



GOVERNMENT OF KERALA

Abstract

Health & Family Welfare Department - Kerala State Action Plan for Prevention and Control of Snakebite Envenoming - Approved - Orders issued.

HEALTH AND FAMILY WELFARE (M)DEPARTMENT

G.O.(Rt)No.2291/2026/H&FWD Dated,Thiruvananthapuram, 14-07-2026

- Read 1 Minutes of the Meeting held by the Chief Secretary on 01-09-2025 regarding formulation of Guidelines on School Safety and Security including prevention and management of snakebite
- 2 Directions of the Hon'ble High Court in the Judgment dated 26.09.2025 in W.P(C) No.32493/2019 filed by Sri Kulathur Jaisingh and W.P (C)No.34037/2019 (Suo motu).
- 3 Circular No.M3/347/2019-Health dated 09.11.2025

ORDER

Snakebite envenoming is a critical, time-sensitive medical emergency that has long remained a neglected public health challenge. In Kerala, our unique ecological landscape, bordered by the Western Ghats, high rainfall, and a high human-wildlife interface, results in a significant burden of snakebite incidents, particularly among rural, tribal, and agricultural communities. Recognizing the gravity of this issue, the Government of Kerala has taken a decisive step by declaring snakebite as a notifiable disease under the Kerala Public Health Act.

2. This landmark decision underscores the state government's commitment to a data-driven, systematic approach to saving lives. The Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) represents our strategic roadmap to achieving the ambitious vision of "Zero Preventable Deaths and Disabilities due to Snakebite by 2030," in alignment with World Health Organisation (WHO) and National Action Plan (NAPSE) goals.

3. Government are pleased to approve and issue the Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) as annexed to this order with immediate effect.

(By order of the Governor)
DR SHARMILA MARY JOSEPH
PRINCIPAL SECRETARY

To:

The Principal Secretary, Revenue Department.

The Principal Secretary, Local Self Government Department

The Principal Secretary, Animal Husbandry Department.

The Principal Secretary, Agriculture Department.

The Principal Secretary, General Education Department

The Principal Chief Conservator of Forests(Wildlife) & Chief Wildlife Warden, Thiruvananthapuram

The Director of Health Services, Thiruvananthapuram

The Director , Animal Husbandry, Thiruvananthapuram

The Director , Agriculture ,Thiruvananthapuram

The Director of Medical Education, Thiruvananthapuram

The Executive Director , The State Health System Resource Centre, Thiruvananthapuram

State Mission Director, National Health Mission, Thiruvananthapuram

All Head of the departments and Organisations under H&FW Dept.

District Medical Officers of all Districts

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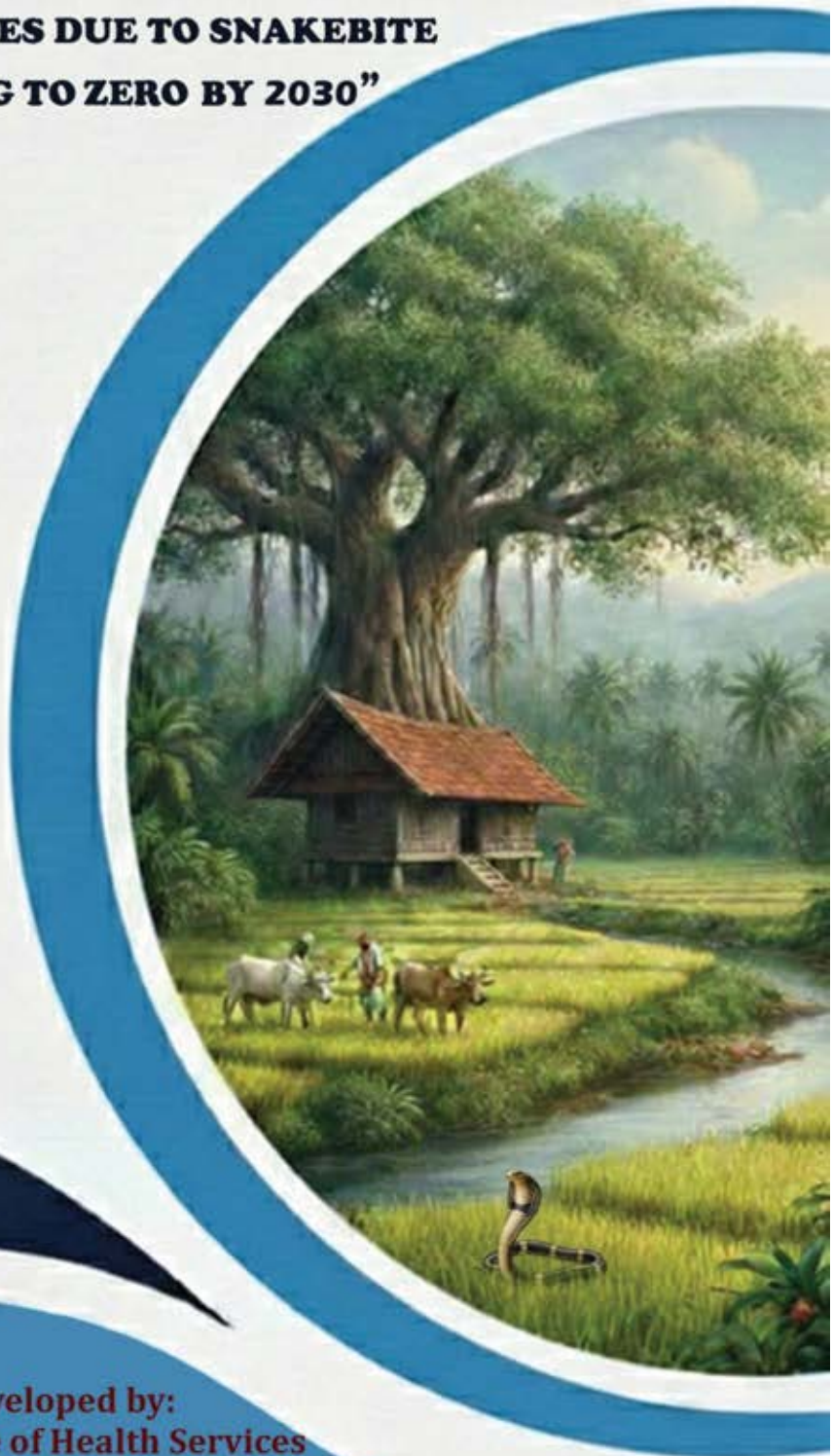
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PA to ACS (H&FW)

PA to Principal Secretary (Health)



KERALA STATE ACTION PLAN FOR PREVENTION AND CONTROL OF SNAKEBITE ENVENOMING (KSAPSE)

**“A STRATEGIC APPROACH TO BRING THE SNAKEBITE DEATHS
AND DISABILITIES DUE TO SNAKEBITE
ENVENOMING TO ZERO BY 2030”**



Developed by:
Directorate of Health Services
Centre for One Health – Kerala
Department of Health and Family Welfare
Government of Kerala



Sri K Muraleedharan
Hon: Minister for Health
Government of Kerala



Message

The health impacts of environmental and ecological shifts are increasingly evident in Kerala, and the rising incidence of human-wildlife conflict, particularly snakebite envenoming, has emerged as a critical public health challenge requiring urgent intervention. Snakebite is a time-sensitive medical emergency that disproportionately affects our most vulnerable rural and tribal communities, including our farmers and plantation workers. In Kerala, our unique biodiversity and high interface between humans and snakes lead to over 8,000 recorded incidents annually, often resulting in preventable deaths and permanent disabilities. Aligned with the World Health Organisation's global mandate and the National Action Plan of India, our government, backed by unwavering political commitment, has set an ambitious vision to bring snakebite deaths and disabilities to zero by 2030. To achieve this, we have taken the historic step of declaring snakebite a notifiable disease in Kerala and ensuring every case is monitored and managed with the highest level of priority.

This State Action Plan is built upon a comprehensive "One Health" framework, recognising that human health is inextricably linked to the health of animals and our shared environment. Our strategy focuses on strengthening the health system by ensuring the uninterrupted availability of high-quality Anti-Snake Venom (ASV) and essential life-support equipment across all levels of care, from primary health centres to our tertiary medical colleges. Beyond clinical treatment, we are prioritising community empowerment through culturally appropriate awareness campaigns in Malayalam designed to dispel myths and promote lifesaving first-aid practices. This mission requires seamless intersectoral coordination between the Departments of Health, Forest and Wildlife, Agriculture, and Local Self-Government to create a "Support Neighbourhood" for victims that bridges the gap between medical excellence and community awareness.

We are also investing in innovation by establishing regional venom research capacities to develop more effective, species-specific treatments tailored to Kerala's unique biodiversity. I applaud the efforts of the Department of Health Services, Forest and Wildlife, the Centre for One Health – Kerala and all other partner departments and agencies for their dedication to developing this strategic roadmap. I also extend my gratitude to our frontline workers, including our doctors and snake rescuers, who are the backbone of this mission. Let us work together to ensure that no life in Kerala is lost to a snakebite and that our state remains a global model for public health resilience.

K Muraleedharan



Dr Rajan N. Khobragade, IAS
Additional Chief Secretary, Department of Health &
Family Welfare and AYUSH
Government of Kerala

Message

Snakebite envenoming is a critical, time-sensitive medical emergency that has long remained a neglected public health challenge. In Kerala, our unique ecological landscape, characterised by the Western Ghats, high rainfall, and a dense human-wildlife interface, results in a significant burden of snakebite incidents, particularly among our rural, tribal, and agricultural communities.

Recognising the gravity of this issue, the Government of Kerala has taken a decisive step by declaring snakebite a notifiable disease under the Kerala Public Health Act. This landmark decision underscores our commitment to a data-driven, systematic approach to saving lives. The Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) represents our strategic roadmap to achieve the ambitious vision of "Zero Preventable Deaths and Disabilities due to Snakebite by 2030," in alignment with World Health Organisation (WHO) and National Action Plan (NAPSE) goals.

This comprehensive plan adopts a "One Health" perspective, integrating the efforts of the Health Department with the Forest and Wildlife, Education, Agriculture, and Local Self-Government sectors. By strengthening surveillance through the IDSP-IHIP portal, ensuring the uninterrupted supply of quality Anti-Snake Venom (ASV) across all levels of care, and leveraging technology such as the SARPA app for snake awareness, safe snake rescue, and protection, we are building a robust ecosystem for prevention and management.

A cornerstone of this strategy is community empowerment. Through targeted awareness programmes, school safety initiatives, and the strengthening of our primary healthcare network, we aim to eliminate the delays and misconceptions that so often lead to tragic outcomes. Our focus remains steadfast on equity, ensuring that even the most remote tribal settlements have access to timely, life-saving care.

I commend the efforts of the Department of Health Services, the Centre for One Health – Kerala, and all partner departments and stakeholders involved in developing this Action Plan, and I express confidence that its systematic implementation will significantly strengthen the State's capacity to prevent, manage, and ultimately eliminate snakebite-related mortality. Together, we can transform Kerala into a model state for snakebite resilience and ensure that no person is left behind due to this preventable hazard.

Dr Rajan N. Khobragade, IAS

Dr Sharmila Mary Joseph, IAS
Principal Secretary,
Department of Health & Family Welfare
Government of Kerala



Message

The strength of Kerala's healthcare model lies in its ability to systematically absorb localized vulnerabilities into a structured, institutionalized response framework. Snakebite envenoming has surfaced as a tangible indicator of ecological shifts and human-wildlife friction. Overcoming this challenge requires moving away from reactive emergency care toward a rigid, data-driven preventive system.

From an administrative standpoint, this document outlines an interdepartmental matrix that enforces specific, measurable responsibilities across multiple sectors. The Health Department's primary objective is to guarantee complete standard operating readiness. This document represents a comprehensive strategic framework built to protect our citizens, particularly the rural, coastal, and tribal communities who bear the highest risk of human-snake conflict. Grounded in the One Health framework, this roadmap outlines the shared responsibilities of the Health, Forest, Agriculture, and Local Self-Government sectors. Our focus is steadfast on strengthening healthcare infrastructure: ensuring the absolute readiness of primary and secondary facilities via a structured referral network, enforcing rigorous cold chain logistics for anti-snake venom (ASV), and integrating standardized clinical management protocols.

Simultaneously, we are embedding protocols directly into community environments. From safety audits and structural sealing in our schools and Anganwadis to strategic public-private partnerships and the deployable SARPA rescue framework, we are building layered defenses where it matters most.

I highly commend the, the Directorate of Health Services, Centre for One Health – Kerala and the multi-sectoral expert panel for establishing this clear, actionable blueprint. Our focus must now turn completely to rigorous field execution, continuous surveillance monitoring, and absolute institutional accountability to safeguard every citizen across the state.

Dr Sharmila Mary Joseph, IAS



Dr Renu Raj IAS

Additional Secretary, Department of Health & Family Welfare
Government of Kerala

Message

Snakebite envenoming represents a significant yet neglected public health challenge in Kerala, particularly affecting our rural, tribal, and agrarian communities, who face heightened risks due to close interactions with diverse snake species in our lush ecosystems.

Historically, Kerala has evolved from reliance on traditional herbal remedies and folk practices to a modern, evidence-based system integrating polyvalent anti-snake venom (ASV) therapy, specialised ICUs, and the innovative SARPA platform for certified snake awareness and rescues. Venomous species inflict acute systemic effects like coagulopathy, renal failure, and neurotoxicity, yielding significant morbidity, mortality, permanent disabilities, and economic losses, particularly during monsoons, mating seasons, and agricultural peaks.

The Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) pioneers a comprehensive One Health approach, forging synergies across health services, forestry, animal husbandry, agriculture, education, local self-governments, and wildlife sectors. Developed by the Department of Health & Family Welfare and the Centre for One Health - Kerala, this strategic blueprint aims to achieve zero preventable snakebite deaths and disabilities by 2030 through multi-pronged interventions.

SAPSE not only mitigates immediate risks but builds resilient systems for human-snake coexistence, economic safeguards for livelihoods, and equity in healthcare, ensuring that no one, especially the impoverished and marginalised, is left behind.

I extend my deepest appreciation to all contributors for this visionary document. I urge policymakers, frontline warriors, NGOs, herpetologists, Local self-governments, and communities to embrace KSAPSE with unwavering resolve, transforming Kerala into a global exemplar of snakebite elimination.

Dr Renu Raj IAS

Dr. Meenakshy V
Director of Health Services(I/C)
Government of Kerala



Message

Snakebite envenoming continues to pose a serious yet often under-recognised public health challenge in Kerala. The burden is intensified during monsoon seasons, natural disasters, and in remote terrains where timely access to care may be limited. Beyond mortality, snakebite results in long-term disabilities, psychological trauma, loss of livelihood, and significant out-of-pocket expenditure, thereby deepening social and economic vulnerability.

The Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) articulates a comprehensive, evidence-based, and time-bound roadmap grounded in the One Health approach. Spearheaded by the Department of Health & Family Welfare in partnership with the Centre for One Health–Kerala and other key stakeholders, the Action Plan aligns with national and global targets to eliminate preventable snakebite deaths and substantially reduce morbidity by 2030.

By reinforcing health-system readiness, promoting interdepartmental coordination, advancing scientific evidence, and empowering communities with knowledge and resilience, KSAPSE represents a transformative public health initiative. It not only aims to prevent avoidable deaths but also seeks to reduce disability, protect livelihoods, and prevent catastrophic health expenditure among vulnerable families.

Let us collectively commit to translating this vision into measurable action with determination, accountability, and compassion. Through sustained implementation of KSAPSE, Kerala can emerge as a national leader and global exemplar in eliminating snakebite mortality and building a resilient, inclusive, and One Health–driven public health system.

Dr. Meenakshy V



Sri Anu S Nair IAS
State Mission Director
National Health Mission, Kerala

Message

Snakebite envenoming continues to pose a significant public health challenge in Kerala, especially among rural, tribal, coastal, and agricultural communities. Although Kerala reports comparatively lower snakebite mortality than many other Indian states, each preventable death or disability represents a gap in awareness, timely access to care, and coordinated system readiness. With snakebite now declared a notifiable condition in Kerala, the State has taken a decisive step toward strengthening surveillance, improving access to Anti-Snake Venom (ASV), and ensuring uniform standards of care across public and private health facilities.

The Kerala State Action Plan for Prevention and Control of Snakebite Envenoming (KSAPSE) reflects a comprehensive, multisectoral strategy aligned with the national NAPSE framework and the global WHO target of reducing snakebite deaths by 50 per cent by 2030. This plan places strong emphasis on early recognition, pre-hospital care, rational ASV administration, robust referral pathways, and capacity-building for healthcare providers at all levels. Equally important are the community-centred interventions that address misinformation, promote safer behaviours, and empower frontline workers, volunteers, and Local self-governments to prevent delays in care-seeking.

Kerala's unique ecological landscape and high human–snake interface demand coordinated action that goes beyond the health sector. The collective efforts of the Departments of Health, Forest & Wildlife, Local Self Government, Education, Animal Husbandry, Tribal Welfare, Agriculture, and our dedicated network of SARPA volunteers, NGOs, and herpetologists are vital to reducing snakebite incidents and ensuring the safety of our communities. The National Health Mission, Kerala, is dedicated to operationalising the KSAPSE through its extensive human resource network and institutional resources within a comprehensive One Health framework.

Together, we can ensure that every citizen—regardless of geography, occupation, or socio-economic status—has timely access to safe, effective, and equitable snakebite care.

