

Review Article

Region and Rabies: A Review of Geographical Variations, Challenges and Strategies for Control

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Abstract

Rabies, one of the oldest known zoonotic diseases, continues to claim thousands of lives every year—despite being entirely preventable. It disproportionately affects populations in Asia and Africa, particularly in low-resource rural regions where dog-mediated transmission remains endemic. This review explores the interplay between regional contexts and rabies epidemiology, highlighting disparities in disease burden, surveillance capacity, vaccine access, health infrastructure, and cultural beliefs. It also outlines successful regional interventions, emphasizing the need for geographically tailored strategies. With the global “Zero by 30” goal in sight, addressing these regional dynamics is key to achieving equitable and sustainable rabies elimination.

Keywords: PEP, Rabies, Region, Surveillance

INTRODUCTION

Rabies is an acute, progressive encephalitis caused by viruses of the *Lyssavirus* genus, most notably the rabies virus (*Rabies lyssavirus*). It is primarily transmitted through the saliva of infected animals—usually domestic dogs—and almost always fatal once clinical symptoms appear. Despite its 100% preventability through prompt and adequate post-exposure prophylaxis (PEP), rabies continues to cause an estimated 59,000 deaths annually, most of which occur in Asia and Africa.^{1,2}

The global burden of rabies, however, is not evenly distributed. High-income countries have nearly eliminated dog-mediated rabies, while low- and middle-income regions continue to bear the brunt of the disease. Regional differences in health

infrastructure, public awareness, veterinary services, wildlife ecology, and socioeconomic conditions shape how rabies is transmitted, perceived, and controlled. This review delves into these regional variations to offer a nuanced understanding of the current challenges and the strategic priorities necessary for rabies control and elimination.

Rabies in Different Regions of the World

1. Africa: A Persistent Challenge

Africa accounts for approximately 36% of global human rabies deaths, with children disproportionately affected.³ Most cases are due to bites from unvaccinated dogs in rural areas. In many African

countries, such as the Democratic Republic of Congo, Tanzania, and Nigeria, rabies surveillance systems are weak or absent. Deaths often go unrecorded due to inadequate diagnostic capabilities, misclassification of encephalitis causes, and limited autopsy practices.⁴

Cultural perceptions also play a critical role. In several sub-Saharan communities, dog bites are often seen as “normal” or attributed to supernatural causes, delaying critical medical intervention.⁵ Vaccines, when available, are often costly or located far from communities, and rabies immunoglobulin (RIG) is rarely accessible.

Veterinary infrastructure is similarly lacking. In many regions, stray dog populations roam freely, and mass dog vaccination campaigns are logistically and financially challenging. Yet, pilot projects in countries like Tanzania and Chad have shown that with community involvement, even resource-limited settings can implement effective dog vaccination programs.⁶

2. Asia: The Global Epicenter of Rabies

Asia carries the highest rabies burden globally. India alone accounts for about 35% of all human deaths from rabies, followed by China, the Philippines, and Vietnam.⁷ The common denominators across much of Asia include large populations of stray and free-roaming dogs, dense urban settlements, and inequitable healthcare access.

In India, dog bites are prevalent, with approximately 17 million dog bites reported annually.⁸ While the country has launched a National Rabies Control Programme (NRCP), implementation remains fragmented, varying across states and municipalities. Rural areas often lack PEP availability, and patients must travel long distances or pay out-of-pocket, leading to treatment delays.

Some Asian countries, however, have made significant strides. For instance, the Philippines has rolled out animal bite treatment centers across all regions and promotes intradermal vaccination to lower costs. Sri Lanka’s coordinated mass dog vaccination

campaigns, combined with public awareness programs, have led to a remarkable reduction in human rabies deaths.⁹

3. Latin America and the Caribbean: A Public Health Success Story

Once a major hotspot, Latin America has made substantial progress in controlling rabies. Coordinated efforts through the Pan American Health Organization (PAHO) led to widespread dog vaccination, education campaigns, and surveillance improvements. Between 1980 and 2020, human rabies cases in Latin America declined by more than 95%.¹⁰

Brazil and Mexico have been regional leaders in implementing canine rabies vaccination campaigns that reach both urban and rural populations. Surveillance systems have also matured, with regional data sharing and laboratory capacity building contributing to a strong early-warning system.

