

Indian Rabies elimination strategies and mission zero by 2030

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Abstract

Rabies remains a major public health challenge in India despite being preventable through timely and appropriate medical intervention. Progress toward the global “Zero by 30” goal of eliminating human deaths from dog-mediated rabies is hindered by incomplete post-exposure prophylaxis, shortages of rabies vaccines and immunoglobulins, and inadequate vaccination coverage among free-roaming dogs. Experiences from Assam highlight the consequences of delayed wound management, incomplete animal surveillance and gaps in community awareness, whereas initiatives in Goa and Sikkim demonstrate the potential of sustained canine vaccination, sterilization, digital monitoring and coordinated One Health approaches. Key strategies for accelerating elimination include maintaining high dog vaccination coverage, exploring oral rabies vaccines, expanding dose-sparing intradermal vaccination, improving access to monoclonal antibodies, and integrating human, veterinary and municipal surveillance systems. Targeted pre-exposure prophylaxis for children in high-risk areas, combined with public education on immediate wound washing and responsible animal care, may further strengthen prevention. Achieving rabies elimination by 2030 will require sustained policy implementation, reliable healthcare supplies, community participation and coordinated action across human, animal and environmental health sectors.

Keywords: Rabies; Rabies elimination; Zero by 30; One Health; Dog-mediated rabies; Post-exposure prophylaxis; Canine vaccination; Rabies immunoglobulin; Digital surveillance; Public health

Rabies presents one of the most tragic paradoxes in modern medicine, it is 100% fatal once clinical symptoms appear, yet rabies is 100% preventable with timely medical intervention (Debnath *et al.*, 2025). Globally, rabies causes approximately 59,000 to 60,000 human deaths each year, with India historically accounting for nearly one-third of the global

burden fatalities. To end this public health crisis, India launched the National Action Plan for Dog-Mediated Rabies Elimination (NAPRE) in 2021, aligning with the World Health Organization’s (WHO) global goal of “Zero by 30” eliminating human deaths from dog-mediated rabies by 2030 (Mani, 2025). Achieving this ambitious goal requires



overcoming steep operational hurdles, scaling proven success models, and uniting human, animal, and environmental health sectors under a unified “One Health framework”

The Scale of the Challenge

India is home to an estimated 62 million free-roaming and street dogs, creating a human-to-dog ratio of roughly 23:1 (Brill *et al.*, 2024). Official data from the Integrated Disease Surveillance Programme (IDSP) portal recorded over 3.7 million reported animal bite cases in 2024 alone, while broader community surveys estimate up to 17.4 million annual animal bites across the country (WHO, 2025). Despite the widespread availability of modern cell-culture vaccines and rabies immunoglobulins (RIG), human deaths persist due to several structural barriers:

Incomplete Prophylaxis: A nationwide survey revealed that while 71% of bite victims received at least three vaccine doses, only 43% completed the full Post-Exposure Prophylaxis (PEP) schedule (Krishna *et al.*, 2025).

Healthcare Supply Gaps: Approximately 30% of public health facilities experience rabies vaccine stockouts, and nearly 20% lack rabies immunoglobulins.

Low Canine Vaccination Coverage: Interrupting rabies transmission in dog populations requires sustaining at least 70% mass dog vaccination coverage. Currently, canine vaccination in most Indian states remains far below this threshold.

2. Lessons from the Field: Cautionary Gaps and Proven Blueprints

The Cost of Mismanagement (Assam Case Study)

A 2023 case study from Lakhimpur, Assam, underscores how subtle gaps in awareness and post-bite management can prove fatal. A 59-year-old man was bitten by an unimmunized, adopted pup. Instead of receiving immediate wound washing with soap and water—a crucial step to clear the virus—the patient underwent **wound suturing and bandaging at a private clinic, which is strictly contraindicated for dog bites**. Although PEP

doses were administered, the sutured wound and delayed animal surveillance led to a fatal outcome. Furthermore, the dead pup was buried without laboratory confirmation, leaving the local veterinary and rapid response teams unable to trace further exposures.

The Blueprint for Success (Goa and Sikkim) Conversely, state-led initiatives in Goa and Sikkim provide compelling evidence that rabies elimination is achievable in India:

Goa achieved rabies-controlled status through an integrated One Health model featuring sustained mass dog vaccination (exceeding 70% coverage), continuous digital surveillance, rapid response teams, and extensive school and community education. Sikkim implemented a decade-long Catch-Neuter-Vaccinate-Release (CNVR) program alongside community-based sterilization and vaccination drives, drastically reducing animal bite incidents and human cases.

3. Strategic Pathways to Zero by 2030

To turn national vision into field reality, public health experts and policymakers emphasize four primary operational pathways:

1. Sustained Canine Vaccination & Oral Rabies Vaccines (ORV): Controlling the virus at its animal source is essential. In addition to traditional parenteral injections during Catch-Neuter-Vaccinate-Release (CNVR) drives under the Animal Birth Control (ABC) Rules 2023, experts advocate adopting Oral Rabies Vaccines (ORV) an edible vaccine bait that allows healthcare workers to vaccinate free-roaming, hard-to-catch street dogs efficiently.