Anu S Nair IAS

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Chapter 1

Introduction

Snakebite is an acute, life-threatening, time-sensitive medical emergency. It is an eminently preventable public health hazard that most often affects rural populations in the tropics and subtropics. There are about 4,000 species of snakes worldwide, of which more than 350 are found in India, including 52 venomous or mildly venomous species. The venomous snakes found in India belong to three families: Elapidae, Viperidae and Hydrophinae (Sea Snakes). The Big 4 species responsible for the majority of snakebite envenoming (SBE) in India include *Naja naja* (Indian Cobra) and *Bungarus caeruleus* (Common Krait), *Daboia russelii* (Russells' Viper) and *Echis carinatus* (Saw scaled viper)(Alirol et al. *Snake Bite in South Asia: A Review 2010*).

SBE is most often accidental, occurring in individuals with an outdoor occupation. The WHO relisted SBE as a Neglected Tropical Non-Communicable Disease in June 2017. With its triad of high mortality, high disability, and substantial psychological morbidity, snake bite warrants high-priority research.

In 2018, the Seventy-first World Health Assembly adopted a comprehensive resolution calling for a coordinated response to the global burden of snakebite envenoming, a neglected tropical disease (NTD). Snakebite envenoming is a substantial but neglected public health issue, particularly in low and middle-income countries (LMICs). Annually, there are approximately 4.5–5.4 million snakebites, 1.8–2.7 million cases of envenomation, 81 000–130 000 deaths from snakebites, and a considerably higher number of permanent disabilities from snakebites worldwide. Roughly 95% of these incidents occur in LMICs. To halve snakebite deaths by 2030, WHO launched the Snakebite Information and Data Platform to create a comprehensive database of venomous snakes and anti-venom, while providing member countries with an opportunity to share their epidemiological data on snakebite envenoming. However, the platform does not currently display any data for highly affected Asian and South American countries.

India faces a significant Snakebite burden in terms of human mortality, economic loss, and both human and animal, with varied epidemiological patterns across regions. It is also a fact that snakebite-related issues involve multiple stakeholders (departments/ministries) across various sectors (e.g., Health, Forest and Wildlife, Agriculture, Animal Husbandry, Ministry of Labour, Tribal Affairs, Local Self Government, etc.). SBE is most often a condition associated with impoverishment and inequity, with the people most affected typically being those with the least access to quality healthcare. It is largely preventable through system-level interventions; therefore, universal health coverage based on robust health systems and people-centred primary health care requires prioritisation to reduce the impact of SBE. Engaging communities, national and international partners to extend awareness, knowledge, and access to care to the extent possible will ensure that no person is left behind.

Chapter 2

Historical Perspective of Snakebite Prevention and Control in Kerala

Snakebite envenomation has historically been a significant public health challenge in Kerala. The history of managing this menace reflects a complex interplay between ancient indigenous healing traditions, cultural settings, the influence of colonial medicine, and the contemporary adoption of standardised public health strategies. This evolution moved from a decentralised, localised system focused on herbal remedies and folk practices to a highly centralised, technologically aided, and medically standardised approach, culminating in the formal recognition of snakebite as a priority notifiable disease in the 21st century.

Early Period (Pre-20th Century)

Snakebite care was primarily based on traditional healers, herbal remedies, and community practices. Prevention was centred mainly on cultural practices, environmental awareness, and adherence to astrological or mystical beliefs. This system, though diverse and highly localised, lacked standardisation and depended on practitioners' knowledge and the specific preparations used, resulting in varying outcomes across the region.

Transition and hybridisation in the colonial and early modern period (20th Century)

The colonial and post-independence period marked a major transition in snakebite management, with the gradual introduction of modern medicine alongside the continued use of traditional healing systems. The history of snakebite envenomation in India is incomplete without reference to the development of Anti-Snake Venom (ASV), a national effort that drew significantly on the expertise of the Irula community for venom collection. Early ASV preparations were associated with high rates of anaphylaxis and difficulties in reconstitution, but safer and more effective formulations progressively replaced these.

Although ASV serotherapy began to challenge traditional practices—particularly in medical colleges and tertiary care hospitals—its limited availability, weak rural health infrastructure, and strong community trust in folk remedies meant that traditional healers remained the first point of contact for most victims well into the late 20th century. Snakebite was largely managed as a localised medical problem rather than a cohesive public health priority.

This period also highlighted the importance of intersectoral coordination and region-specific knowledge. In Kerala, the late recognition of the hump-nosed viper (*Hypnale* spp.) as a medically significant species—only in the late 1980s—marked a critical turning point. Today, bites from this species constitute a major share of snakebite cases in the state, often leading to excessive ASV use. The recognition of other species, such as the Malabar pit viper and the mimics of the “big four,” underscores the need to integrate regional snake identification and appropriate management into medical officer training.

Standardisation and Integration as a Public Health Priority (21st Century)

The contemporary period is defined by a decisive shift toward standardising care and integrating snakebite envenomation into Kerala's robust public health infrastructure. Recognising the high burden and high case-fatality rate, the state has adopted evidence-based treatment protocols, making the timely administration of polyvalent ASV the cornerstone of management. Key strategic initiatives include strengthening ASV's supply chain, establishing specialised treatment units (ICUs/ventilators) in tertiary and secondary care hospitals, and training medical professionals to manage complex envenomation and its complications. Furthermore, the state leveraged technology through initiatives like the Snake Awareness, Rescue and Protection (SARPA) platform to connect the public with trained, certified snake rescuers, effectively managing the human-snake conflict while reducing improper handling and improving pre-hospital care, culminating in the formal declaration of snakebite as a notifiable public health disease in 2025.

Chapter 3

Snakebite Epidemiology

Snakebite Envenoming (SBE) is a significant, neglected global health issue, primarily affecting rural communities worldwide and causing substantial morbidity and mortality. Envenoming results from the action of snake venom components, with ASV being the only definitive lifesaving therapy. ASV is a biological product raised by harvesting serum from equines injected with graded doses of venom of the Big 4 species. Being a significant public health concern, particularly in endemic regions, timely and adequate pre-hospital management is crucial for improved victim outcomes and reducing morbidity and mortality. SBE, after years of neglect, is finally being given its due importance both nationally and globally.

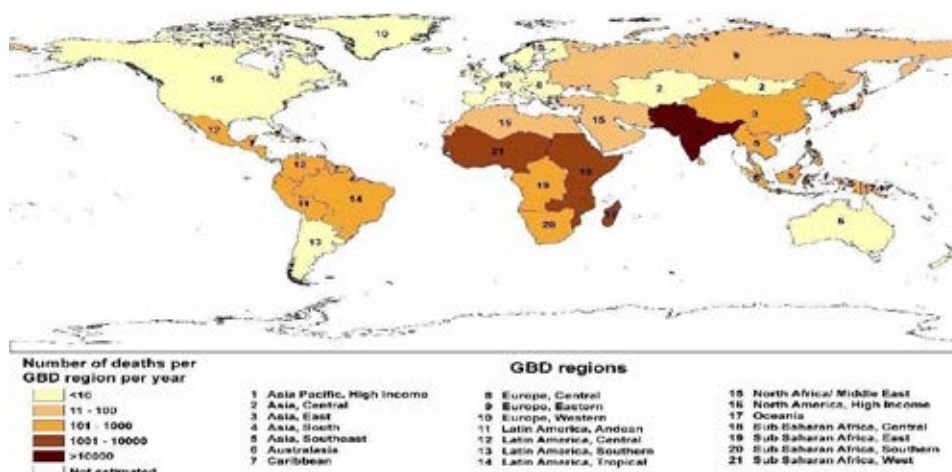
Global Scenario

SBE is a major preventable cause of morbidity and mortality in the Tropics. There are an estimated 4.5 to 5.4 million snakebites annually worldwide, resulting in envenoming in roughly half of them. This, in turn, leads to 81,000–138,000 deaths, with an additional 400,000 permanent disabilities. However, these figures likely underestimate the true burden due to substantial under-reporting, as many victims seek care from traditional healers or die before reaching health facilities, particularly in remote and underserved areas.

SBE is listed among the 24 neglected tropical diseases (NTDs) and accounts for the highest mortality burden among them. SBE results in more deaths than all the other NTDs put together. The socioeconomic impact of SBE is also considerable, with nearly 70% of victims being male, and in the 20–65 age bracket, the economically productive age group. Snakebite is among the leading forms of human-wildlife conflict globally, by far outnumbering deaths and attacks from other wildlife species. SBE is also a significant cause of livestock loss in the tropics. The South-East Asia region is a biodiversity hotspot for venomous snakes and is also home to some of the world's most densely packed agrarian communities—snakebites in the region account for nearly 70% of the estimated global snakebite deaths.

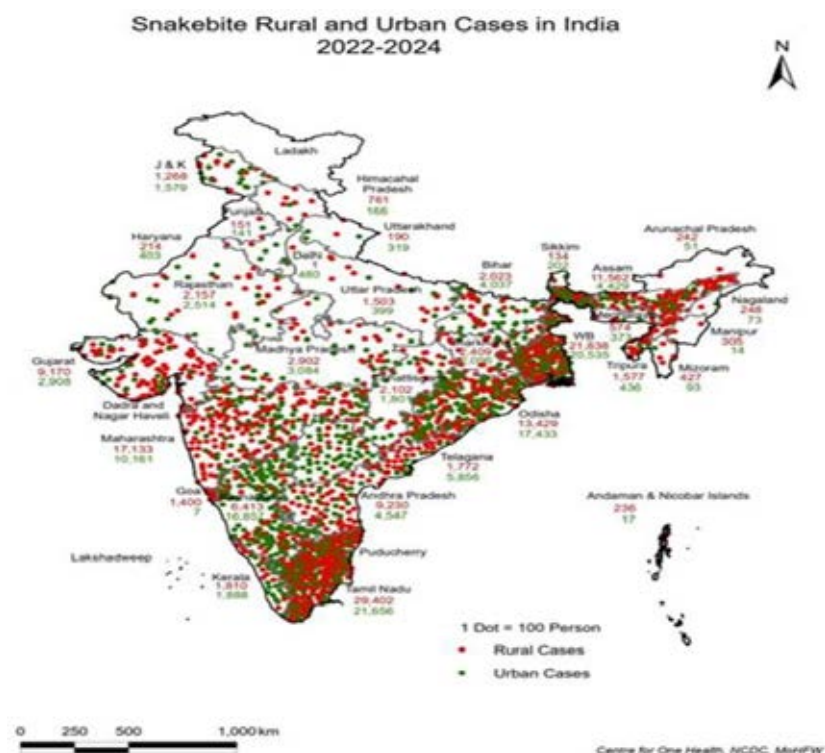
Indian Scenario

A study conducted by Indian Researchers estimates that between 2000 and 2019, India witnessed approximately 1.2 million deaths and 3.6 million cases of permanent disabilities due to snakebites which says one in 250 Indians is at risk of dying from a snakebite before 70 yrs old (*Suraweera et al. Trends in snakebite deaths in India from 2000 to 2019 in a nationally representative mortality study. 2020*). From 2001 to 2014, just under 70% of these snakebite deaths occurred in eight states with about 55% of the population: Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, Andhra Pradesh (which includes Telangana, a recently defined state), Rajasthan and Gujarat.

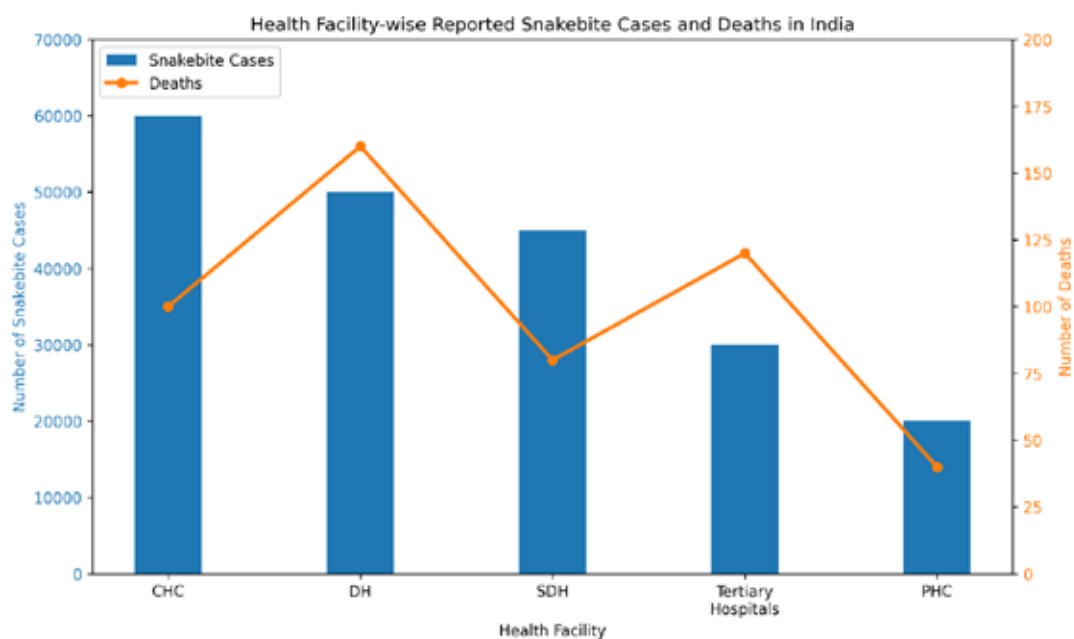


Snakebite is a disease associated with inequity and impoverishment, with the majority of bites occurring in rural populations and going unreported. Access to quality healthcare is poor in many parts of rural India, compounding the issue. Snakebite is most common among outdoor occupations that place them at risk of snake-human conflict. The lack of protective gear or the ease of working without boots or gloves increases the risk of being bitten. The burden of premature death as a consequence of snakebite envenoming in India is estimated at 2.97 million disability adjusted life years, whereas the global burden is estimated at 6.07 million disability-adjusted life years. Rapid urbanisation, land reclamation, the consequences of climate change, poor waste management, and urban flooding have increased snake-human encounters, raising risks even in cities. Construction sites and garbage piles become home to rodents and reptiles, leading to significant bites reported from urban perimeters as well. According to the Central Bureau of Health Investigation (CBHI) reports (2016-2020), the average annual frequency of snakebite cases in India is around 0.3 million, and about 2000 deaths occur due to snakebite envenoming.

In India, around 90% of snakebites are caused by the 'big four' species, namely common Krait, Indian Cobra, Russell's Viper and Saw Scaled Viper. Administration of polyvalent anti-snake venom (ASV) containing antibodies against Cobra, Russell's Viper, Common Krait, and Saw Scaled Viper is effective in 80% of snakebite cases; however, the lack of trained human resources and health facilities to treat snakebite patients remains a cause of concern. Also, the unavailability of data on incidence, morbidity, mortality, socio-economic burden, treatment patterns, etc., is a major hindrance in planning for the mitigation of snakebite in India.



Shewale et al. Implementing Interventions Under “National Action Plan for Snakebite Envenoming (NAPSE) in India”: Challenges, Lessons Learnt and Way Forward for Stakeholders Participatory Approach 2025

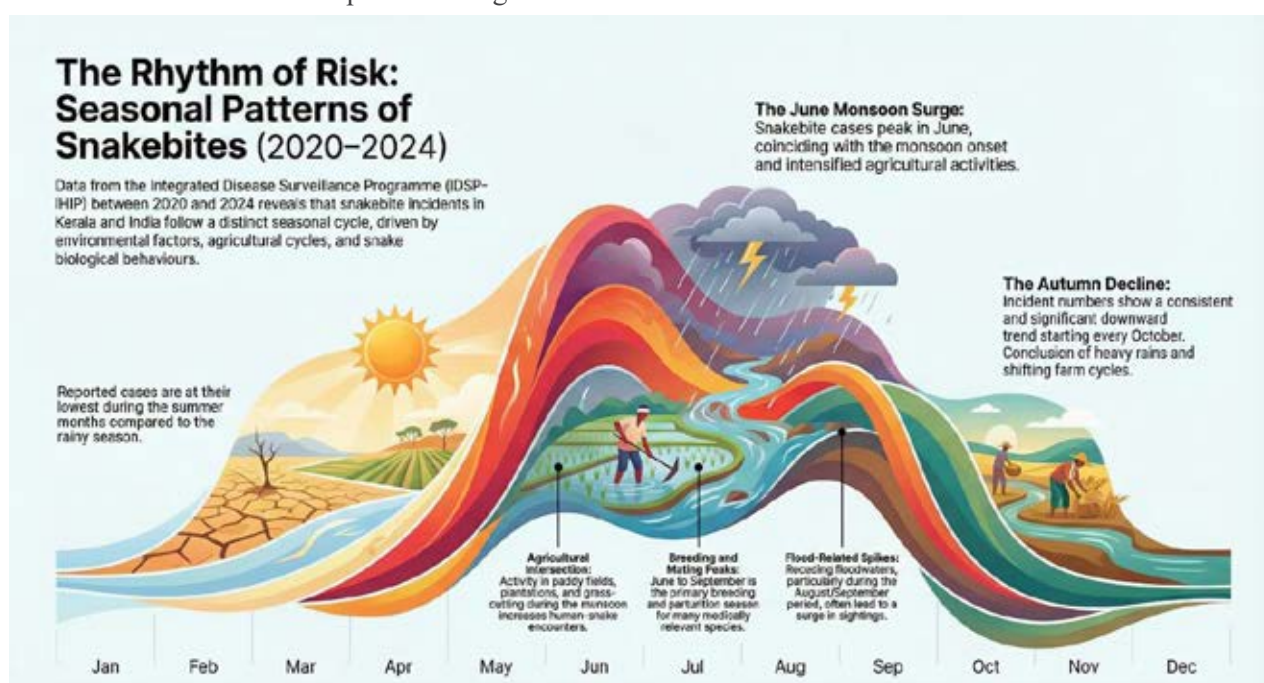


Health Facilities-Reported Snakebite Cases and Deaths from 2020–2024 (Source–IDSP/IHIP)

Currently, snakebite cases and related deaths in India are monitored through the Integrated Diseases Surveillance Program–Integrated Health Information Portal (IDSP–IHIP). Community health workers document snakebite cases using the S (Suspected) form, while Medical Officers (MO) report presumptive snakebite cases and fatalities using the P form. Recently, IDSP launched a community reporting tool for any outbreak-related alert. In 2024, over 0.12 million cases were reported, with 370 deaths.