Challenges remain, particularly in remote and indigenous populations, and occasional cases still occur due to bat-transmitted rabies, but overall, the region stands as a model of how sustained, government-backed intervention can bring rabies under control.

4. Europe and North America: Elimination and Surveillance

Europe and North America have largely eliminated dog-mediated rabies. Here, the focus is on rabies in wildlife species such as bats, raccoons, foxes, and skunks. The U.S. and Canada routinely report isolated cases of rabies in wild animals, with bats being the most common source of human rabies.¹¹

These regions employ advanced tools such as oral rabies vaccination (ORV) programs targeting wildlife reservoirs, robust animal control laws, and strong diagnostic surveillance networks. While human deaths are rare, travel-related exposure and illegal animal imports continue to pose a risk.¹²

Factors Driving Regional Disparities in Rabies Control

1. Health System Inequities

The accessibility and affordability of PEP vary widely. In high-income countries, PEP is readily available and administered promptly. In contrast, in resource-poor regions, PEP may be too expensive, unavailable locally, or hindered by supply chain issue.¹³ Even when vaccines are available, RIG is often not—particularly in Africa, where WHO estimates that less than 1% of exposed individuals receive RIG.¹⁴

2. Surveillance Gaps

Many countries lack real-time rabies reporting systems. The absence of laboratory confirmation, inadequate diagnostic infrastructure, and absence of data-sharing between health and veterinary sectors contribute to underreporting.¹⁵ In parts of Asia and Africa, actual rabies deaths may be 100 times higher than reported figures.

3. Sociocultural Beliefs and Practices

In some regions, spiritual beliefs and stigma around rabies affect health-seeking behavior. Some people may consult traditional healers or rely on herbal remedies rather than seeking PEP. Misconceptions, such as believing a wound must bleed to be dangerous, delay treatment.¹⁶

4. Animal Control Policies

Regions that have implemented strict animal registration, vaccination mandates, and control of stray dog populations—such as in parts of Southeast Asia and Latin America—have succeeded in reducing transmission. In contrast, regions lacking these policies struggle with large unvaccinated canine populations and poor animal birth control strategies.¹⁷

Strategies for Regional Elimination of Rabies

1. Mass Dog Vaccination

The WHO recommends vaccinating at least 70% of dogs in a population to interrupt rabies transmission. Successful case studies from Latin America, Tanzania, and Sri Lanka demonstrate that even resource-poor regions can achieve this through community engagement and mobile vaccination units.¹⁸

2. Expanded Access to PEP

Intradermal vaccine regimens require smaller doses and are thus cost-effective. Decentralizing vaccine delivery, establishing bite treatment centers, and training frontline health workers can greatly improve outcomes. WHO's efforts to support prequalification of cost-effective vaccines can bridge gaps in low-income countries.¹⁹

3. Public Education and Community Engagement

Culturally sensitive public education campaigns are essential. Programs that include school curricula, religious leaders, and radio outreach have proven to change behavior and improve early reporting of bites.²⁰

4. Integrated One Health Surveillance

A "One Health" approach, integrating human, animal, and environmental health sectors, is key to effective rabies control. Countries that have implemented joint outbreak investigations, animal bite registries, and mobile surveillance apps have improved both detection and response.²¹

CONCLUSION

Rabies is a preventable yet tragically neglected disease that continues to claim lives—especially among the poor, rural, and marginalized. The burden of rabies is not just medical but also reflects deep-rooted regional disparities in access to healthcare, veterinary services, public health infrastructure, and education.

The world has the tools and knowledge to eliminate dog-mediated rabies, but success will require not a

one-size-fits-all approach, but one that is responsive to regional contexts. Strong political will, intersectoral coordination, community involvement, and sustained investment are essential. By focusing on regional disparities and building upon localized successes, we can move closer to the shared vision of “Zero by 30.”

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