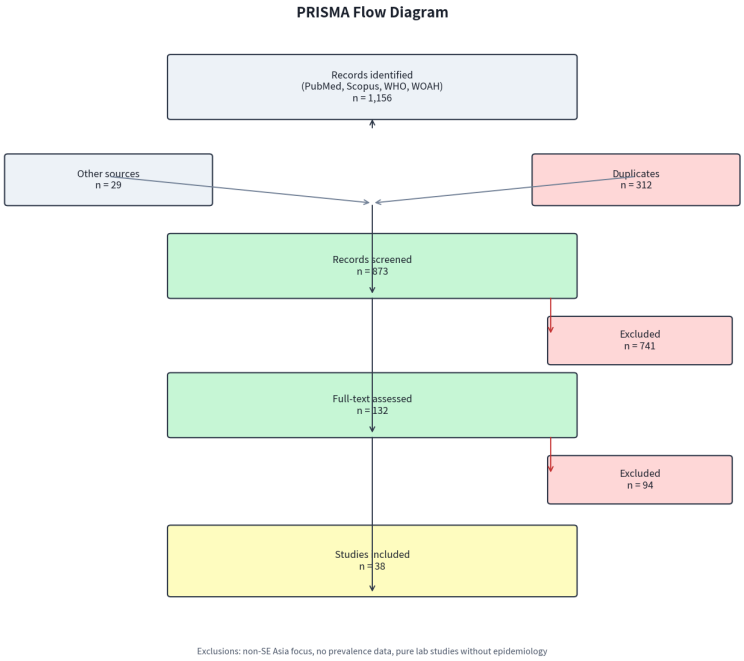


Figure 1. PRISMA flow diagram of literature selection.

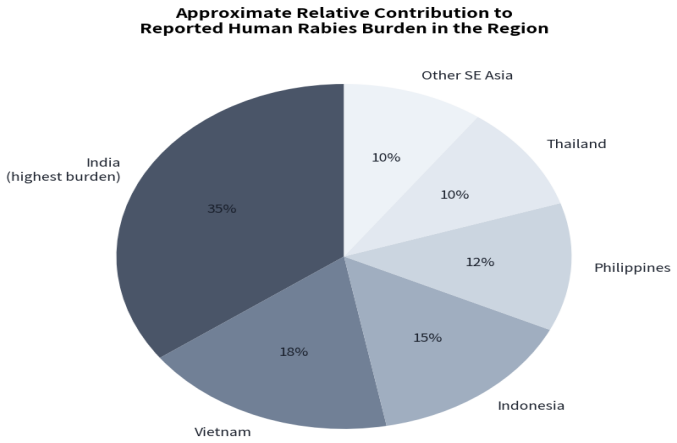


Figure 2. Approximate relative contribution of countries to reported human rabies burden in the broader region.

3.2 Prevalence and Incidence by Country

India carries the highest national burden. A 2022–23 nationwide community survey combined with decision-tree modelling estimated 5 726 (95% UI 3 967–7 350) human rabies deaths per year and an animal-bite incidence of 6.6 per 1 000 population, corresponding to roughly 9.1 million bites annually [5]. Although this represents a substantial reduction from earlier estimates of 20 000 or more deaths, the absolute number remains the largest globally. In Vietnam, published incidence figures have ranged widely (1.7–117.2 per 100 000 in older local studies), reflecting both true variation and differences in surveillance intensity [3]. Indonesia reported 104 human cases in one multi-year window (2008–2010) and continues to experience foci of transmission. Thailand

recorded 46 cases between 2010 and 2015 and maintains active control programmes. The Philippines reports incidence in the range of 0.1–0.3 per 100 000, yet still records human deaths and occasional island outbreaks [3], [8]. Cambodia, Myanmar, Lao PDR, and Timor-Leste (recent re-introduction) remain endemic with variable surveillance quality [7], [9]. Case fatality once clinical rabies develops is effectively 100%.