Densely populated, low-altitude agricultural regions in states such as Karnataka, West Bengal, Jharkhand, Odisha, and Madhya Pradesh account for most snakebite deaths, particularly during the rainy season when human–snake encounters are more common both indoors and outdoors. Considering these trends, a checklist for ensuring the availability of logistics and equipment is prepared, and states are encouraged to undertake training as part of pre-monsoon preparedness. Data from IDSP–IHIP also reveal that snakebite cases typically peak in June and decline in October, showing a seasonal pattern over the years.

Seasonal patterns are related to the monsoon, breeding season, mating season, etc. It is observed that snakebite cases typically peak during June, with the onset of the monsoon, and are also linked with agricultural activities at that time. Mechanisation in the agriculture sector has changed this trend. In addition to environmental factors, snakebite is linked to snake behaviour during the mating and breeding period. Less snakebites are also expected during summer.



Seasonality under Snakebite Cases (Reported from 2020–2024 as per IDSP/IHIP).

Kerala Scenario

Kerala’s environmental and cultural landscape plays a major role in shaping the pattern of snakebite envenoming in the State. Before understanding the burden and risks, it is important to recognise the unique ecological setting and the long-standing human–snake relationship that influences snakebite occurrences.

Snakes have been venerated and worshipped through the ages. The concept of ‘Kaavukal’ is unique to Kerala, in which a space is reserved in most large landholdings or temple premises for snakes. These microenvironments function as unique conservation ecosystems, as no tree cutting or removal is allowed in the ‘kaavukal’, and neither are snakes or other species disturbed or harmed there, making it a perfect model of conservation.

Kerala’s ecological diversity, shaped by the Western Ghats and high rainfall, allows for a rich diversity of snake species and exposure contexts. The tropical climate and rainfall, along with lush green landscapes and evergreen forests, support a rich ecosystem that sustains 87 endemic reptiles in the Western Ghats, of which

10 are endemic to Kerala. The Forest Department reported a total of 8873 Human-Wildlife Conflict incidents in Kerala during 2022-23, of which snakes directly or indirectly caused 984. The confirmed snakebite deaths were reported to be 48, and 11795 snakes were rescued from various parts of Kerala (Forest Statistics Report 2022-2023).

Contexts and situations that lead to snakebite primarily occur outdoors. Snakebite is distinctly more common with certain outdoor activities and occupations, including farming, grass cutting, pastoral activities, firewood collection, open defecation, forest-related activities, plantation-related activities for rubber, tea, coffee, or palm, brick kilns, timber mills, fishing and swimming, and playing. Vulnerable groups include persons involved in activities under the 'Rural Employment Guarantee Scheme', tribal and fishermen communities. Working in waterlogged lands, canals, highly vegetated lands, etc., increases the risk. Sometimes, due to the nature of the work, bites may go unnoticed, leading to severe outcomes. Children and students playing outdoors get bitten when they accidentally step on or touch a snake. SBE in a classroom, and Homicidal snakebite envenoming was also reported in Kerala. A recent school-based study from Thrissur involving over 2,400 high school students documented substantial baseline misconceptions regarding snakebite first aid, including a preference for traditional practices over prompt transport to facilities with antivenom (Abraham S V et al.). *Baseline Knowledge and Change in Confidence after Learning First Aid from Emergency Physicians: A Pre-Post Interventional Study of 2462 High School Junior Red Cross Cadets. Indian Journal of Public Health* 69(2). .2025).

The majority of bites reported have occurred in the late afternoons and evening hours, with a decline in nocturnal bites attributed to improved quality of life, use of beds and cots, shielding windows and doors with mosquito nets, and proper cleaning and maintenance of surroundings. Women in the household get bitten while cleaning premises, fetching firewood, or during indoor or outdoor activities. The 2018-2019 Kerala floods led to a spurt in snakebites as floodwaters receded. The floods that occurred in August also reported several juvenile snake sightings, with June-September being the breeding and parturition season for some of the major medically relevant species.

Medically Relevant Snake Species

While almost 90% of snakebites in Kerala are accidental, there are still cases of intentional snake handling, sometimes mistaking highly venomous snakes for non-venomous ones. Within 12 families, Kerala harbours 130-plus snake species. While some snakes are endemic to certain regions or parts of Kerala, the majority are widely distributed throughout Kerala.

The major families are

1. Family Typhlopidae (2 species)
2. Family Gerrhopilidae (3 species)
3. Family Uropeltidae (24 species)
4. Family Pythonidae (1 Species)
5. Family Boidae (3 species)
6. Family Acrochordidae (1 species)
7. Family Colubridae 43 species)
8. Family Xenodermatidae (4 species)
9. Family Homalopsidae (3 species)
10. Family Viperidae (7 Species)
11. Family Elapidae (7 species)
12. Family Hydrophiidae (6 species)

As in other Indian states, the major species responsible for SBE are the Big 4: spectacled cobra/Indian cobra (*Naja naja*), common krait (***Bungarus caeruleus***), Russell's viper (*Daboia russelii*), and saw-scaled viper (*Echis carinatus*). The first 3 members are distributed across Kerala's geography, while the Saw Scaled viper distribution is limited to some areas of Kasargod, Kannur, and Palakkad.

The Big Four concept was created to standardise the production of polyvalent antivenom in India.

Although these snakes are major contributors to snakebite incidents, recent research suggests that other species are also relevant causes of morbidity and mortality. For example, the hump-nosed pit viper (*Hypnale hypnale*) is acknowledged as a major offending snake in Kerala and parts of Karnataka. A member of Crotalinae, a subfamily of vipers, the Hump Nosed Pit Viper bites are hemotoxic and can be lethal in children, the elderly or in individuals with significant comorbidities. These snakes are widely seen in the fringes of the Western Ghats and in forest areas, plantations, and dense jungles and are endemic to the South-Western Ghats.

The hump-nosed pit viper, *H. hypnale*, is a medically significant yet frequently overlooked species in India. Historically, *H. hypnale* envenomation was thought to induce only localised effects; however, contemporary research confirms its ability to cause systemic toxicity, including venom-induced consumption coagulopathy, acute kidney injury and thrombotic microangiopathy. Administering the current polyvalent antivenom to victims of *H. hypnale* bites did not reduce the morbidities or prevent mortality; instead, it exposes them to additional risks associated with ASV administration (Abraham S V et al A Single-Centre Review of Cases to Understand the Indian Polyvalent Antivenom Use in Hump-Nosed Pit Viper Bites in South India. *Journal of Emergencies, Trauma, and Shock* 18(1): p 15-21, Jan–Mar 2025). A retrospective study conducted at a tertiary hospital in Kerala indicated that among the 47.3% of cases with known snake species, *D. russelii* accounted for 23.1%, *H. hypnale* accounted for 15.4%, *N. naja* accounted for 5.5% and *B. caeruleus* accounted for 3.3%. Additionally, data from online snake rescue databases, such as indiansnakes.org, corroborate these findings, highlighting frequent encounters with *H. hypnale* in these regions. Significantly, hospitals in Kerala, Tamil Nadu and Karnataka refrain from administering polyvalent antivenom when *H. hypnale* is accurately identified as the causative agent.

Venomous Snakes Of Kerala

Spectacled Cobra	<i>Naja naja</i>
Common Krait	<i>Bungarus caeruleus</i>
Russells Viper	<i>Daboia russelii</i>
Saw Scaled Viper	<i>Echis carinatus</i>
King Cobra	<i>Ophiophagus hannah</i>
Hump Nosed Pit Viper	<i>Hypnale hypnale</i>
Malabar Pit Viper	<i>Craspedocephalus malabaricus</i>
Large-Scaled Pit Viper	<i>Craspedocephalus macrolepis</i>
Horse Shoe Pit Viper	<i>Craspedocephalus strigatus</i>
Bamboo Pit Viper	<i>Craspedocephalus gramineus</i>
Beddomes Coral Snake	<i>Calliophis beddomei</i>
Bibrons Coral Snake	<i>Calliophis bibroni</i>
Slender Coral Snake	<i>Calliophis melanurus</i>
Striped Coral Snake	<i>Calliophis nigrescens</i>
Mildly Venomous	

Kerala Mud Snake	<i>Dieurostus dussumieri</i>
Glossy Marsh Snake	<i>Gerarda prevostiana</i>
Dog-Faced Water Snake	<i>Cerberus rynchops</i>
Bronze Headed Vine Snake	<i>Ahaetulla perroteti</i>
Gunther's Vine Snake	<i>Ahaetulla dispar</i>
Long-Nosed Vine Snake	<i>Ahaetulla oxyrhyncha</i>
Malabar Vine Snake	<i>Ahaetulla malabarica</i>
Isabelline Vine Snake	<i>Ahaetulla isabellina</i>
Travancore Vine Snake	<i>Ahaetulla travancorica</i>
Sahyadri Vine Snake	<i>Ahaetulla sahyadrensis</i>
Keeled Vine Snake	<i>Ahaetulla antiqua</i>
Ornate Flying Snake	<i>Chrysopelea ornata</i>
Common Cat Snake	<i>Boiga trigonata</i>
Ceylon Cat Snake	<i>Boiga ceylonensis</i>
Collared Cat Snake	<i>Boiga nuchalis</i>
Forsten's Cat Snake	<i>Boiga forsteni</i>
Travancore Cat Snake	<i>Boiga dightoni</i>
Yellow-Green Cat Snake	<i>Boiga flaviviridis</i>

Several non-venomous or less medically important snake species closely resemble the commonly implicated “Big Four” snakes in external appearance, leading to frequent misidentification. They mimic the patterns and morphological features of venomous species. Rat snake and racers for Indian cobra, common and Travancore wolf snakes for common kraits, pythons, boas and Russell's wolf snake for Russell's viper, common cat snake for saw scaled viper, etc. This resemblance increases the likelihood of inappropriate handling by community members and contributes to snakebite incidents. Misidentification may also reinforce misconceptions when bites from look-alike species or dry bites do not result in severe envenoming, thereby perpetuating reliance on unscientific first-aid practices and delaying appropriate care. Fishermen's communities encounter sea snakebites, often when they try to remove the snake by hand after it becomes entangled in fishing nets. Their venom is a mixture of potent neurotoxins and myotoxins and is not neutralised by the available anti-snake venom. Though sea snakes are potentially deadly, bites reported to the hospital have been few, probably because their short fangs are not an effective delivery mechanism for significant human envenoming.

Sea Snakes

Hook-nosed Sea Snake	<i>Hydrophis schistosus</i>
Annulated Sea Snake	<i>Hydrophis cyanocinctus</i>
Cochin-Banded Sea Snake	<i>Hydrophis ornatus</i>
Black and Yellow Sea Snake	<i>Hydrophis platurus</i>
Yellow Sea Snake	<i>Hydrophis spiralis</i>
Short Sea Snake	<i>Hydrophis curtus</i>

Apart from the big fours and pit vipers, coral snakes are considered venomous, but their morphological features restrict their capability to cause potent envenomation. In addition to the hump nosed pit viper, all other members of the Viperidae family can cause morbidity and disability in victims. Of these, the other pit viper species are also medically relevant, leading to significant bite-site complications rather than systemic effects.

Medically Important Snake Species of Kerala

Medically important snake species refer to species responsible for clinically significant envenoming and public health burden, rather than all biologically venomous snakes.

Common Krait	Spectacled Cobra	Russell's Viper	Hump Nosed Pit Viper	Saw Scaled Viper
King Cobra	Malabar Pit Viper	Large-Scaled Pit Viper	Bamboo Pit Viper	Horse Shoe Pit Viper
Hook-Nosed Sea Snake	Cochin Banded Sea Snake	Yellow Sea snake	Annulated Sea Snake	Short Sea Snake
Black & Yellow Sea snake	Slender Coral Snake	Bibron's Coral Snake	Striped Coral Snake	Beddome's Coral Snake

The Malabar Pit Viper (*Craspedocephalus malabaricus*), the Large-Scaled Pit Viper, and the Bamboo Pit Viper are medically important snake species found in the Western Ghats of India. These Pit Viper species are further split into distinct species, each inhabiting various regions within the Western Ghats. Thus, it is obvious that epidemiological investigation of snakebite envenoming and related factors is pertinent to the formulation and implementation of policy in any part of the world. Distribution of the Large-Scaled Pit Viper, Baboo Pit Viper, and Horse-Shoe Pit Viper is away from habitations and at higher altitudes, and hence their bite cases are reported very rarely.

Chapter 4

Strategic Components of the State Action Plan for Snakebite Envenoming

Snakebite envenoming remains a significant public health challenge in Kerala, affecting vulnerable communities across rural, tribal, agricultural, and forest-fringe regions. As the state moves towards the ambitious goal of eliminating snakebite deaths by 2030, a focused, coordinated strategy is essential. The strategic components of the SAPSE outline the core pillars needed to translate the vision into action.

Vision & Mission of SAPSE

Vision: “To achieve zero deaths due to snakebite envenoming in Kerala by 2030”

Mission: To progressively reduce the morbidity associated with SBE and implement preventative measures.

Pillars of the Kerala State Action Plan for Snakebite Envenoming (SAPSE)

The Kerala State Action Plan for Snakebite Envenoming (SAPSE) is structured around a set of interlinked pillars that collectively address the prevention, management, surveillance, and long-term reduction of

snakebite envenoming across the State. These pillars reflect Kerala's unique ecological diversity, strong public health system, high forest-human interface, and the need for coordinated action across health, animal, wildlife, agriculture, and local governance sectors.



STRENGTHENING OF HEALTH SYSTEM

Ensuring Provision of Anti-Snake Venom (ASV) at designated Health facilities

- Strengthen State-Level ASV Procurement and Financial Planning. Ensure sustained financial allocation through state schemes and National Health Mission (NHM) support, with precise annual forecasting based on the burden and consumption trends, and the essential drug list across all tiers of the health system (CHCs, THs, THQs, DHs, GHs, and Medical Colleges).
- Build & maintain a Skilled Workforce for ASV use, ensuring that doctors and nursing staff across all public and private facilities are trained in standard treatment protocol, ASV administration protocols, and management of adverse reactions. Incorporate periodic refresher training and competency-based skill assessments.
- Guarantee Uninterrupted ASV Supply Across the State- Regularly review district-level ASV stock positions, buffer stock requirements, and consumption patterns—radio-tagged ASV vials to support real-time tracking of ASV movement and stock availability at treating centres.
- Upgrade Cold Chain Infrastructure for ASV Storage: Strengthen cold-chain capacity (2–8°C) at all storage points, including district warehouses and CHCs.
- Rationalising the administration of ASV and avoiding unnecessary administration of ASV.
- Identification of biting snake species, to help rationalise the use of ASV.
- A community-oriented model for snakebite management equips and empowers medical facilities, including PHCs, CHCs, Taluk Hospitals, District Hospitals, and Medical College Hospitals, and supports staff skill development, including supporting staff such as ambulance drivers.

Strengthening surveillance of snakebite cases and deaths in humans:

- Snakebite surveillance is the key index for the success of any intervention programme. It involves the collection of essential data to (1) determine the extent of the snakebite issue, (2) monitor and evaluate the progress and impact of intervention, (3) manage potential human exposures adequately, and (4) calculate the cost-effectiveness of control efforts.

The activities for strengthening surveillance of snakebite cases and deaths are as follows.

- a) Operationalising mandatory snakebite notification across health facilities through the designated state web-portal/e-Health platform. All public and private health institutions should promptly notify confirmed and suspected snakebite cases to enable real-time surveillance using the format shared.
- b) Strengthening the periodic reporting system for snakebite through IDSP and IHIP.
- c) The data available from IHIP and HMIS shall be verified with the individual institutions, and the details as per the formats shared shall be sent by the district nodal officers every month.

- d) The snake rescue data available with the forest department shall also be triangulated to identify LSGs that are hotspots for snake bites.
- e) Comprehensive Resource Mapping Across the State: Conduct systematic mapping of all facilities capable of providing snakebite management (public and private), including ASV-availability sites, critical care facilities, and emergency services.
- f) Identify SBE treatment facilities at three levels: L1, L2 and L3 centres,
 - L1 with basic care and lacking an ICU,
 - L2, ICU without endotracheal ventilatory or dialysis facilities,
 - L3 with advanced support systems including dialysis, endotracheal ventilation, ±plasmapheresis and other advanced therapies
- g) Priority should be given to strengthening L1 and L2 centres, especially in high-risk LSGs, as investments at these levels yield better outcomes for the resources spent.

Mapping of laboratories with capacity for diagnosing complications related to snakebite envenoming (coagulation tests, renal function tests, electrolytes, etc.)

Strengthening Pre-Hospital Care and Emergency Services

The clinical management of snakebite cases with envenomation comprises two inseparable components: timely administration of appropriate antivenom (ASV) to neutralise circulating venom, and supportive, symptomatic, and adjunctive therapies to halt the progression of envenomation, manage complications, and stabilise the patient. The emergency care required for snakebite envenoming closely parallels the management of other acute medical emergencies, including airway compromise, respiratory failure, shock, and organ dysfunction.

An integrated emergency care approach, embedded within existing health-system structures, therefore represents the most cost-effective and scalable strategy for reducing snakebite-related mortality and morbidity.

