Strengthening Animal Rabies Outbreak Response through Community Engagement and One Health Approaches: Lessons from Local Contexts in Thailand

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Summary

Rabies remains a persistent zoonotic threat in Thailand, requiring early detection and coordinated response to prevent human mortality. Despite significant progress toward elimination, challenges persist in achieving rapid detection and notification at the local level, particularly in high-risk areas like the northeast region, which is characterized by large free-roaming dog populations and inconsistent access to health services. This study examines lessons learned from local community engagement and One Health approaches implemented to strengthen rabies response in Thailand's upper northeastern region, with a focus on participatory and community-based surveillance and risk communication. We conducted a descriptive analysis of program experiences, surveillance processes, and community-based activities to better understand how frontline actors like community members, livestock volunteer, village health volunteers, animal and public health staff contributed to more timely and coordinated responses. Stakeholders shifted from primarily technical surveillance and vaccination approaches toward participatory models that engaged communities in rabies detection and reporting. Community members were trained to recognize rabies signs and used simplified reporting systems integrated into local structures, while risk communication through leaders and community activities improved awareness and timely reporting. In parallel, One Health coordination and municipal involvement strengthened collaboration between animal and human health sectors, enabling faster and more effective outbreak response. Lessons from local contexts in Thailand's upper northeastern region highlight how community engagement and One Health approaches serve as central pillars in strengthening rabies response. At the same time, strengthened coordination across human and animal health sectors under a One Health framework enables more integrated and efficient response actions. Together, these approaches illustrate how locally grounded, participatory strategies can significantly improve rabies response systems and accelerate progress toward rabies elimination in Thailand.

Methods

This study employed a descriptive qualitative analysis to examine community-based rabies surveillance and response in the upper northeastern region of Thailand, a recognized hotspot for emerging zoonotic diseases. The study focused on high-risk areas characterized by large populations of free-roaming dogs, recurrent animal rabies outbreaks, and limited access to veterinary services. The study investigated how participatory, community-driven strategies strengthen the timeliness and coordination of local responses while identifying systemic operational bottlenecks at the district and sub-district levels. Data were collected between October 2024 and March 2026 from program records, surveillance reports, coordination meetings, and field observations, supplemented by informal consultations with key stakeholders. Interventions included community capacity building, participatory surveillance with simplified reporting, risk communication activities, and strengthened One Health coordination. Data were analyzed using a descriptive approach, focusing on timeliness of detection and response, community participation, effectiveness of risk communication, and multi-sectoral coordination. Qualitative data were thematically analyzed to identify key patterns and lessons for improving rabies response.

Results

A total of 47 animal rabies outbreaks were reported across eight provinces in the upper Northeastern region of Thailand from October 2024 to September 2025. Rabies cases were detected predominantly in dogs (n=35), followed by beef cattle (n=7), jackal (n=2), cats (n=2), and buffalo (n=1). The distribution of outbreaks was highest in Mahasarakham and Mukdahan (n = 10 each), followed by Loei (n = 7), Kalasin, Khon Kaen, and Roi Et (n = 6 each), and lower numbers in Udon Thani and Nongkhai (n = 1 each). Pet dogs and cats are the primary

interface driving rabies transmission dynamics in this region. Due to low vaccination coverage and unrestricted movement, free-roaming pets act as a critical bridge between wildlife reservoirs, livestock, and human populations. Livestock (cattle and buffalo) are mainly affected through spillover exposure following contact with infected animals, while wildlife (jackal) serves as a natural reservoir that can sustain and reintroduce infection into domestic animal populations. Across provinces, the timeliness of outbreak management varied by stage of the response cascade. Median detection time ranged from approximately 1 to 3 days, while notification was consistently rapid, occurring within one day in most provinces. In contrast, initial response time showed greater variability, ranging from approximately 2 to 5 days, with the longest delays observed in Loei (median 4.63 days, range 3–11 days).

Animal rabies outbreak management in the upper northeastern region of Thailand demonstrated a progressive shift toward more decentralized, community-supported systems, particularly under participatory surveillance and One Health coordination in a context where free-roaming dogs constitute the primary maintenance host and principal rabies transmission risk at the human–animal interface. Outbreak detection increasingly originated at the community level, marking a transition from passive facility-based surveillance to active, community-driven case identification in a setting where rabies-positive free-roaming dogs remain the predominant source of exposure risk. Community members, head villagers, livestock volunteers, and village health volunteers played a central role in detecting suspected rabies cases through observation of abnormal animal behavior, unexplained animal deaths, and exposure incidents involving suspected rabid animals. The integration of simplified reporting mechanisms within local community structures facilitated earlier recognition and initiation of alert signals. Within the notification component, animal health authorities improved intersectoral information flow by sharing confirmed laboratory results from active and passive surveillance via the established One Health network at the provincial, district, and sub-district levels. In general, information was quickly distributed from community focal points to district livestock offices and relevant authorities via volunteer networks and local communication channels. This mechanism increased cross-sector situational awareness and allowed for more timely coordination of public health and veterinary response actions. In high-engagement areas, suspected cases were frequently reported shortly after observation, allowing investigation teams to be activated earlier. However, variability in notification timeliness persisted across settings, particularly in areas with poor communication networks and low community participation. Outbreak response was strengthened through improved multi-sectoral coordination under a One Health approach. Joint field investigations were conducted by animal health officers, public health personnel, and local administrative authorities, often supported by community volunteers who facilitated case location and contextual information (Figure 1). Response measures encompassed rapid risk assessment, epidemiological investigation, sample collection and laboratory confirmation, targeted vaccination of at-risk dog populations, movement restrictions where necessary, risk communication, community engagement, and coordinated intersectoral collaboration across relevant agencies. Digital communication approaches also contributed to earlier recognition of suspected rabies events by improving community awareness of clinical signs, exposure risks, and reporting channels, thereby increasing the likelihood of prompt identification and initial reporting at the community level (Figure 2). Compared to previous approaches, response actions were more integrated and timely, particularly in areas with established coordination mechanisms. Despite these improvements, operational bottlenecks were consistently identified across all stages. These included limited veterinary workforce capacity, logistical constraints affecting field deployment, delays in communication between sectors, and variability in community engagement. These constraints contributed to uneven performance in outbreak detection and response across locations.

