

ONE HEALTH APPROACHES TO RABIES

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Abstract

Rabies remains one of the world's most fatal yet entirely preventable viral zoonosis, claiming over 55,000 human lives annually, primarily across resource-limited regions in Asia and Africa. Traditional, isolated interventions often fail because they treat human exposures and animal outbreaks as separate crises. This article explores the transformative power of the One Health framework, which unifies human medicine, veterinary sciences, and environmental management. By shifting from reactive post-exposure treatment to proactive canine mass vaccination campaigns aiming for a critical 70% threshold, integrated surveillance, and wildlife ecological management, communities can successfully disrupt transmission pathways. Examining successful paradigms from Latin America, Bangladesh, and Nepal's progressive strategic roadmap, this paper outlines actionable blueprints to bridge inter-sectorial funding disconnects, harness digital field diagnostics, and achieve the global mandate of zero dog-mediated human rabies deaths by 2030.

Keywords: Dogs, Rabies and Humans.

The Silent Threat

Imagine a disease with a near 100% fatality rate upon the onset of clinical symptoms, yet a disease that is 100% preventable. This is the harrowing paradox of rabies, an acute viral infection caused by neurotropic RNA viruses belonging to the Lyssavirus genus. Globally, rabies triggers a relentless state of terror, executing a quiet slaughter of more than 55,000 individuals every single year averaging over 100 preventable deaths every single day. The vast majority of these casualties are children living in marginalized rural communities across Asia and Africa.

Unlike sensationalized outbreaks such as Ebola or SARS, which provoke immediate international hysteria due to human-to-human transmission, rabies is a slow, structural crisis. It thrives explicitly as a disease of poverty. It nests within remote villages and chaotic urban slums where public sanitation is poor, free-roaming dog populations swell, and life-saving human post-exposure prophylaxis (PEP) remains financially

toxic or logistically out of reach. Because the communities pulling the weight of this disease are politically invisible, national policymakers frequently trap rabies in a cyclical loop of systemic neglect, underestimating its true public health burden due to fragmented reporting pipelines.

The Structural Frictions

Historically, nations have approached rabies through separate lenses. The human health sector treats the symptoms and scrambles to provide expensive PEP vaccine regimens to bite victims, costing global economies billions annually. Conversely, veterinary departments focus heavily on economically valuable livestock diseases (like foot-and-mouth disease or peste-des-petits ruminants), paying little heed to free-roaming domestic dogs which possess no commercial market value. This imbalance creates a profound operational disconnect: the human health sector reaps the massive economic and

public welfare benefits of animal control, yet the veterinary sector is forced to bear the heavy field costs of canine mass immunization without immediate structural incentives.

The One Health Blueprint

The One Health framework rejects this institutional fragmentation. It recognizes that human health is inextricably tied to the health of domestic animals, wildlife ecosystems, and our shared environments. Instead of constantly

reacting with expensive human treatments after an animal bite occurs, One Health shifts focus upstream to eliminate the virus directly at its animal reservoir. Empirical data proves that achieving a consistent 70% mass dog vaccination coverage threshold is sufficient to break transmission dynamics completely across all mammalian hosts, clearing the virus from domestic dog herds and safeguarding adjacent human populations.

Table 1: The One Health Inter-Sectorial Rabies Management Architecture

Sector Source	Core Interventions & Field Activities	Unified Outcomes & Strategic Impacts
HUMAN HEALTH	Pre- & Post-Exposure Prophylaxis (PEP), localized bite clinic data, intradermal dosing rollout.	Drastic reduction in human mortality reduced economic stress from clinical treatment costs.
ANIMAL HEALTH	Strategic mass dog vaccination (70%+ coverage), animal birth control (spaying/castration), pet tracking registrations.	Disruption of reservoir viral transmission, healthy stable companion animal matrices.
ENVIRONMENTAL & WILDLIFE	Socio-environmental sanitation, garbage/rubbish control, wildlife oral rabies vaccine (ORV) baits.	Mitigation of stray dog scavenging, suppression of cross-species spillover at wildlife interfaces.