Activities to strengthen the CHCs/THs/THQHs/DHs/GHs are as follows:

Key Activities for Strengthening Pre-hospital Care and Emergency Services:

- Education and awareness creation:
 1. among the public
 2. among health care workers
- Developing or popularising the existing software (e.g., mobile apps like SARPA) to help the general public understand the facilities and expertise available for snakebite envenomation management.
- Ensure Reliable and Rapid Ambulance Services for Snakebite Cases: Guarantee the availability of 108 ambulances and facility-owned emergency vehicles for the timely transport of snakebite victims. Equip ambulances with trained staff capable of recognising symptoms of envenoming, providing basic life support during transit and initiating ASV administration if required and:
- Streamline Referral Pathways and Advanced Management Protocols: Implement an efficient referral and treatment framework through:

A structured hub-and-spoke model (L1, L2, L3):

L1: Basic stabilisation; facilities without ICU, including recognising and treating a compromised airway. These centres should be available at 30-minute reachable points.

L2: ICU support without endotracheal ventilation/haemodialysis

L3: Tertiary centres with facilities for endotracheal ventilation, haemodialysis, plasmapheresis and other

advanced therapies

- 24×7 state snakebite helpline for clinical guidance, triage support, and decision-making. In addition, social media platforms can be effectively leveraged. At present, a dedicated WhatsApp group exclusively for snakebite management is functioning very effectively, with experts supporting snake identification and clinicians guiding management and critical decision-making.
- Ambulance stations and transfers in a ‘hub and spoke’ model, staffed with personnel trained to initiate ASV and life-support care.



THE GOLDEN PATH TO RECOVERY:

Strengthening Emergency Care for Snakebite in Kerala

COMMUNITY EMPOWERMENT & FIRST RESPONSE



Education & Awareness Initiatives

Community sensitization on snakebite risks, first-aid "dos and don'ts," immediate medical care.



Digital Support via SARPA App

Use mobile technology to locate facilities with Anti-Snake Venom (ASV) and expert management.



Grassroots Volunteer Networks

Train ASNAs, Kudumbashree members, and volunteers in early recognition and correct referral.

RAPID PRE-HOSPITAL TRANSPORT



Reliable 108 Ambulance Services

Guarantee availability of 108 ambulances and facility-owned vehicles with basic life support.



Trained Transit Personnel

Staff trained to recognize symptoms, initiate ASV, and manage airways during transit.

THE HUB-AND-SPOKE REFERRAL MODEL

Level 1 (L1) – Basic Stabilization

Facilities within 30 mins, focus on basic stabilization, airway management, No ICU.

Level 2 (L2) – Secondary ICU Support

Secondary centers with ICU for monitoring; Lacking endotracheal ventilation or hemodialysis.

Level 3 (L3) – Advanced Tertiary Care

Major medical colleges offering advanced life support, ventilators, dialysis, and plasmapheresis.

24/7 Diagnostic Laboratory Readiness

Secondary facilities must provide 20-minute Whole Blood Clotting Tests (2DN8CT), urine analysis, and coagulation profiles around/ (PT-INR/APTT).



ICU and Ventilator Expansion



Dedicated Dialysis Units

Ensure functional dialysis services are available at Medical Colleges and selected District hospitals to manage acute kidney injury from hemotoxic bites.

STRATEGIC RESOURCE ALLOCATION

Prioritizing L1 and L2 Investments

Focus resources on lower-level facilities (L1 and L3) for high-impact early management and reduced burden on tertiary centers.

Rationalized ASV Supply

Use real-time tracking (radio-tagged vials) for uninterrupted ASV supply at all tiers, avoiding unnecessary administration.

VISION: ZERO PREVENTABLE SNAKEBITE DEATHS BY 2030.

- Strengthen Diagnostic Laboratory Capacity at All Secondary-Care Facilities
- Ensure the availability and 24×7 functioning of essential investigations required for snakebite diagnosis and monitoring, including:
 - Confirming the species as far as possible
 - 20-minute whole blood clotting test (20WBCT)
 - Urine analysis
 - Prothrombin time- International Normalised Ratio (PT-INR), Activated Partial Thromboplastin Time (APTT), Fibrinogen
 - Platelet count
 - Liver and kidney function tests
- Point-of-care tests where applicable:
 - Ensure Sufficient Beds with Ventilator-Supported Capacity
 - Upgrade and Expand ICU Capacity for Snakebite Case Management: Strengthen ICUs at District Hospitals/ selected Taluk Hospitals by ensuring the availability of trained staff, standardised treatment protocols, equipment for airway management, continuous monitoring, and ventilatory support, based on the finalised hub-and-spoke network.
 - Ensure Availability and Functionality of Dialysis Units: Enhance access to dialysis services at Medical colleges, District Hospitals and selected Taluk hospitals, especially for patients with hemotoxic envenoming who develop acute kidney injury.
 - Strategic prioritisation of resource allocation: Greater impact can be achieved by investing in strengthening L1 and L2 facilities, where early management can prevent complications and save more lives. Higher and tertiary-level centres are generally equipped to manage complex cases and do not require extensive additional investments in training or high-cost equipment for snakebite care. Redirecting excessive expenditure on expensive equipment and drugs at tertiary centres—often used for a limited number of advanced cases—towards lower-level facilities can prevent complications, reduce referrals, and result in significantly better overall outcomes.

Sl.No.	Requirements at Primary Health Care Centre
1	IV Fluids: Normal Saline
2	Anti-snake Venom (in domestic fridge)- The type of ASV procurement- to be determined by the availability, cost and effectiveness of the cold chain and the type of snake species (polyvalent) prevalent in the area.- at the selected Primary Health Care Centre based on risk assessment
3	Facility to give oxygen by mask, I-gel or laryngeal mask airway (LMA) for respiratory support to patients presented with respiratory distress. Support from anaesthetists in each district can be mobilised to conduct hands-on training for small groups of medical officers during monthly district conferences. These practical training sessions can be organised as focused 2-hour modules, performed before or after the regular monthly conference.)
4	Availability of basic equipment: clean, dry glass test tubes, IV sets, syringes, a Blood pressure monitor, and an AMBU Bag with a mask and airway
5	Other desirable facilities: Laryngeal tube with laryngeal mask airway, Oxygen supply
6	Availability of Essential drugs like Paracetamol, Hydrocortisone, Antihistaminics, Adrenaline, Neostigmine, Atropine, Tetanus Toxoid, Analgesics, etc.
7	Linkages for referral to Snakebite management facilities.
8	Availability of ambulatory services for transfer of snakebite victims to higher referral centres (Secondary or tertiary health care centres).

Maintain Adequate Stocks of Essential Emergency Medicines: Ensure uninterrupted availability of

emergency drugs, including ASV, adrenaline, antihistamines, corticosteroids, antiepileptics, IV fluids, vasopressors, and drugs for managing anaphylaxis.

The effective clinical management of snakebite envenoming requires a clearly defined set of preparedness standards across all tiers of the health system. Establishing uniform requirements for infrastructure, equipment, essential medicines, and human resource competencies is critical to ensuring timely stabilisation, appropriate antivenom administration, and safe patient referral. The following section delineates the minimum and desirable facility-level provisions for Primary Health Centres, Taluk/District Hospitals, and Tertiary/Medical College institutions, thereby enabling a coordinated, efficient, and evidence-based response to snakebite cases throughout the State.

Sl.No.	Requirements at Taluk/District Hospital Level
1	All Taluk/District Hospitals should have a dedicated snakebite room with a dedicated bed in the indoor area.
2	Equipment to carry out clinical and laboratory assessment, including biochemical (20 mins WBCT) and haematological measurements, ECG, and radiography.
3	Facility for transfusion of blood or fresh frozen plasma, cryoprecipitate, surgical debridement of dead tissue, dialysis, insertion of an endotracheal tube, anaesthetic bag or ventilator.
4	Availability of trained Healthcare professionals for managing snakebite (regular training of doctors, nurses, dispensers, ambulance staff). Training in the identification and early management of snakebite is essential at every facility.
5	All house surgeons during the internship are assigned duty 24 × 7 during the snake-bite season (snake-bite management should be stressed in the UG curriculum and in house surgery).
6	All newly appointed and existing Medical Officers should have hands-on training in the management of snake bites.

Establishment and Strengthening of Regional Venom Research Capacity in Kerala

In alignment with national efforts to establish Regional Venom Centres, it proposes to strengthen existing institutions with expertise in snakebite management, toxicology, and antivenom research in Kerala.

1. Conduct Region-Specific Research on Venoms of Kerala's Medically Important Snakes: This includes characterisation of inter- and intra-species venom variation, seasonal differences, and clinical correlation with envenoming patterns in the state.
2. Develop Advanced Laboratory Facilities for Venom and Toxicological Studies: Strengthen institutional capacity with state-of-the-art facilities for biochemical, proteomic, genomic, taxonomic, and toxicological analysis of snake venoms. (establishing collaborations with academic institutions, biotechnology centres, and the state forensic and wildlife departments).
3. Support Development of Region-Specific Antivenoms: Set up state-accredited venom collection centres to ethically collect, authenticate, and supply region-specific venoms of Kerala's medically important snakes. Facilitate partnerships with antivenom manufacturers to improve the formulation, potency, and efficacy of ASV, and to incorporate venoms from non-Big Four species endemic to the state into polyvalent antivenom production.
4. Efforts to develop a separate Polyvalent ASV for pit vipers, especially HNPV and MPV.

Capacity Building by Training Health Professionals

- Strengthen Existing Institutes as State Training Centres: Upgrade Government, private, and non-government institutions already engaged in snakebite management to function as formal training centres, supporting standardised, evidence-based training programmes across Kerala. Conduct workshops that emphasise confidence building and hands-on training rather than didactic lectures. The Sarpa Padam programme of the Forest Department can be used.
- Training of health professionals at all levels: Provide structured training for doctors, nurses, paramedics, pharmacists, ambulance staff, and frontline workers on appropriate snakebite

management, timely administration of ASV, management of complications, and adherence to standard treatment protocols. Customised Standard Treatment Protocols should also ensure the legal safety of Medical Officers.

- Capacity Enhancement for Primary-Level Snakebite Management: Equip PHCs, CHCs, and rural health facilities to provide initial stabilisation for snakebite patients, especially in remote and tribal areas where delays in referral are common. Emphasise early recognition, first aid, and safe transport to higher centres. Facility to provide the first dose of ASV in confirmed cases of envenomation in selected, remotely located PHCs in Kerala if needed.
- Specialised Training in Clinical Diagnosis and ASV Use: Conduct hands-on training for clinicians, nurses, and paramedics in:
 - Clinical diagnosis and syndromic identification of snakebite
 - Identification of medically important snake species (expert help may be sought in this regard)
 - Indications, dosing, and administration of antivenom
 - Recognition and management of anaphylaxis and early complications

Emphasis should be placed on team building within each institution, with clearly pre-assigned roles. Mock case scenarios should be incorporated, as they are highly effective.

- Engagement and Sensitisation of Private Sector Providers: Conduct CMEs and workshops to sensitise private hospitals, clinics, and practitioners on state-specific snakebite management guidelines, notification norms, and referral protocols.
- Intersectoral Training with Veterinary Professionals facilitates joint training programmes for health and veterinary professionals to improve coordination in managing snakebite in both humans and animals (in rural and agricultural regions).
- Training of Laboratory Professionals: Build capacity of laboratory staff to correctly perform and interpret snakebite-related diagnostic tests (20WBCT, clotting times, renal and liver panels, electrolytes).
- Emergency and Life-Support Skills Training: Conduct Basic Life Support (BLS) and airway management training for doctors, nurses, and paramedics.
- Modular Training for PHC and CHC Medical Officers: Implement a six-module curriculum covering:
 - Snake species identification and preventive aspects
 - Signs and symptoms of envenoming
 - Treatment protocols and management of complications
 - Policy, legislation, and compensation schemes related to snakebite (the Forest Department already has a compensation scheme for human death or injury, and the Animal Husbandry Department has a scheme for compensating loss of livestock).
 - Referral pathways and documentation
 - Community engagement and first-aid messaging
- Training of Pharmacists and Nurses in ASV Infusion Practices provides practical training in safe ASV reconstitution, infusion techniques, monitoring for reactions, and stabilisation during transit to higher centres.
- Training on Snakebite Surveillance and Notification: Build the capacity of health workers and facility staff to report snakebite cases and deaths accurately—through notification procedures on e-Health/IDSP/IHIP platforms and adherence to mandatory reporting systems.

Public-Private Partnership

Engagement with professional organisations such as IMA, IAP, Public professional bodies, NGOs, and civil society for undertaking activities related to Snakebite, research, organising Continued Medical Education programs, and conducting plenary sessions on scientific updates on Snakebite.

Inter-sectoral Coordination

Effective snakebite prevention and control could be achieved through the active involvement of Vaccine Manufacturers, the Wildlife sector, tribal and rural populations, KVKs, PRI, and community engagement. Joint Training/Sensitisation workshop of District level Medical/ Veterinary Department on Snakebite and Joint gap analysis for formulation of Action Plan for Prevention and Management of Snakebite. Feedback and suggestions from periphery health workers are also important.

CLINICAL MANAGEMENT & REFERRAL

The clinical management and referral of snakebite envenoming (SBE) are time-critical processes that begin with pre-hospital care.

Pre-Hospital Care and First Aid

Timely pre-hospital care involves appropriate first aid and rapid transport to the nearest possible health centre. Deficiencies in these components can significantly increase the risk of death or disability. First-aid should prioritise reassuring the victim. In resource-poor settings, the recommended first-aid measure is to immobilise the victim, particularly the bitten limb, using a splint. All tight encircling objects in the bitten area or limb should be removed, as swelling will make removal difficult later. Cutting the wound and sucking blood (wound incision) should be forbidden, as it may lead to wound infection, increased swelling, significant bleeding, or even envenoming in cases of mouth abrasions from those sucking the bite site. The wound/bite mark area should not be touched or washed, as rubbing the skin can potentially accentuate systemic venom absorption and exacerbate local tissue damage. Effective pre-hospital care also includes ambulance transport.

Hospital Management and Diagnosis

Upon arrival at the health facility, all snakebite patients must be triaged for at least 24 hours. The initial step is a rapid primary survey to identify critically ill patients who present with a compromised airway, respiratory failure, shock, or cardiac arrest. Critically ill patients must be resuscitated, stabilised, and promptly administered antivenom after looking for evidence of envenoming.

For stable patients, a complete history is collected, including the site, circumstances, and timing of the bite. A focused physical examination is performed to assess for signs of local and/or systemic envenoming, and a baseline 20-minute Whole Blood Clotting Test (20WBCT) is performed. The clinical features are compared against species-specific syndromes to infer the likely biting species. In the absence of clinical and laboratory evidence of envenoming upon presentation, the patient is examined for signs and symptoms at 2, 6, 12, and 24 hours, with the 20WBCT repeated at 6, 12, and 24 hours, or until evidence of envenoming is noted.

In cases with evidence of systemic envenoming and rapidly progressive local swelling, Indian poly-specific antivenom is administered, except where there is clear evidence that the likely biting species' venom cannot be neutralised.

Referral

The majority of snake-bite envenomation deaths and catastrophic consequences can be avoided through timely transport and referral to a facility where safe and effective antivenoms are promptly available.

PREVENTION, COMMUNITY ENGAGEMENT AND AWARENESS

Kerala's diverse ecological landscape and high human–snake interface require a multi-pronged strategy involving schools, households, local self-governments, and digital platforms. The following interventions

aim to strengthen community-level knowledge and promote safer behaviours.

Key Activities for Strengthening Prevention and Community Awareness:

1. Increasing Community Awareness on Snakebite Prevention and Early Care-Seeking

- Conduct widespread community sensitisation campaigns on snakebite risks, first-aid dos and don'ts, signs of envenoming, and the importance of reaching a health facility without delay.
- Use culturally appropriate IEC materials in Malayalam through OPDs, CHCs, schools, Anganwadis, Kudumbashree groups, farmer collectives, and tribal settlements.
- Aligning community-based preventive measures with the pre-monsoon vector control programmes
- Establish a structured community volunteer network to strengthen grassroots-level awareness, early recognition of snakebite, and timely referral of victims to standard treatment centres (trained Kudumbashree members, ASHAs, MLSPs, youth club members, and accredited local volunteers). Volunteers will be trained in safe first-aid practices, syndromic identification, correct referral pathways, and risk communication, enabling them to provide immediate guidance to households during snakebite events.
- They will support community education through door-to-door visits, school sessions, agriculture-group meetings, and local campaigns. The network will coordinate closely with PHCs/CHCs, the District Snakebite Committee, and the 24×7 Snakebite Helpline to ensure that victims are promptly transported to designated SBE treatment centres, especially in high-risk, remote, and tribal areas.
- Sensitisation of government policymakers, health professionals and frontline health workers at various levels and partners on Snakebite management and treatment.
- Developing IEC materials in Malayalam, Hindi, and English.
- Dissemination of IEC through Audio-Visual print Media, community Radio, Nukkad natak and through engagement with currently active NGOs in the sector
- Mass Media and Interpersonal Communication
- Setting up a 24×7 snakebite helpline to answer queries related to snakes and snakebite.
- Educating traditional healers and addressing myths to engage the communities through outreach programmes and PRIs

2. Behaviour Change Communication (BCC) Campaigns

- Launch state-wide BCC campaigns promoting safe practices such as the use of footwear, the use of torches at night, the use of headlamps in plantations, safe storage of grains/firewood, and the avoidance of harmful traditional remedies.
- Utilise storytelling, folk media, local influencers, and social media platforms to reinforce messages.
- Conduct focused campaigns before the monsoon and agricultural seasons when bite incidence is higher.

3. Community-Based Programmes – Sarpa Paadam & Sarpa Rakshak

- Expand *Sarpa Paadam* modules focusing on prevention, first aid, and safe rescue practices, targeting school children, farmers, Kudumbashree groups, and Community Volunteers.
- Strengthen the *Sarpa Rakshak* volunteer network for safe snake handling, awareness sessions, and rapid rescue to prevent retaliatory killing of snakes.
- Provide structured training, certification, and safety gear for accredited volunteers.