Universal Intradermal PEP & Monoclonal Antibodies

WHO-recommended dose-sparing intradermal (ID) vaccination regimens significantly reduce vaccine costs and volume while maintaining high efficacy. Furthermore, India's development and rollout of novel rabies monoclonal antibodies (such as TwinRab™) offer a scalable, affordable alternative to blood-derived immunoglobulins, overcoming chronic supply chain shortages.

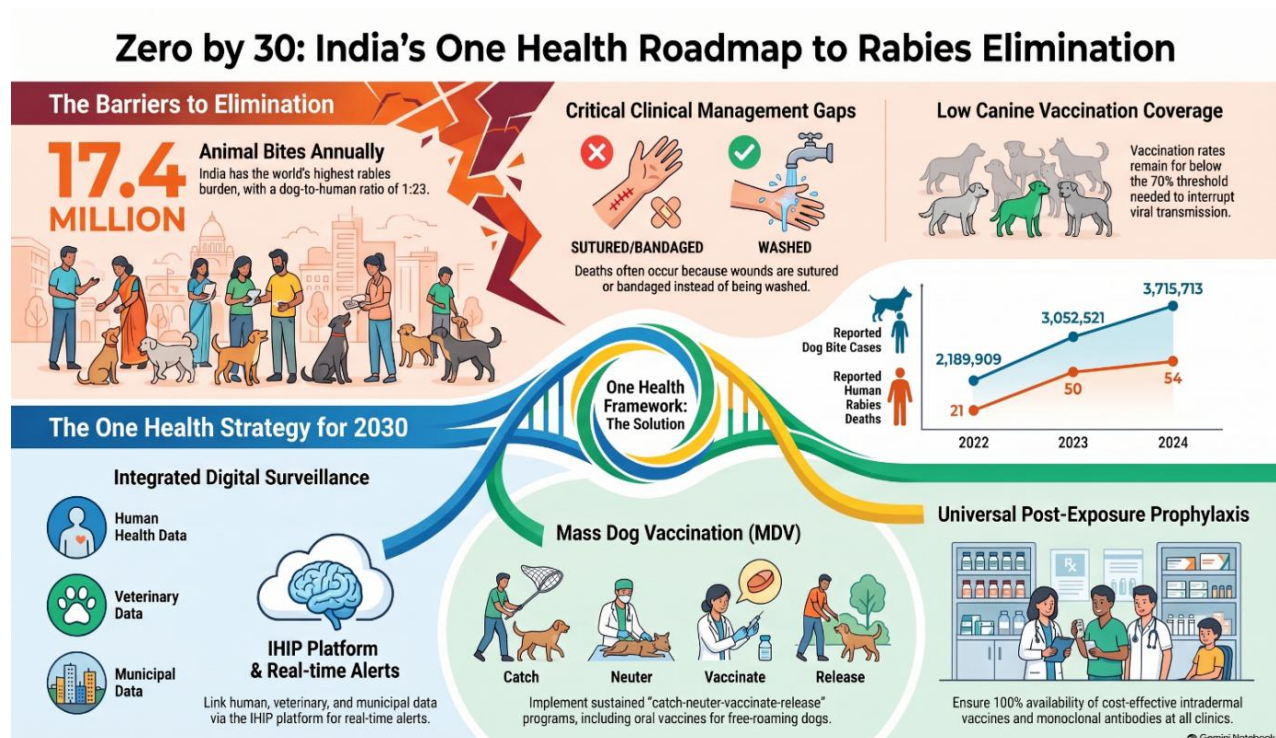
Integrated One Health Surveillance & Digital Tracking

Eliminating data silos between medical, veterinary, and municipal authorities is critical. Upgrading platforms like the Integrated Health Information Portal (IHIP) into a unified GIS-enabled system will allow real-time reporting of animal bites, automated outbreak alerts, and targeted hotspot mapping. Additionally, the expansion of over 279 Model Anti-Rabies Clinics and the Rabies-Free Cities

community protection can be drastically elevated.

Conclusion

India's journey toward eliminating rabies by 2030 is supported by proven scientific tools, robust vaccine manufacturing capacity, and an established policy framework. The primary requirement now is converting policy commitment into enforced, multi-sectoral action on the ground.



initiative across major urban centres strengthens local response infrastructure.

4. Targeted Child Pre-Exposure Prophylaxis (PrEP) & Awareness:

Children suffer a disproportionately high rate of severe Category III bites. Recent economic modelling demonstrates that implementing routine childhood intradermal Pre-Exposure Prophylaxis (PrEP) in high-incidence endemic districts could reduce human rabies mortality by up to 89.9% while decreasing the need for post-bite immunoglobulins. Paired with public education campaigns emphasizing immediate wound washing and responsible pet ownership,

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