Integrated Surveillance, Digital Bridges and Field Diagnostics

A successful campaign hinges on information velocity. Traditional models suffer from severe delay: an animal bite occurs, the victim seeks care at a local hospital, but animal health teams in the same district remain completely oblivious. One Health actively bridges this gap through Integrated Bite Case Management (IBCM). When medical staff-identify a high-risk bite patient, real-time alert data streams directly to local veterinary officers via mobile networks. Veterinary teams can immediately quarantine the suspect animal or apply a 10-day observation protocol.

Simultaneously, the introduction of non-invasive, field-ready tools such as lateral flow immune-chromatographic assays and tissue needle biopsies empowers frontline staff to diagnose cases rapidly without waiting weeks for central laboratory results. If an animal tests negative, clinicians can safely withhold precious, costly PEP lines, optimizing national healthcare stocks and directing them explicitly where clinical danger is real.

The Ecology of contamination

The environment acts as a structural facilitator for rabies transmission. In expanding urban zones, poor solid waste management creates expansive open-air garbage dumps. This unmanaged rubbish provides an abundant, high-calorie food source for free-roaming and community street dogs, driving rapid increases in animal densities and localized territorial friction. By incorporating environmental management such as modern waste infrastructure and closed municipal bins in cities can naturally stabilize the stray dog carrying capacity.

Furthermore, a critical risk factor is the wildlife-domestic interface. In regions where agricultural communities border forest reserves, the virus moves along a dual tract: the non-sylvatic cycle (domestic dogs) and the sylvatic cycle (jackals, foxes, bats). When domestic animals cross paths with wildlife, localized spillover events can spark unexpected outbreaks. One Health addresses this by scattering Oral Rabies Vaccine (ORV) baits along environmental buffer zones, mimicking successful preservation

strategies implemented across North America and Europe to curb wildlife viral maintenance.

Table 2: Pathological Transmission Risks vs. One Health Defenses

Risk Component	Pathological Vector / Accelerant (+)	One Health Mitigating Intervention (-)
Domestic & Stray Matrix	High street dog density, unmitigated open-air rubbish heaps, roaming interactions.	Mass dog immunization campaigns (70% minimum target), spaying & humane birth control lines.
Wildlife Interface	Sylvatic reservoirs (jackals, bats, foxes), cross-species spillover near border farms.	Oral Rabies Vaccine (ORV) bait drops across buffer zones, community awareness alerts.
Human Exposure Vector	Unreported animal bites, lack of rural PEP access, delayed clinical responses.	Integrated Bite Case Management (IBCM), intradermal PEP expansion, smartphone reporting channels.

Global Victories and Regional Transformation: From Paper to Field

The power of unified inter-sectoral coordination is not theoretical; it is highly proven. In Latin America, coordinated regional efforts spearheaded by the Pan American Health Organization (PAHO) successfully integrated ministries of health and agriculture, driving down canine rabies to near extinction. Similarly, Bangladesh demonstrated exceptional results by rolling out a One Health roadmap, slashing human rabies fatalities by over 85% within a short multi-year span. Sri Lanka and Bhutan have achieved comparable successes by pairing centralized mass dog vaccination with intense local public awareness programs.

In Nepal, a highly endemic low- and middle-income country (LMIC), the historical approach was heavily fragmented, with NGOs and resources clustered inside the capital while rural plain districts bore 94% of the true rabies burden. Recognizing this mismatch, the Government of Nepal enacted its progressive One Health Strategy 2020. Guided by Stepwise Approach for Rabies Elimination (SARE) assessments, the nation is actively establishing cross-departmental tasks

forces, moving human PEP lines to regional centers via cost-effective intradermal regimens, and scheduling nationwide canine vaccination programs to firmly hit the 'Zero by 30' global eradication target.

Conclusion: The Final Stand for Global Eradication

Humanity has eradicated only two major diseases in history: smallpox in human medicine and Rinderpest in animal medicine. Both were managed within separate, vertical tracks. Rabies stands as the ultimate test case for our collective capacity to eliminate a lethal threat that straddles both domains simultaneously. The data is indisputable, the scientific toolkits are fully mature, and the economic benefits are deeply clear.

What remains is an urgent need for political will, flexible inter-ministerial budgeting, and strong grassroots community ownership. By breaking down ancient institutional silos and adopting the One Health model fully, we can finally pull rabies out of the shadows of neglect and secure a safe, rabies-free world for future generations.

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