4. Integration of Snakebite Education in School Curriculum

- Integrate basic snake ecology, safety measures, first aid, and appropriate care-seeking behaviour into school health programmes and textbooks.
 - Organise interactive 'Snake Safety' sessions, quizzes, and demonstrations led by trained Sarpa Mitras, health educators, and Forest Department experts.
- Ensure availability of IEC posters and safety instructions in all schools and hostels, especially in high-risk rural and forest-fringe areas.

5. School and Anganwadi Safety Initiatives

- Conduct periodic safety audits of school premises and anganwadi centres, ensuring removal of hiding spots, proper compound lighting, and clearing thick vegetation.

- Sensitise teachers, anganwadi workers, and school management committees on prevention, early recognition of envenoming, and emergency referral steps.
 - Include snakebite education sessions during PTA meetings.
- 6. Village-Level Planning through Local Self-Government (LSGD)**
- Integrate snakebite prevention into Panchayat-level annual action plans.
 - Mobilise ward health & sanitation committees for community walks, home visits, clearing vegetation near houses, rodent control, and safe sanitation practices.
 - Support LSGDs to budget for torches, foot protection gear (Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) workers, farmers, plantation workers) and display of risk-zone signboards and signage.
 - Do's and Don'ts of snakebite boards may be developed in English and Malayalam, and exhibited in LSG institution offices, schools, PHCs and public offices.
- 7. Promotion of Personal Protective Equipment (PPE)**
- Promote the use of protective footwear, gloves, head-lamps and torches among farmers, plantation workers, MGNREGA workers, forest-dependent communities, and migrant labourers.
 - Encourage employer-supported PPE distribution in plantations, factories, construction sites, and tea/rubber estates.
 - Include PPE demonstrations in community awareness sessions and health camps.
- 8. Digital Platforms for Prevention and Awareness – SARPA App and Other Tools**
- Promote the app through schools, Panchayats, and health facilities to improve awareness and reduce human–snake conflict.
 - for public reporting of snake sightings, rescues, and risk hotspots.
 - Integrate bite alerts, educational videos, and first-aid guidance into the app interface.
 - Encourage the use of digital IEC at Hospitals, railway stations, and bus stands.
- 9. Targeted Outreach in High-Risk and Vulnerable Areas**
- Conduct special IEC drives in tribal settlements, forest fringes, coastal belts, and agricultural clusters.
 - Use mobile health units, community radio, panchayat-level WhatsApp groups, and local influencers to disseminate timely warnings and preventive messages.
 - Engage LSGDs to maintain seasonal “snake safety preparedness plans” in high-incidence panchayats.



Chapter 5

Strategies for School and Anganwadi Safety for Prevention and Management of Snakebite (*Based on Government of Kerala Circular on School Safety and Snakebite Management*)

In compliance with High Court directions and interdepartmental consultations, the Government of Kerala issued detailed guidelines to standardise preventive, preparedness, and emergency response measures for snakebite incidents in public, aided, and unaided schools, and Anganwadi centres.

General Safety Requirements for Schools and Anganwadis (All institutions must treat the Ministry of Education and NCPCR school-safety manuals as foundational reference documents).

- Every school must conduct a comprehensive safety audit of its infrastructure, including classrooms, playgrounds, toilets, electrical wiring, boundary walls, and any structural hazards such as pits, exposed wiring, vegetation overgrowth, or stagnant water.
- These hazards must be promptly addressed to reduce wildlife and snakebite risks.
- Schools and Anganwadis must maintain a well-equipped first-aid room or designated space, with up-to-date kits and at least two staff trained in basic first aid and CPR.
- Emergency contact details, including nearby government and private hospitals, public health officials, and ambulance services, must be prominently displayed on the premises.
- A Child Emergency Medical Response Plan must be prepared and displayed in each institution, with clear steps to be followed in a medical emergency, including snakebite.
- Institutions must coordinate with the nearest PHC/Taluk Hospital to ensure knowledge of the nearest ASV-available hospital, paediatric emergency care, and referral pathways.
- Schools must also identify and liaise with authorised snake handlers through the Forest Department for emergency removal of snakes from premises.
- Regular inspections of entry points for snakes or reptiles should be conducted, and any found should be sealed accordingly.

Environmental and Structural Preparedness

- Garbage, food waste, and overgrowth attract rodents, which, in turn, bring snakes onto school premises. Schools must ensure quarterly cleaning of premises, particularly before the monsoon and immediately before reopening each academic year.
- Local Self-Government Institutions (LSGIs) are responsible for supporting this process through routine monitoring and vegetation removal.
- Structures such as compound walls, doors, windows, storage areas, playground edges, and potential hiding spots (e.g., stacked materials) must be secured.
- Shoes and bags should not be left unattended outside classrooms.
- Students must be encouraged to use only designated walkways and avoid thick vegetation or abandoned areas.
- Premises must be inspected for burrows, holes, and any structural gaps that could allow snake entry, and these should be sealed immediately.
- For anganwadis, special attention must be given to clearing vegetation near play areas, fencing wells, proper waste disposal, and ensuring clean, well-lit, child-safe environments.

Student, Staff, and Institutional Capacity Building

- Schools must conduct regular education sessions for students, teachers, anganwadi workers, and non-teaching staff on snakebite risks, identifying common snakes, safe behaviour, and early signs of envenoming.

- Sensitisation programmes, mock drills, and periodic awareness drives should be implemented and supported by the Forest Department, the Health Department, and the Local Bodies.
- The Forest Department conducts two major programmes:
 - Sarpa rakshak – safety checks for the presence of venomous snakes before reopening.
 - Sarpa Paadam – structured awareness modules, delivered annually across educational institutions by trained SARPA Educators using standardised presentations.
- Incorporation of snakebite prevention into the school curriculum and NCC training materials.

Emergency Preparedness and Response

- Staff must be trained to:
 - Keep the victim calm and reassured, immobilise the limb without compromising arterial flow
 - move the victim to safety
 - Keep the bitten limb dependent
 - Avoid giving food, drinks, or medications.
 - Arrange immediate transportation, and restrain the victim from running or walking long distances.
 - Recognise early warning symptoms such as ptosis, breathing difficulties, progression of swelling or bleeding manifestations.
- Schools must coordinate with ambulance services (108) and maintain contact details of standby vehicles when ambulances are unavailable.
- Mock drills should be held biannually with participation from LSGD, Health, Forest, and Education Departments.
- Institutions must maintain updated lists of hospitals with ASV stock and ensure staff are aware of referral centres.
- Emphasises familiarity with SARPA and other Apps that assist with identification and safe rescue procedures.

Collaboration with Departments and Community Stakeholders

- Forest & Wildlife Department identifies wildlife risks, seals snake entry points, and provides access to certified snake handlers (*Guidelines for the rescue and release of snakes from humans*, available at: <https://forest.kerala.gov.in/images/flash/whatsnew/guidelineswlv.pdf>).
- The Health Department ensures the availability of ASV in hospitals, trains school staff in first aid, and supports emergency referral planning.
- The Local Self Government Department oversees structural fitness inspections, the removal of hazardous trees, fencing, electrical safety, and sanitation.
- Including snakebite Risk assessment in the checklist.
- School Safety Monitoring Committees (including PTA, ward members, managers, and representatives from Forest, LSGD, and Health) continuously monitor safety and certify the school during annual fitness assessments.

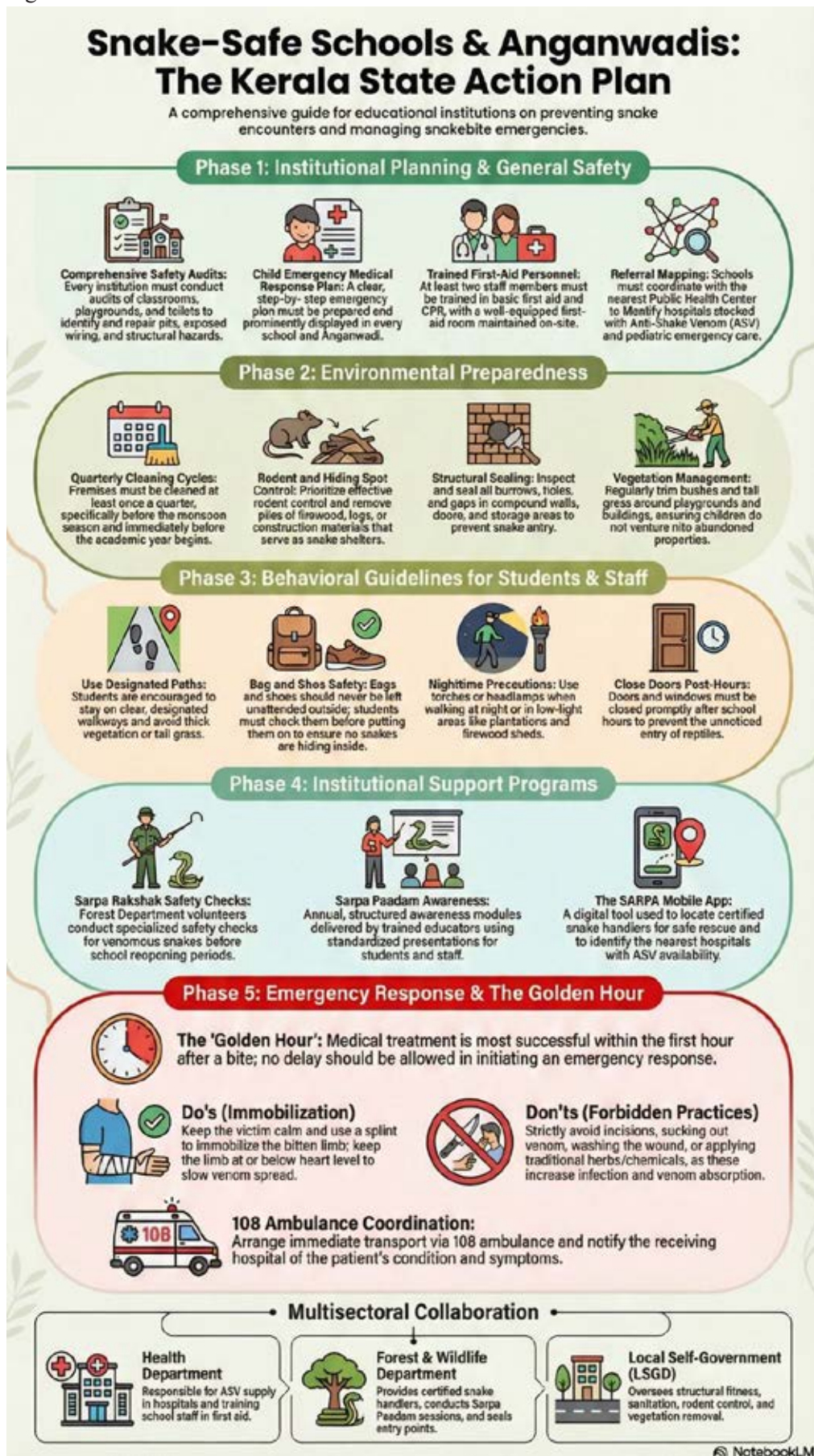
Post-Event Actions After a Snakebite Incident

- Verify bite marks (noting that krait bites may have no visible marks).
- Immobilise the affected limb with splints without compromising arterial flow.
- Ensure the victim is transported lying down.
- Avoid harmful practices such as incisions, suction, washing the wound, or applying chemicals, herbs, or “black stones,” which increase venom absorption and the risk of infection.
- Contact the nearest health facility and inform the doctors of any symptom updates during transport.

Surveillance and Reporting

- Schools and Anganwadis must immediately report snake sightings, entry points, or environmental risks.
- Institutions should integrate reporting with the State’s snakebite notification system, once operational.

- The School Safety Monitoring Committee must oversee routine inspections, document risks, and ensure regular submission of surveillance checklists.



Chapter 6

Strategies for Animal and Agriculture Health Sector

Snakebite envenoming poses a significant but often under-recognised risk to livestock, agricultural workers, and rural livelihoods in Kerala. The close interaction among humans, domestic animals, wildlife, and agricultural landscapes—particularly in paddy fields, plantations, forest-fringe areas, and coastal zones—increases the likelihood of snake–human and snake–animal encounters. Loss of livestock due to snakebite results in substantial economic hardship for farming households, while agricultural practices influence snake habitats and movement patterns.

Ensuring Provision of Anti-Snake Venom at All Veterinary Facilities

- Ensure the availability of adequately trained veterinary personnel across Kerala's Veterinary Hospitals, Dispensaries and Mobile Units for correct snakebite management and ASV administration.
- Maintain uninterrupted ASV supply at district, block, and rural veterinary centres, with regular monitoring of stock levels through the Kerala Animal Husbandry Department.
- Upgrade cold-chain infrastructure at veterinary institutions to safely store ASV at appropriate temperatures.

Prevention of Snakebites in Livestock

- Kerala's Agriculture and Animal Husbandry Departments should identify livestock risk zones, particularly near forest fringes, wetlands, paddy fields, and grazing areas.
- Display signage on preventive steps, first aid, and emergency contacts.
- Create physical and natural barriers around cattle sheds, goat farms, and poultry units to minimise direct contact between snakes and animals.
- Ensure availability of polyvalent ASV at Veterinary Hospitals and Dispensaries, with appropriate storage.
- Provide continued training to field veterinarians and para-veterinary staff.

Strengthening Emergency Care Services at District & Block Levels

- Strengthen Mobile Veterinary Units (MVUs) across Kerala to provide timely snakebite emergency services in animals, ensuring ASV availability in MVUs operating in remote and tribal areas.
- Enhance Veterinary Hospitals and MVUs with basic diagnostic tools and emergency treatment facilities to manage animal envenomation.

Capacity Building for Veterinary and Agriculture Professionals

- Provide structured training to Fisheries, Veterinary, and Agriculture professionals on snakebite management, antivenom administration, and related technical aspects.
- Strengthen first-contact veterinary care in rural and tribal regions where immediate transport to higher veterinary centres may not always be possible.
- Train Veterinary Doctors, Paravets, Gopal Mitras, and Pashu Sakhis in snake identification, early clinical diagnosis, and indications/practicalities of antivenom administration.
- Sensitise private veterinary practitioners through CMEs, workshops, and programmes led by Kerala Veterinary Universities and field institutes.
- Facilitate joint training for Health and Veterinary professionals on operational aspects of managing snakebite in both humans and animals.
- Strengthening training on surveillance and reporting of snakebite cases and deaths in livestock.

Information, Education & Communication for Animal Owners

- Through Kerala's Animal Husbandry Department, Veterinary Universities, and KVKs, sensitise animal owners on local snake species, their habitats, seasonal activity, and early recognition of snakebite in livestock.
- Ensure regular monitoring of animal sheds for snake entry, rodent presence, and holes by the State Animal Husbandry and Agriculture Departments.
- Ensure routine clearing of grass, low shrubs, and thick vegetation around barns and cattle sheds through Agriculture Department initiatives.
- Undertake community outreach and develop IEC materials.

Strengthening Surveillance of Snakebite Cases and Deaths in Animals

- Establish systematic surveillance under the Animal Husbandry Department to:
 - Determine the state-level snakebite situation in livestock.
 - Monitor progress and impact of interventions.
 - Provide data to manage potential human exposures arising from animal-snake encounters.
 - Support cost-effectiveness assessments for livestock snakebite control.

Production and Use of Anti-Snake Venom for Animals

- Ensure adequate supply and state-level planning for antivenom production and distribution for livestock and companion animals.
- Provide training through KVKs and the Animal Husbandry Department on correct intravenous administration of rehydrated antivenin, considering symptom severity, snake species, and animal size.

Chapter 7

Strategies for Wildlife and Forest Sector

Kerala's unique ecological landscape, characterised by dense forests, the Western Ghats, plantation belts, and extensive forest-human interface areas, places the Wildlife and Forest Department at the centre of snakebite envenoming prevention and control. Frequent interactions between humans and snakes occur in forest fringes, tribal settlements, plantations, eco-tourism zones, and wildlife corridors, increasing the risk of snakebite while also posing conservation challenges.

The strategies emphasise community awareness, ecological research, safe snake rescue and relocation, and coordination with the Health and Animal Husbandry sectors for emergency response and antivenom access. Anchored in a One Health approach, these interventions aim to protect both human life and biodiversity, while strengthening Kerala's capacity to prevent and manage snakebite envenoming in forest and wildlife landscapes.

Education and Awareness

- The Forest & Wildlife Department should conduct dedicated awareness campaigns in communities located near Kerala's forest fringes, hilly terrains, plantation belts, and high-risk rural zones.
- Key messages include maintaining distance from snakes, avoiding handling or provoking them, staying on designated trails, taking care when climbing or collecting firewood, avoiding tall grass and leaf piles, and wearing proper footwear, especially at night.
- Emphasise coexistence and habitat protection to reduce long-term human snake conflict.
- Awareness at ecotourism destinations, pilgrim routes and passages, etc.

Antivenom Distribution Support

- In remote, forest-adjacent, or tribal regions where human access is limited, the Forest Department may coordinate with the Health Department to improve access to ASV at PHCs/CHCs and support last-mile distribution.
- Forest frontline staff can provide basic first-aid guidance during emergencies when immediate access to a health facility is limited.
- An updated list of hospitals with ASV administration facilities is to be made available/shared through mobile apps like SARPA.

Strengthening Key Stakeholders

- Introduce interdisciplinary approaches for capacity building, involving Health, Veterinary, Panchayats, Forest Department, and local community networks.
- Engage local communities in reporting snake sightings, supporting first aid, and assisting in the safe and timely transport of snakebite victims to treatment facilities.