Discussion

This study demonstrated a marked transition in animal rabies outbreak management in the upper Northeastern region of Thailand toward a more decentralized, community-engaged surveillance and response system. This transformation occured in a high-risk epidemiological context where free-roaming dogs remain the dominant maintenance host and principal interface for rabies transmission between wildlife, livestock, and humans. The findings highlighted how strengthening community engagement and operationalizing One Health collaboration can improve early detection and response capacity at the local level.

The findings underscore that free-roaming dogs and cats function as the primary drivers of rabies transmission in the upper northeastern region, functioning as the critical epidemiological link across species and settings. Consistent with national surveillance patterns, dogs accounted for the vast majority of confirmed animal rabies cases, particularly among unvaccinated or semi-owned populations with unrestricted movement. The continued occurrence of spillover infections in cattle, buffalo, and cats indicated persistent gaps in achieving effective mass dog vaccination coverage and sustaining herd immunity at the recommended threshold. Moreover, the detection of rabies in wildlife reservoirs, such as jackals, reflected the presence of a complex transmission ecology that sustained rabies circulation at the wildlife–livestock–domestic animal interface. This study suggests that forest habitats and proximity to wildlife areas serve as critical risk factors for rabies remaining endemic in certain districts. Current control strategies have historically faced limitations due to a lack of environmental sector involvement and a primary focus on human health outcomes. Addressing this interface requires a more robust One Health surveillance system that actively integrates data from wildlife, livestock, and companion animal sectors to anticipate and prevent cross-species transmission events. Despite advancements in detection and

notification, there is significant variation in outbreak response timeliness across different provinces in the northeastern region. While high-risk areas like Loei, highlight inconsistencies in local operational capacity. Furthermore, the lack of a real-time centralized data platform prevents synchronized actions between animal and human health sectors, often leading to siloed responses. Strengthening the speed and uniformity of field-level interventions is essential for achieving the national goal of zero human deaths by 2030. Consistent capacity building for frontline responders, such as livestock and public health volunteers, is vital to ensure that rapid response mechanisms are functional across all administrative levels.

The results highlight a definitive transition from passive, facility-based surveillance to proactive, community-driven models for early detection. Successful local initiatives, such as the Chiang Mai and Thungsong Models in other regions, demonstrate that empowering Local Administrative Organizations (LAOs) and community leaders to conduct independent disease surveillance creates a "bottom-up" approach that is essential in areas where free-roaming dogs remain the primary transmission risk. The application of the One Health framework has significantly strengthened notification mechanisms and information flow between the animal health, public health, and local administrative sectors. This integration is formalized through Memorandums of Understanding (MOUs) among multiple ministries, which facilitate the sharing of epidemiological data and laboratory results. Platforms such as Thai Rabies Net and the Rabies One Data system serve as digital conduits for information flow, allowing agencies to immediately notify relevant stakeholders of positive cases. This streamlined notification process enables faster activation of joint investigations and improves overall situational awareness at the district level.

While the speed of detection and notification has improved, the effectiveness of the initial response continues to be hindered by persistent operational bottlenecks. The study identifies significant variation in response timeliness across different provinces, often caused by limited veterinary workforce capacity, logistical constraints, and frequent staff turnover within local administrative units. These systemic challenges are exacerbated by the lack of a real-time centralized data platform, which can lead to fragmented or siloed response actions between sectors. To ensure a consistent and rapid response, it is critical to strengthen the capacity of Surveillance and Rapid Response Teams (SRRTs) and promote joint outbreak investigations under a One Health approach. Standardizing these response mechanisms is essential for Thailand to reach its goal of zero human deaths from rabies by 2030

However, despite these advances in community engagement and One Health coordination, several operational constraints continued to limit optimal performance of rabies outbreak response systems. These included limited veterinary workforce capacity, logistical challenges in field deployment, and high turnover among frontline personnel in local administrative units. In addition, uneven levels of community participation across districts affected the sensitivity and consistency of surveillance outputs. Strengthening Surveillance and Rapid Response Teams (SRRTs), standardizing joint investigation procedures, and investing in sustained capacity building at the community level were therefore essential to ensure consistent and effective implementation of rabies control measures.

Conclusion

This study highlights that strengthening animal rabies outbreak response in the upper Northeastern region of Thailand is increasingly achieved through the integration of community engagement and coordinated multi-sectoral collaboration consistent with One Health approaches. In a context where free-roaming dogs remain the primary rabies reservoir, community-based surveillance has become a critical entry point for earlier detection, more rapid notification, and improved linkage to response systems. The study provides key lessons from local contexts in Thailand, emphasizing that durable improvements in rabies control require not only technical interventions but also institutionalized community participation and resilient intersectoral coordination mechanisms.



Figure 1. Integrated community engagement across animal, public health, municipal, and community sectors within a One Health framework to strengthen rabies prevention and control

Keywords: animal rabies, outbreak, response, one health, Thailand.

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