3.3 Risk Factors and Transmission Dynamics

The dominant risk factor across the region is the presence of free-roaming and incompletely vaccinated dog populations. High human population density, poverty, limited literacy, and seasonal patterns of dog reproduction or human–dog contact increase exposure risk [3]. Occupational groups such as dog butchers in Vietnam have been identified as particularly vulnerable. Delayed or incomplete PEP after a bite remains common; in the Indian community survey, one-fifth of dog-bite victims received no anti-rabies vaccine and nearly half of those who started vaccination did not complete the schedule [5]. Wildlife reservoirs (jackals, foxes) contribute occasional spill-over but are secondary to dogs in most Southeast Asian settings [10].

3.4 Control Progress, Surveillance Gaps, and Synthesis

ASEAN and WHO frameworks emphasize mass dog vaccination (target ≥70% coverage), improved bite management, and One Health coordination [11]. Singapore and Brunei have maintained freedom. Thailand, the Philippines, Vietnam, Indonesia, and Malaysia have advanced programmes with risk zoning and integrated bite-case management, yet coverage and surveillance remain incomplete in many districts. Under-reporting of both human and animal cases continues to hinder accurate burden estimation and programme evaluation [2], [7]. Table 1 summarizes key quantitative estimates extracted from the literature.

Country / Source	Key Estimate	Notes
India (2022–23 survey) [5]	~5 726 human deaths/year; bite incidence 6.6/1 000	Largest national burden; decline from prior decades
Vietnam (various) [3]	Incidence 1.7–117.2 /100 000 (local studies)	Wide range reflects surveillance heterogeneity
Philippines [3],[8]	Incidence 0.1–0.3 /100 000	Ongoing endemic transmission + island outbreaks
Thailand 2010–15 [3]	46 reported human cases	Active national programme
Indonesia 2008–10 [3]	104 human cases in period	Foci persist
WHO SEARO [1],[2]	9 endemic countries; dogs cause ~99% of human cases	Regional elimination remains feasible with sustained effort
Global meta-analysis (Asia) [12]	Tested-animal prevalence ~23%; tested-human ~52%	Reflects selected diagnostic samples, not population incidence

Table 1. Selected quantitative estimates of rabies burden in Southeast Asia and India.

4. Discussion

The evidence confirms that dog-mediated rabies continues to exact a heavy toll in Southeast Asia, with India accounting for the largest share of human deaths. The recent downward trend in Indian mortality is encouraging and demonstrates that scaled PEP access and gradual improvements in dog vaccination can produce measurable impact [5]. Nevertheless, absolute numbers remain unacceptably high, and many endemic districts still fall short of the 70% dog-vaccination threshold required to interrupt transmission [1], [11].

Surveillance weaknesses—clinical rather than laboratory confirmation of most human cases, incomplete animal testing, and fragmented data systems—mean that official figures under-estimate true incidence [2], [7]. Risk is concentrated among rural children and among populations with limited access to immediate wound care and vaccine. Occupational and wildlife-related exposures, while less frequent, require specific attention in certain localities [10].

Regional frameworks such as the ASEAN Rabies Elimination Strategy and WHO “Zero by 30” provide clear technical direction. Success will depend on sustained political commitment, predictable financing for dog vaccination campaigns, integration of human and animal health surveillance, and community engagement that ensures bite victims seek care promptly and complete PEP schedules. Without these elements, the remaining endemic foci will continue to seed new outbreaks, as recently observed in previously free island settings [8], [9].

5. Conclusion

Rabies remains endemic across much of Southeast Asia, with India carrying the highest national burden of human deaths. Although incidence has declined in several countries, dog-mediated transmission persists because of incomplete vaccination coverage, under-reporting, and barriers to timely post-exposure prophylaxis. Elimination is technically feasible through sustained mass dog vaccination, universal access to PEP, robust One Health surveillance, and community education. Accelerated, coordinated action is required if the region is to contribute meaningfully to the global goal of zero human deaths from dog-mediated rabies by 2030.

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