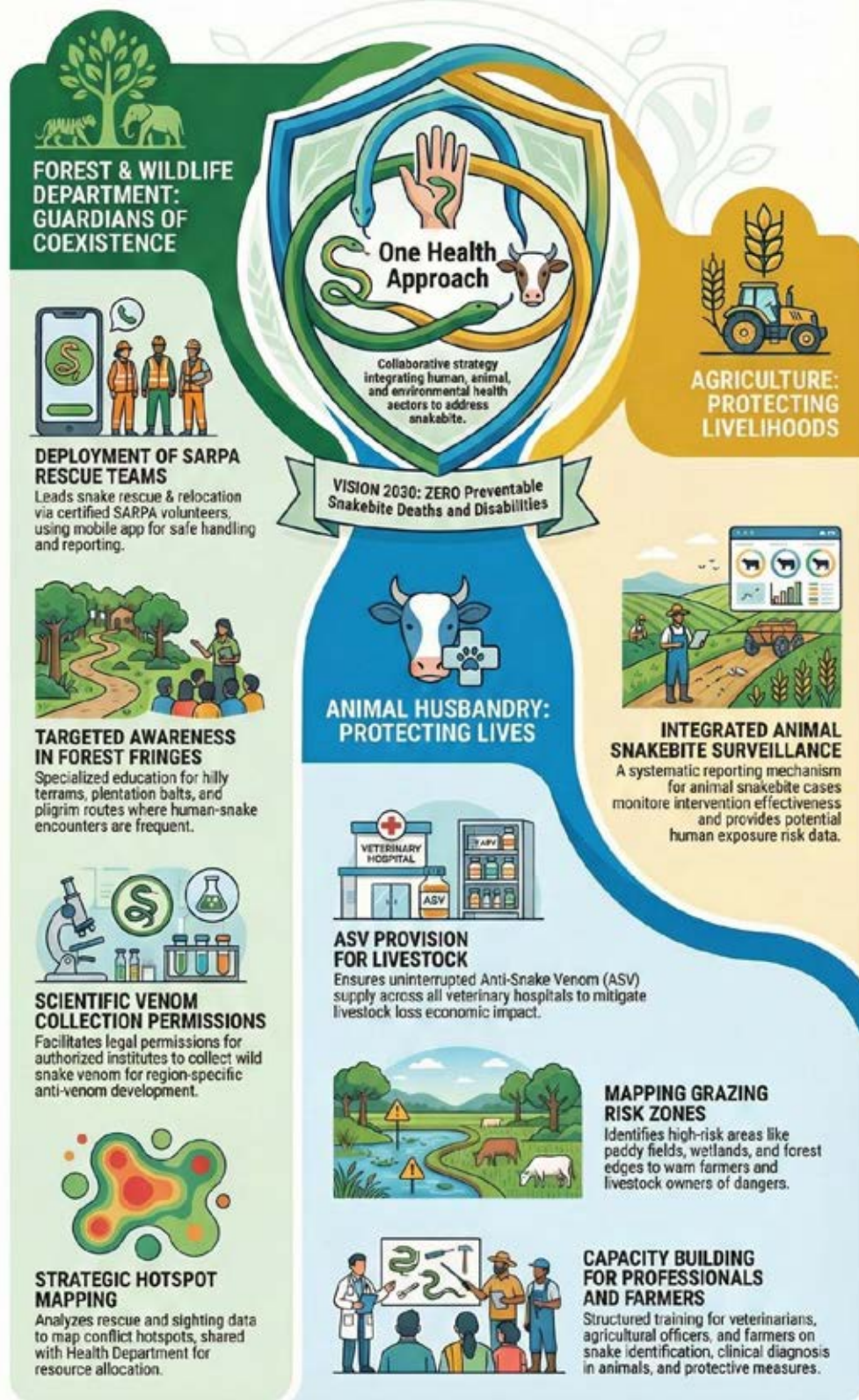
Systematic Research and Monitoring

- Kerala Forest Department may support ecological research on regional snake species (behaviour, movement patterns, and habitat)
- Research models such as radiotelemetry and field ecology studies can provide insights into snake biology relevant to Kerala's forest landscapes.

Snake Venom Collection and Safe Relocation

- Permit authorised research institutes to conduct venom collection from wild snakes in Kerala as per state norms to support regional antivenom development.
- Lead snake rescue and relocation operations through certified SARPA volunteers, ensuring safe handling and reporting of snake sightings.
- Exploring the integration of snakebite reports into the SARPA app as well.

A One Health Shield: Stakeholder Roles in Kerala's Snakebite Action Plan (SAPSE)



NotebookLM

Chapter 8

Role of other Stakeholders in The State Action Plan for Prevention & Control of Snakebite Envenoming (SAPSE), Kerala

The prevention and control of snakebite envenoming in Kerala requires the active participation of multiple sectors working in a coordinated manner. As snakebite is influenced by ecological, occupational, social, and health system factors, no single department can address the challenge in isolation. A multisectoral and collaborative approach is therefore fundamental to achieving Kerala's vision of zero snakebite deaths by 2030.

Effective implementation of SAPSE depends on strong engagement from health services, local self-governments, forest and wildlife authorities, animal husbandry and agriculture departments, education institutions, and community networks. Each stakeholder contributes uniquely to strengthening preparedness, improving access to timely care, enhancing surveillance, promoting community awareness, and fostering safer human–snake coexistence. Through this collective effort, Kerala aims to build a resilient, integrated system capable of reducing both mortality and morbidity associated with snakebite envenoming.

Major stakeholders of Kerala's Snakebite Prevention and Control Programme include:

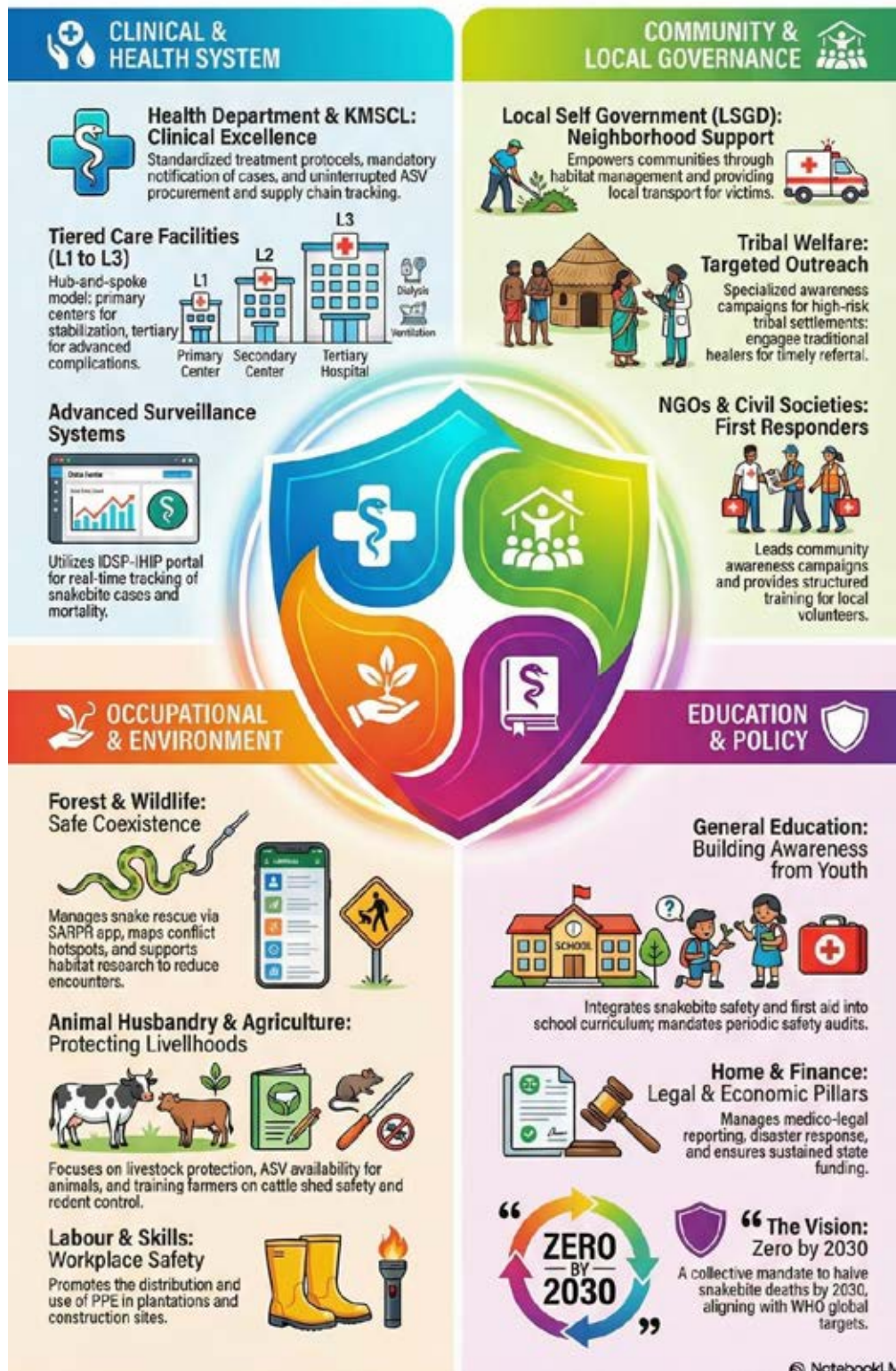
1. Department of Health & Family Welfare, Government of Kerala

Key State Stakeholders:

- Directorate of Health Services (DHS)- State Surveillance Unit (SSU)
 - National Health Mission (NHM) Kerala
 - Directorate of Medical Education (DME)
 - Kerala Medical Services Corporation Ltd. (KMSCL) – Drug Procurement
 - State IEC division
 - District Medical Officers (H)
 - Public health facilities from PHC to Medical College level
2. Department of Tribal Welfare, Government of Kerala
 3. Department of Agriculture Development & Farmers' Welfare, Kerala
 4. Department of Forest & Wildlife, Kerala
 5. Local Self Government Department (LSGD)
 6. Department of Animal Husbandry, Kerala
 7. Department of General Education, Kerala (Schools/Anganwadi/CBSE/ICSE recognition bodies)
 8. State Disaster Management Authority
 9. KMSCL and ASV suppliers
 10. Department of Labour & Skills, Kerala
 11. State Revenue Department
 12. Home Department (Police, Disaster Management)
 13. State Planning Board
 14. Non-Governmental Organisations and Civil Societies

A UNIFIED SHIELD: STAKEHOLDER ROLES IN KERALA'S ACTION PLAN FOR SNAKEBITE ENVENOMING (SAPSE)

Goal: To illustrate how diverse government departments and civil sectors collaborate under a "One Health" framework to achieve Kerala's goal of zero preventable snakebite deaths and disabilities by 2030.



Role of the Health Department

- Advocacy with all stakeholders to prioritise snakebite envenoming across the state and ensure resource

mobilisation.

- Ensure accessibility and rapid availability of treatment for snakebite victims at all levels of care.
- Capacity building and training of medical, nursing, paramedical and frontline teams on appropriate snakebite management.
- Develop and disseminate standard IEC materials statewide.
- Strengthen data systems for snakebite (cases, antivenom consumption, outcomes) and ensure analysis and sharing with other departments.
- Strengthen Public–Private Partnerships through engagement with IMA, IAP, professional bodies, NGOs, and community organisations.
- Strengthen intersectoral coordination with Animal Husbandry, Agriculture, LSGD, Tribal Welfare, and Forest Departments.
- Regularly update technical guidelines for clinical management.
- Monitor and evaluate snakebite prevention and control activities at the district/state levels.
- Support venomics and anti-venomics Research.
- Develop and approve a detailed and customised ‘Snakebite Treatment Protocol for Kerala’.
- Follow up with some random victims after treatment, regarding any prolonged effects of snakebite.
- Coordinate with the Forest. Environment and Climate change, and the Animal husbandry departments, on the one-health approach to SBE

Role of the Department of Animal Husbandry & Agriculture

- Advocacy for prioritising snakebite prevention to reduce livestock mortality.
- Mapping high-, medium-, and low-risk livestock zones with the Health Department.
- Ensure uninterrupted logistics (manpower, medicines, ASV for animals).
- Capacity building for Veterinary Surgeons, Paravets, Agriculture Officers, and extension staff.
- Develop standard IEC materials for farmers and livestock owners.
- Promote intersectoral information sharing across health, wildlife, and agriculture systems.
- Explore linking state livestock databases with the snakebite surveillance system when relevant.
- Publish and update technical guidelines for snakebite in animals.
- Coordinate operational research with Kerala Veterinary and Agriculture Universities.
- Integrate snakebite management into veterinary and agriculture curricula.

Role of Forest & Wildlife Department

- Organise awareness campaigns for communities living near forest fringes, hills, and plantation belts.
- Educate at-risk communities on how to identify venomous vs non-venomous snakes.
- Conduct behavioural and habitat studies of Kerala’s medically important snakes.
- Facilitate permissions for venom collection for antivenom research.
- Guide the formation of authorised Snake Rescue Teams (such as SARPA).
- Train wildlife officers, rangers, rescue teams, and volunteers in safe handling of venomous snakes.
- Map conflict hotspots using yearly snake rescue and sighting data. This data can be shared with the Health Department’s Snakebite portal.
- Collaborate with universities and NGOs on species distribution mapping.
- Enforce protection of snake species under the Wildlife Protection Act.
- Issue alerts on illegal snake trade and coordinate enforcement with the Police.
- Conduct snake rescue operations from human settlements statewide.

Role of Panchayati Raj Institutions

- Engage and empower communities to prevent and manage snakebite.
- Form village-level committees to address snakebite-related risks and awareness needs.
- Work with PHC/CHC to strengthen rural health infrastructure.

- Support local ambulance or alternative transport in remote areas.
- Ensure monitoring, accountability, and progress tracking at ward and panchayat levels.
- Strengthen multi-sectoral collaboration between Health, Animal Husbandry, Forest Department, and NGOs.
- Immediately notify animal health and human health departments of snakebite cases.
- Ensure victims receive complete medical treatment and follow-up.
- Maintain ward-level snakebite registers for human and animal cases.
- Convene Gram Sabhas to inform communities and mobilise preventive actions.
- Provide PRI capacity building on snakebite prevention and control.
- Create and support a trained Volunteer network to rescue snakes, raise community awareness, and facilitate victims in receiving appropriate care in the event of bites.
- Provide safety precautions to MGNREGS – similar workers.

Role of the Department of Tribal Welfare

- Conduct targeted awareness programmes and IEC dissemination for tribal communities.
- Educate tribal households on snake identification and prevention.
- Support the development of tribal-specific training modules for health personnel.
- Ensure timely medical care and referral for tribal snakebite victims.
- Monitor activities implemented under SAPSE in tribal-dominated blocks.
- Engage traditional healers to address myths and encourage timely medical treatment.

Role of the Department of General Education

- Include modules on snakes and snakebite safety within Kerala's school curriculum.
- Conduct regular awareness programmes/Interactive games in public, aided, unaided, and residential schools (including Anganwadis).
- Implement safety protocols at the school and conduct periodic supervision using a checklist.

Role of KMSCL /ASV Supply Chain

- Ensure regular antivenom procurement and uninterrupted supply in Kerala.
- Facilitate affordable access to ASV, especially for rural and tribal populations.
- Support research and development for region-specific ASV, including for HNPV.
- Strengthen production of geographically relevant ASV through authorised manufacturers.

Role of the Department of Labour & Skills

- Promote workplace snakebite prevention measures for agricultural, plantation, forest, construction, and industrial workers.
- Facilitate compensation and rehabilitation for affected workers.
- Raise awareness on snakebite prevention in workplaces.
- Provide IEC for high-risk occupational groups.
- Distribute snakebite prevention kits (gumboots, torches, gloves) in high-risk sectors.

Role of the Department of Finance & Revenue

- Ensure adequate state-level funding for SAP-SE implementation.
- Allocate contingency funds for high-burden snakebite areas.
- Support financing for ASV supply chain, training, and IEC programmes.
- Revenue Department to support relief measures, including treatment costs and wage-loss support for victims.
- Share snakebite death data with the health department for surveillance.

Role of Home Department (Police & Disaster Management)

Police Department:

- Ensure medico-legal reporting of snakebite cases in accordance with legal requirements.
- Assist in cases involving protected species, illegal trade, and smuggling.
- Support hospitals in the medico-legal aspects of snakebite cases.

Disaster Management:

- Integrate snakebite prevention into disaster preparedness plans.
- Ensure ASV and medical logistics during floods, cyclones, and other emergencies.
- Support mitigation and response measures during disaster-related snakebite spikes.

Role of State Planning Board

- Integrate snakebite priorities into state development programmes.
- Monitor and evaluate SAPSE implementation.
- Support research collaborations, resource mobilisation, and policy innovations.

Role of NGOs & Civil Societies

- Establish a district-level coordination committee comprising the Health, Forest, Agriculture, Local Self Government, and Veterinary departments, along with active NGOs.
- Create a unified district action plan that integrates NGO activities with government-led snakebite prevention and response strategies.
- Facilitate joint field activities, including community awareness programs, school campaigns, and training sessions for frontline workers.
- Ensure standardised IEC materials and training modules across all partners to ensure uniform messaging.
- Enable two-way information flow by sharing surveillance data, incident reports, and best practices between district officials and NGOs.
- Conduct periodic joint evaluations, including field verification, to assess programme effectiveness and guide improvements.

Chapter 9

The Surveillance of Prevention and Control of Snakebite

Components of Surveillance System

The surveillance system for Snakebite, envenoming cases and deaths in humans/animals and wildlife will have the following components:

Sl. No	Components of Surveillance System	Snakebite Envenoming
1.	Priority events/ Data Parameters	• Surveillance of Snakebites in Humans • Surveillance of deaths due to Snakebite envenoming (Suspected and Confirmed) • Surveillance to estimate coverage of Anti-Snake Venom • Surveillance on the shortage of Anti-Snake Venom • Surveillance on Transport and referral centres
2.	Data nodes/Data generation points	For Snakebites and ASV coverage – Snakebite management facilities at PHC/Block level to be sent to the District Hospitals/Medical Colleges, Pvt. Health Facilities
3.	Responsible officers	• Ward level-ASHA/JHI/ANM/AWW • PHC/FHC- Medical Officer • Block-Block Level Medical Officer • District- Designated District Nodal Officers, Nodal officers of Tertiary care institutions • State – SNO, Snakebite Prevention and Control
4.	Recording and Reporting Mechanism	• Snakebite management register • S and P form of IDSP/IHIP Portal • Monthly reporting format for Health Facility • Mobile app for laymen to know the status of availability of ASV, Infrastructure and staff available in the centre.
5.	Monitoring and Evaluation	• The surveillance system will be monitored for timeliness, Completeness, and the usefulness of the data. • For evaluation, the monthly conference should check the use of ASV, cases treated, and cases that occurred.
6.	Data Sharing and Intersectoral Coordination	• The human health sector will periodically share the analysed reports (time, place & person) on snakebite incidents and deaths with the respective veterinary and wildlife departments to take appropriate action, and vice versa.
8.	Infrastructure and logistics	• Ensuring the availability of ambulance services for snakebite cases • Ensuring the availability of laboratory tests required for the diagnosis of Snakebite, such as 20 minutes Whole blood clotting test, urine analysis, Prothrombin time, platelet count, clot retraction time, the facility to collect a blood sample from the first IV

		canulation, and the sample should be sent to the higher centre once the person is stabilised OR first step ASV is given. • Ensure adequate availability of essential resuscitation equipment and emergency drugs at peripheral health facilities, with particular focus on respiratory stabilisation. This includes provision for consumable airway devices such as LMA and i-gel, capacity building of Medical Officers in their use, and decentralised procurement mechanisms enabling Medical Officers to stock and replenish these critical emergency supplies at the user level. • Ensuring the availability of beds with mechanical supported ventilation units • Human and infrastructural resource strengthening in ICUs treating snakebite in the public health system • Strengthening and ensuring the availability of the dialysis Unit • Ensuring the availability of emergency medicines • Ensuring appropriate management and referral for Snakebite cases • Establish a 24×7 snakebite helpline leveraging both government machinery and expert social platforms to address public and clinical queries related to snakes and snakebite.
9.	Information, Education and Communication	• Strengthen Information, Education and Communication (IEC) strategies to actively counter misinformation on snakebite management, discourage patients from seeking care from unqualified practitioners and unscientific traditional healers, and promote timely access to appropriate medical treatment. This requires a clear policy framework with strict regulatory and punitive measures against individuals or groups who spread misleading information, practise quackery, or conduct snake-handling shows that endanger public health.

Ø The surveillance of prevention and control of snakebite includes Clinical/Physical Surveillance as per the standard guidelines by the Department of Health and Family Welfare, Kerala, and the MoHFW.

Ø Recording and reporting of every case of Snakebite cases and deaths occurring in the community is an essential step for maintaining the surveillance, and it will be undertaken through the existing IDSP/IHIP portal and the Programme division at the National level.

Ø Following records and reporting formats should be available at the snakebite management facility:

1. Snakebite exposure register
2. Monthly Reporting format
3. Line List Format for confirmed cases and Deaths

Reports should be counterchecked against other documents, such as emergency drug use records, lab test results, and equipment use records. Kerala facilities will ensure the availability of all these formats through DHS/NHM Kerala for uniform state-wide reporting.

Recommended Case Definition for Snakebite Surveillance

- Standard case definitions for Snakebite:
- Snakebite surveillance under Prevention and control of Snakebite envenoming and the Integrated Disease Surveillance Programme (IDSP) is of three types.
 - A Suspect Case must be reported by a health care worker in the S Form.
 - Probable Case has to be reported by the medical officer in P form to enable systematic review, rational use of ASV, and evidence-based corrective measures.

The definitions are as follows: - Suspected Snakebite case-

- **Definition:** History of Snakebite reported by the victim themselves or by accompanying persons in the reporting period. All reported snakebite cases should include follow-up details, particularly patient outcomes. (To be reported in S form by Health worker)
- **Probable Snakebite case**
- History of snakebite* reported by the victim themselves or accompanied individual in reporting period with clinical features# suggestive of snakebite or systemic envenoming.
- **Exposure** is defined as a history of snakebite with one bite/fang mark on any body part. Suspected snakebite without any fang or bite mark, but the belief that a snake has bitten them

Clinical features include-

- Puncture marks on the wound
- Redness, swelling, bruising, bleeding, or blistering around the bite
- Severe pain and tenderness at the site of the bite
- Nausea, vomiting, or diarrhoea
- Laboured breathing or breathlessness
- Rapid heart rate, weak pulse, low blood pressure
- Altered vision
- Metallic or mint taste in the mouth
- Increased salivation and sweating
- Numbness or tingling around the face and/or limbs
- Muscle twitching

<u>Preparatory Checklist for Prevention and Control of Snakebite Envenoming at States/District/Block</u> (whichever is applicable)				
No.	Document / Record	Level	Availability (Y/N)	Remarks
1	Line list of Snakebite cases – 2018 to 2025 and analysis of data based on high-risk population, high-risk group, etc., completed (If yes, please attach a copy of the analysis of data) -	State/ District Level		
2	Training on Prevention and control of Snakebite, including appropriate snake Bite Management, administration of anti-snake venom, Criteria for referral and other technical aspects, held at the state level/district/block level. <i>(If Yes, Date of training held, list of participants to be attached with the checklist)</i>	State Level		
		District Level		
		Block Level		
3	Availability of Standard Treatment Guidelines for Management of Snake Bite by NHM- 2017	State Level		
		District Level		
		Block Level		
4	Availability of IEC on snakebite management at PHC/CHC issued by the program division, NCDC	State Level		
		District Level		

		Block Level		
5	Adequate Availability of Anti-Snake Venom in Health care units (State/District/Blocks) for Snake Bite Management (<i>*Based on previous year consumption + 10% of buffer stock</i>)	State Level		
		District Level		
		Block Level		
6	Adequate cold chain facilities to store ASV stocks at appropriate levels	State Level		
		District Level		
		Block Level		
7	Whether Anti Snake Venom Serum (ASV) is included in the list of essential drugs	State Level		
8	Identification of high-risk areas (districts/blocks) as per the rainfall and Significant distance of the affected community from the nearby hospital having ASV, areas with communities seeking traditional therapy, difficult terrain and transportation issues, etc.	State Level		
	Availability of Diagnostic Facility			
9	♡ Peak flow meter ♡ Urine examination for albumin ♡ Blood examination by dipstick	Primary Healthcare Centre		
	♡ APTT ♡ CBC ♡ Serum Electrolyte Test ♡ Liver function test (LFT) ♡ Renal Function Test (RFT) ♡ Blood sugar ♡ ECG ♡ Abdominal ultrasound ♡ Troponin I ♡ Urine Myoglobin ♡ Blood Grouping ♡ Arterial blood gases analysis	District Level Hospitals		
	Relevant investigation related to the following complications ♡ Coagulopathy ♡ Hemolysis ♡ Renal failure ♡ Hepatic injury ♡ Cardiotoxicity ♡ Myotoxicity – ♡ Infection- Serum procalcitonin, culture (blood, urine, wound) and sensitivity	State Level Hospitals		
	Availability of facilities for managing Snakebite cases			

10	♥ IV Fluids ♥ Blood pressure monitor ♥ AMBU Bag with mask ♥ Laryngeal tube with laryngeal mask airway ♥ Oxygen facility ♥ Ambulatory services ♥ Essential drugs including Antihistamine, Adrenaline, Neostigmine, Atropine, Analgesics, etc.	Primary Health Care Centre		
	♥ Transfusion of blood or fresh frozen plasma ♥ Surgical debridement of dead tissue ♥ Dialysis, ♥ Insertion of an endotracheal tube, anaesthetic bag or mechanical ventilator	District Level Hospital		
	♥ Advanced surgical management of local necrosis (e.g. split skin grafting), ♥ Bacterial cultures and imaging (CT scans), and rehabilitation ♥ Ventilator and Dialysis Unit for Snakebite cases	State Level Hospital		
11	Availability of Reporting Formats for Day-to-day surveillance reporting of Snakebite at all levels	State Level		
		District Level		
		Block Level		
12	Availability of a general 24x7 Helpline for addressing queries related to Snake bites	State		
13	Media plan prepared to generate community awareness about preventing snakebite.	State and District		
14	IEC prototypes (pamphlets, posters, Audio/video spots) available in Hindi /English /local language for dissemination.	State and District		
15	Community and high-risk occupations awareness meetings	State Level		
		District Level		
		Block Level		
16	Preparation of Ambulatory services for referral transport of the suspected cases	State		
		District		
		Block		
17	List of review meetings held at the state level where Snakebite surveillance issues were discussed with details (dates, agenda), 2018 to 2025	State		
18	Feedback given to districts related to Snakebite Surveillance in the current year	State		
19	Press releases/statements issued on Snakebite cases reported in the media, etc.	State		
		District		
		Block		

20	Intersectoral Coordination: - Meetings with representatives from Urban Affairs/ Panchayat affairs /Agriculture Department/Animal Husbandry Department/Rodent Control Department held	State/District /block		
21	Whether the Advocacy Program for the participation of private institutes/ NGOS/ Community org in Snakebite Management done	State		
		District		
		Block		
		District		
		Block		
22	Whether Joint training of Health, veterinary and wildlife professionals on the operational aspect of the management of Snake bite in Humans as well as in animals has been done	State		
		District		
		Block		
		District		
		Block		

Monthly Reporting Format (District)

SNAKEBITE ENVENOMING REPORTING FORMAT						
State Monthly Report						
District Name:						
Name and contact information of District Nodal Officer:						
Month and Year of Reporting:						
Number of Facilities submitted report / Total no. of health facilities providing facility for snakebite management in the state:						
Number of snakebite cases and deaths reported in the District(Block-wise)						
District	Type of geographical area (Urban/ Rural)	Snakebite Cases in the District			Snakebite Deaths in the District	
		No. of Snakebite case reported	Top five Blocks reporting Snakebite cases	Total No. of Snakebite Envenoming reported	No. of Snakebite deaths reported	Top five priority blocks reporting Snakebite deaths
No. of clinically suspected snakebite cases left against medical advice						
Total ASV (no. of vials) used in the State (monthly)						No. of vials/ doses
Opening balance						
Quantity received						
Quantity utilized						
Closing balance						
Shortage of ASV - Yes/No (If Yes, Please Mention in Vials or Doses)						
Information on Snakebite cases was shared with the State Forest/Wildlife Department.						
Any stakeholders meeting conducted on Snakebite						
Number of trainings conducted at the State and District level in the current year						
Number of field visits conducted by State officials to monitor the progress of Snakebite activities						
Any Unusual increase in Snakebite Bite Cases observed? If yes, write the details, including the locality.						
Any other remarks						
Date:						

Chapter 10

Institutional Mechanism for Monitoring & Evaluation in Kerala

Since snakebite is a notifiable disease in Kerala, monitoring will be anchored in a comprehensive, state-level notification web portal, integrated with the IDSP/IHIP system and linked to all relevant stakeholders.

1. State-Level Coordination

Structure Monitoring and evaluation will be led by:

- Directorate of Health Services (DHS)- State Surveillance Unit (SSU), IDSP
- NHM Kerala
- Kerala Medical Services Corporation Ltd (KMSCL) – Monitoring of ASV procurement, stock levels and supply chain
- District Surveillance Units (DSU) and District One health committees – District-level supervision and reporting quality checks, and address coordination among various stakeholders
- PHC/FHC/CHC and Local Self Government Department (LSGD) – Oversight at the community level through Panchayats, for surveillance, awareness, and follow-up

Kerala Medical Services Corporation Ltd. (KMSCL) shall monitor Anti-Snake Venom (ASV) procurement, stock levels, and supply chain management, and implement additional pharmacovigilance measures, including tracking deaths and complications following the introduction of any new ASV brand. Periodic feedback from clinicians on efficacy and adverse outcomes shall be systematically collected and reviewed to enable timely corrective actions, given past issues reported with certain brands.

2. Comprehensive Snakebite Notification Web Portal

Kerala will develop and maintain a single integrated notification platform for:

- Suspected, probable, and confirmed snakebite cases
- Deaths (human and animal)
- Snake sightings and human–snake conflict alerts
- ASV availability, stock-outs, and utilisation
- Referral timelines, ambulance mobilisation, and outcome

Recognising the significant contributions of private facilities in snakebite management, research, training, and public education, mechanisms should be established to capture their data, expertise, and feedback to strengthen the overall snakebite prevention and control programme.

Process Indicators for Human Health Component

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
Availability of Anti-Snake Venom	Percentage of States that have an adequate supply of Anti-Snake Venom (ASV) at all health facilities.	ASV procurements and utilisation, Proportion of ASV vials procured against annual requirement. % of facilities (PHC & above) expected to maintain stock of ASV, % of facilities having ASV stocks with no ASV stock out in that year	ASV Stock register, Records and reports available at Health facilities / Hospital records/ Media reports about shortage/ Public Grievances*	State Health Departments and State Nodal Officers of the Snakebite DVDMS portal/ Media Supervision reports
Capacity building	% of staff trained in Snakebite management (from PHC & above, including Medical Officers and other supporting health staff (such as ambulance personnel, nursing staff, and lower-level health workers involved in patient transfer and initial care)	Number of staff trained in facilities for management of Snakebite. Number of training certificates issued. Trained Participants, List (facility-wise) % of facilities with trained staff for the administration of Anti-Snake venom	Attendance sheet & Training Reports, Supervision reports	Prevention and Control of Snakebite Envenoming
Diagnostic Support	% of the laboratories' diagnostic capacity for diagnosis of Snakebite envenoming	% of laboratories equipped with diagnostic facilities	Prevention and control of Snakebite envenoming reports & RRL reports, Report of the Disease Surveillance unit	The Programme for Prevention and Control of Snakebite shall include regular IEC activities such as educational talks and video screenings conducted at every appropriate opportunity. It shall be integrated with other routine health education sessions (nutrition, immunisation, and general health

				talks), covering comprehensive accident prevention with specific emphasis on snakebite prevention and timely care.
Surveillance	Strengthening surveillance of Snakebite cases and deaths	%Facilities reporting Snakebite cases and deaths, and zero reports	Prevention and control of Snakebite envenoming Reports and IDSP/ IHIP Reports	Prevention and control of Snakebite, IDSP Disease Alert Report Surveillance unit (web portal)
Health facility	Strengthening of Health facilities for management of Snakebite cases	The percentage of snakebite cases provided ambulance services. % of health facilities with availability of emergency medicines and Ventilation support for snakebite cases, % of ambulance staff trained in transport and first-aid for snakebite victims	Participant list of training, Facility records for (No. of cases of Snakebite, No. of cases brought by ambulance, No. of equipment, etc.)	Facility records
Advocacy, Communication and Social Mobilization	Measuring public awareness about the risk of snakebite	% of population aware about Snakebite management, prevention and first aid	KAP survey	KAP survey results
Inter-Sectoral Coordination	Assess the level of partnership and multi-sectoral collaboration among ministries, other government agencies, NGOs, and the private sector for the implementation of the NAP-SE.	Proportion of identified stakeholders onboard in Joint Monitoring Committees and Joint Task Forces constituted by States. % of stakeholders attending periodic review meetings	Number of meetings held with stakeholders, Minutes of Meetings	Monitoring Reports, Minutes of Meetings

Operational Research	1. ASV development against a few of the common snakes, not included in the big four and not covered by our ASV. 2. Role of drugs, traditional medicine and Ayurveda for supportive treatment, especially local area complications	% of applicable studies done	Study reports	Dissemination of the results manuscript
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* Three-monthly reporting of ASV stock levels, including expiry dates, shall be ensured, with timely transfer of near-expiry stocks to other institutions to prevent wastage and avoid stock-outs.

Process Indicators for Animal Health/Wildlife Component

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
Provision of availability of Anti-Snake Venom	Number of States that have an adequate supply of Anti-SnakeVenom (ASV) at all veterinary polyclinics, Hospitals, dispensaries & Dispensaries in various Wildlife Sanctuaries, National Parks, Zoos, etc.	ASV procurements and utilisation, % of facilities with no ASV stock out	Stock register, Records, and reports available at Health facilities / Hospital records/ Media reports about shortage/ Public Grievances	State Animal Husbandry Department
Snake Population	Enumeration of the Snake population of different species	Species-wise population of snakes		Wildlife Department
Capacity building	Trained staff on snakebite management (Para Vets, Maitri, Gopal Mitra, Pashu Sakhi, etc.)	Number of staff trained in facilities on appropriate management of Snakebite, Number of training certificates issued, Trained Participants, List of facilities with trained staff on the administration of Anti-Snake venom	Programme for Prevention and control of Snakebite Training Reports: Regular supervision reports	Programme for Prevention and control of Snakebite
Diagnostic Support	Strengthening laboratory diagnostic capacity for the diagnosis of Snakebite	% of laboratories equipped with diagnostic facilities	Laboratory assessment reports	Programme for Prevention and control of Snakebite reports, CDDL & SDDL reports, Report of Disease Surveillance

Surveillance	Strengthening surveillance of Snakebite cases and deaths in animals	%of Facilities reporting Snakebite cases and deaths in animals	Programme for Prevention and control of Snakebite Reports and NADRS	Programme for Prevention and control of Snakebite, INAPH Alert Report
Advocacy and Communication	Measuring public awareness about the risk of snakebite in Animals	% of population aware of snakebite management, Prevention and control in Animals	KAP survey	KAP survey results
Inter-Sectoral Coordination	Assess the level of partnerships and multi-sectoral collaboration among ministries, other government agencies, NGOs and the private sector for implementation of the NAP-SE	Proportion of identified stakeholders onboard in Joint Monitoring committees and joint taskforces constituted by States, % of stakeholders attending periodic review meetings	Monitoring Reports	Monitoring Reports
Operational Research	Baseline survey to estimate the Snakebite burden and incidence of Snakebite cases and Deaths in Animals	Number of applicable studies done	Study reports	Dissemination of the results manuscript

Outcome Target Indicators

Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
To prevent and control snakebite envenoming to halve the number of deaths and cases of disability that it causes by 2030	The number of states that have Snakebite as Notifiable diseases in Humans	Publication / Amendment through the State Public Health / State Disaster Act/ Epidemic Act Gazette	State Gazette
	% Decrease in Snakebite deaths and cases in Humans	Monthly /quarterly/ Yearly Surveillance records	Annual Reports, Surveillance Reports

Chapter 11

Legislation Related to Snakebites in India & Challenges to be Addressed

In India, the Wildlife Protection Act, 1972, is the primary legal framework that protects wildlife, including snakes, from hunting, illegal wildlife trade, and unnecessary killing. The following key provisions are relevant for snakebite management, venom collection, rescue operations, and regulation of snake-related activities.

1. Wildlife (Protection) Act, 1972 – Key

Sections Section 9 – Prohibition of hunting

Prohibition of hunting. —No person shall hunt any wild animal specified in Schedules I and II except as provided under section 11 and section 12.

Section 11 – Hunting permitted in certain cases

- The Chief Wildlife Warden (CWLW) may permit hunting of Schedule I animals if they are dangerous to human life or irrecoverably disabled.
- Provided that no wild animal shall be ordered to be killed unless the Chief Wildlife Warden is satisfied that such animal cannot be captured, tranquilised or translocated.
- Provided further that no such captured animal shall be kept in captivity unless the Chief Wildlife Warden is satisfied that such animal cannot be rehabilitated in the wild, and the reasons for the same are recorded in writing.
- The process of capture or translocation must cause minimum trauma.
- Similar provisions apply to Schedule II animals.
- (2) The killing or wounding in good faith of any wild animal in defence of oneself or of any other person shall not be an offence.
- (3) Any wild animal killed or wounded in defence is Government property.

Section 12 – Grant of permit for special purposes

It shall be lawful for the Chief Wildlife Warden to grant a permit for education, scientific research, scientific management (including translocation and population management without killing), museum specimens, or derivation/collection/preparation of snake venom for the manufacture of life-saving drugs.

- Provided that no such permit shall be granted in respect of Schedule I animals without prior permission of the Central Government, and for other wild animals without prior permission of the State Government.

Section 39 – Wild animals to be Government property

- All wild animals hunted, captured, seized, found dead or wounded become Government property.
- Possession of such property must be reported within 48 hours.

- No person may acquire, transfer or destroy Government property without the written permission of CWLW.

Section 44 – Dealings in animal articles and snake venom

- No person shall engage in business as a dealer in animal articles, trophies, captive animals, meat, or derive, collect, prepare or deal in snake venom except under license.
- Licensing conditions, validity, renewal and penalties are detailed under this section.

Section 49A – Definitions

Defines “scheduled animal”, “scheduled animal article”, and “specified date”.

2. Schedules Protecting Indian Snake

Species Schedule I species include:

- All pythons
- Reticulated python (*Malayopython reticulatus*)
- Red sand boa (*Eryx johnii*), Whitaker’s boa (*Eryx whitakeri*)
- Indian cobras (*Naja* spp.), King cobras (*Ophiophagus* spp.), Russell’s viper (*Daboia russelii*)
- Several water snakes and keelbacks
- Schedule II species include:
 - Blind snakes (Typhlopidae), colubrids (except Schedule I species)
 - Elapids (except Schedule I species), vipers (except Schedule I species)
 - Sand snakes, shield-tailed snakes, sunbeam snakes, thread snakes

3. Penalties Under Section 51

Offences under the Act attract imprisonment up to three years or a fine up to one lakh rupees.

- For Schedule I animals or offences in sanctuaries or National Parks, minimum imprisonment is three years (extendable to seven) and a fine not less than twenty-five thousand rupees.
- For repeat offences, the minimum fine is one lakh rupees.

4. Compensation Provisions in Kerala

Kerala provides compensation for human fatalities due to snakebite:

- If the loss of human life is on account of snakebite, the compensation will be limited to Rs. 1 lakh if the accident occurs outside forest areas.

5. Additional Kerala-Specific Legislative and Administrative Framework

Kerala Public Health Act, 2023 and notification of snakebite

The Kerala Public Health Act, 2023, provides the state with the power to declare conditions as “diseases of public health importance” and to mandate notification and a coordinated response. In October 2025, the Government of Kerala formally declared snakebite envenomation a “disease of public health importance” under this Act. The notification makes hospital reporting of snakebite cases mandatory, strengthens the anti-venom supply chain, and mandates standardised treatment protocols aligned with national guidelines.

Forest sector guidelines (2020)

Kerala operationalises provisions of the Wildlife Protection Act through guidelines for rescue and release by certified snake handlers. These guidelines:

- Allow only certified handlers,
- Mandate training and certification,
- Link violations to penal provisions,
- Require publication of district-wise handler lists.

High Court Directions (2019–2025)

The Kerala High Court directed the State to:

- Declare snakebite a notifiable disease,
- Ensure accurate data and continuous antivenom availability,
- Issue circulars on school safety, hospital preparedness, and interdepartmental responsibilities.

School Safety Circular (30 May 2025) Schools must:

- Maintain Child Emergency Medical Response Plans,
- Display nearest hospitals with antivenom,
- Engage authorised snake handlers,
- Conduct regular campus inspections.

This initiative shall be implemented with the active involvement of the Education Department, including systematic training of teachers on prevention, early recognition, and dos and don'ts related to snakebite and other stings and bites. Schools shall anticipate risks on campus and in surrounding environments and implement appropriate remedial measures, with structured engagement of parents to raise awareness and build preparedness. The health sector shall have clearly earmarked responsibilities for technical guidance, training support, and referral linkage.

Community-Level Prevention Initiatives

- The use of digital platforms such as the SARPA app for snake rescue reporting, public awareness, and access to authorised snake handlers, along with other validated applications, to support accurate snake identification, timely response, and informed decision-making in snakebite prevention and management. Free/subsidised treatment for snakebite, seasonal advisories, and integration into IDSP.
- LSG-level responsibilities for habitat management and public awareness.

Challenges to be Addressed

- Strengthening the implementation of notification and reporting systems.
- Finalising and funding the draft comprehensive guidelines.
- Developing antivenom for species beyond the “Big 4” contextual to the state
- Enhancing standardised first-aid messaging and community awareness.
- Improving inter-departmental coordination across forest, health, veterinary, agriculture, LSGD and education sectors.

Chapter 12

Pre-Hospital Care and Diagnostic Aspects of Snakebite Envenoming: Treatment Considerations & Recommendations

Snakebite injuries represent a diverse spectrum of clinical severity, ranging from simple puncture wounds to acute, life or limb-threatening complications that result in death or permanent disability. Salvaging the lives of snakebite victims is critically dependent on a cascade of actions: timely pre-hospital care (which involves appropriate first aid and securing rapid transport to the nearest equipped health centre); competent clinical assessment and definitive diagnosis of envenoming; and prompt initiation of antivenom therapy combined with optimal supportive care. A failure or deficiency in even one of these crucial steps dramatically escalates the risk of patient death or the development of catastrophic disabilities.

Pre-hospital Care

A. First-Aid Practices and Associated Challenges

A significant challenge is the persistent lack of knowledge within rural communities regarding evidence-based first-aid practices for snakebite envenoming. Despite being a region with a high burden of snakebite incidents, community responses remain largely inappropriate; studies and field observations indicate that **only about one-third of victims are taken to health facilities with the availability of antivenom**, while the majority rely on unsafe and ineffective traditional practices. These include incising the bite wound, attempting to suck out venom, applying tight tourniquets, using so-called “snake stones,” summoning the snake to “draw out” the venom, or applying substances such as herbs and animal excreta. Such practices delay timely access to lifesaving medical care, increase the risk of complications, and significantly contribute to preventable morbidity and mortality. Such practices cause critical delays in definitive treatment and frequently result in increased harm, disability, or even fatality. For instance, a tightly tied tourniquet, if left in place for an extended period, could cause severe local damage, including ischemia, necrosis, and gangrene. Furthermore, the pain and swelling caused by a tourniquet may be mistakenly interpreted as a sign of worsening local envenoming. Likewise, incisions and local applications introduce a high risk of skin and soft-tissue infections, sepsis, and tetanus.

Pressure Immobilisation Techniques:

Pressure immobilisation techniques (PIT), including pressure-bandage immobilisation and pressure pad variants, aim to slow venom spread via lymphatic drainage by applying firm pressure over an immobilised limb or bite site. Developed in Australia for neurotoxic elapid bites, they remain standard there but face controversy elsewhere due to limited evidence on efficacy and risks, such as worsened tissue damage in cytotoxic envenoming.

Core Techniques

Pressure-bandage immobilisation uses an elastic bandage at “comfortably tight” pressure (finger-slippable underneath), starting proximally over the bite site and extending up the limb, paired with splinting for immobility. The pressure pad variant applies a firm pad directly on the bite, secured by

a non-elastic band, sometimes without full limb wrapping. These methods trap venom locally and may inactivate some components, per Australian guidelines.

While these techniques are occasionally recommended for neurotoxic elapid bites in certain regions, such as Australia, their utility in most other parts of the world, including India, remains variable and controversial. Clinical efficacy and the potential for these methods to worsen local soft-tissue injury, particularly in cases of cytotoxic envenoming, have not been adequately assessed. Some guidelines discourage their use due to the uncertainty of benefit and the risk of exacerbating local tissue damage. Despite this, a recent systematic review favoured localised pad pressure over full bandaging for certain bites. However, global clinical trials are sparse, and the efficacy against diverse venoms (e.g., viperid cytotoxins common in India) is not robustly assessed. Recent reviews highlight insufficient field trials on application methods (e.g., proximal vs distal bandaging) and call for further research. Public health advice favours no incision, suction, or tourniquets—focus on urgent hospital transfer. It is also to be noted that Pressure Immobilisation Techniques are to be employed only in areas which are far from adequate health facilities. When health facilities are nearby, time should not be wasted employing these techniques.

Pharmacological Interventions: Pharmacological interventions aimed at retarding venom transit by slowing lymphatic flow are a promising area of research as an adjunct to snakebite first aid. Agents such as nifedipine, lignocaine, and glyceryl trinitrate, which primarily inhibit lymphatic pumping, have shown potential. For example, murine studies in which the agent was injected into the hind-foot pad demonstrated a 300–500% increase in lymph transit time and a 50% increase in the time to respiratory arrest during simulated neurotoxic envenoming.

Additionally, drugs like Varespladib (an anti-phospholipase agent) and Marimastat (a snake venom metalloproteinase inhibitor) have shown promise when tested in human subjects in other parts of the globe. Currently, trials on the agents are on in India, and results are awaited.

B. Transportation of the Victim to the Hospital

Rapid transportation of victims to healthcare facilities is essential, as pre-hospital mortality accounts for up to 80% of all snakebite-related deaths in India. Therefore, it is critical to ensure that reliable, affordable transportation and access to healthcare are consistently available, especially across difficult terrain.

Recommendations for Transport:

- Universally approved elements of snakebite first-aid—reassurance and immobilisation of the victim, especially the bitten limb—should be maintained during transport to slow down venom spread. The bitten limb should be immobilised with a splint using any available rigid object, such as wooden or plastic boards or rolled-out newspapers and should be kept dependent.
- All rings and other tight or potentially constricting objects must be removed from the bitten limb, as they can function as a tourniquet when limb swelling begins and progresses proximally.
- Rapid transport to the nearest healthcare facility should be arranged immediately.
- Emergency helpline numbers should be used to expedite transport to centres preferably equipped with antivenom.
- If the victim is being referred from one hospital to another, the receiving hospital must be informed of the patient's condition via phone, and a referral letter detailing the assessment and treatment provided should be prepared. Antivenom availability and supportive care facilities at the receiving hospital should be confirmed.

- During transit, the patient should be placed in the recovery position as far as possible, and movement, especially of the bitten limb, should be minimised to prevent increased systemic venom absorption.
- In situations where a conventional ambulance is unavailable, alternate modes of transport, including a stretcher, bicycle, motorbike, cart, train, or boat, must be considered contextual to geography and terrain.

Diagnostic aspects

Diagnosis includes clinical and laboratory-based identification of features suggestive of local and/or systemic envenoming, and the inference or confirmation of the likely species of the biting snake.

I. Recognising Local and Systemic Envenoming

a. **Variability in Clinical Presentation:** The clinical picture is highly variable, influenced by the patient's age, the snake species, the number and location of the bites, and the quantity and potency of the venom. Patient-specific factors also interfere with routine medications (e.g., antiplatelets, anticoagulants), which can worsen bleeding, and co-morbidities (e.g., coronary artery disease) can make the patient vulnerable to secondary complications like myocardial infarction following shock.

b. **Atypical and Delayed Onset:** While most patients have a clear bite history, some victims of painless nocturnal bites by especially krait species may present without a definite history. In confirmed envenoming, the onset of symptoms can be delayed but may then worsen rapidly. In India, delayed-onset systemic envenoming is classically seen with krait bites, where neuromuscular paralysis may be delayed.

c. **Progression of Symptoms:** The early symptoms of envenoming typically include local symptoms at the bite site, neurotoxic manifestations or bleeding. These clinical manifestations may progressively worsen, leading to severe local effects such as bruising, blistering, dermonecrosis, lymphangitis, and lymphadenitis, with the potential to develop compartment syndrome in the bitten limb. Systemic neurotoxicity presents with a characteristic descending pattern of muscle weakness, typically starting with ptosis, which can progressively impair the bulbar, neck, limb, and, critically, the respiratory muscles.

In cases of hemotoxic envenoming, patients may exhibit persistent bleeding from the bite site, mucosal bleeds (subconjunctival, nasal, gingivobuccal), or even more severe spontaneous internal haemorrhages (which may affect the brain, pituitary gland, heart sac, lungs, or retroperitoneal space). Other significant systemic complications frequently observed include generalised rhabdomyolysis caused by venoms with myotoxic components, and the development of Acute Kidney Injury (AKI). Another significant aspect of envenoming by *Daboia russelii* in Kerala is the transient ptosis, which typically lasts up to 24 hours. A significant challenge arises when patients in snakebite endemic regions present with critical, non-specific signs such as shock, unconsciousness, bleeding, paralysis, respiratory failure, or unexplained abdominal pain, and they cannot provide a clear history of a snakebite. In these scenarios, it is imperative to consider snakebite envenoming as a primary differential diagnosis.

d. Essential Bedside and Laboratory Diagnostics:

1. The 20-Minute Whole Blood Clotting Test (20WBCT): The 20WBCT is a simple, rapid, and inexpensive bedside test to screen for coagulopathy in patients without overt bleeding, and to monitor resolution post-antivenom. It is a gross measure of intrinsic clotting factors, based on whole-blood clotting in a new, clean, dry glass tube. Using plastic, detergent-cleaned, or anticoagulant-coated vessels can result in false-positive results. The test has lower sensitivity for detecting milder coagulopathy and for monitoring resolution after ASV.

2. In patients with suspected neuroparalytic snakebite, the decision to initiate Anti-Snake Venom (ASV) should be based primarily on careful clinical assessment rather than gadget-based measurements. Early identification of neuroparalysis through systematic clinical examination is critical, particularly at peripheral health facilities.

Medical officers should be trained to recognise early evidence of neuroparalysis using simple bedside clinical methods, including:

- Single Breath Count (number of digits counted in a single exhalation),
- Breath-Holding Time at peak inspiration,
- Sentence Completion Test (ability to complete a sentence in one breath), along with focused neurological assessment using the 5 Ds (diplopia, dysphonia, dysarthria, dysphagia, dyspnoea) and 2 Ps (ptosis and pupil changes), and continuous observation of the adequacy of breathing and respiratory effort.

Assessment for ASV administration should be guided by clinical findings and the 20-minute Whole Blood Clotting Test (20WBCT), acknowledging that in certain situations reliance on 20WBCT alone may be misleading. At peripheral levels, the emphasis should be on timely clinical decision-making and early initiation of ASV, rather than waiting for extensive investigations.

Where monitoring devices are used, pulse oximetry is recommended for assessing oxygen saturation; the use of PEFR is not advised for decision-making in snakebite envenoming. Essential basic monitoring at all peripheral facilities should include pulse oximetry, blood pressure apparatus, and random blood sugar (GRBS) measurement. If available, a baseline ECG may be recorded.

Laboratory investigations beyond the 20WBCT—such as INR and APTT—are desirable but should be arranged at Taluk-level hospitals or higher facilities, as establishing complete biochemical testing at peripheral centres may not be practical. At the peripheral level, collection of baseline blood samples is sufficient, allowing detailed analysis at referral institutions during subsequent stages of management or after initiation of the minimum recommended ASV dose.

The table below lists additional tests that could be performed to screen for and monitor systemic envenoming in snakebite victims at healthcare settings equipped with laboratory facilities.

Level of Health-facility	Laboratory test
District (secondary)-level health facility	Complete blood count, Peripheral blood smear, Prothrombin time/international normalised ratio, Activated partial thromboplastin time (aPTT), Serum creatinine and blood urea nitrogen, Serum electrolytes, Serum creatinine, phosphokinase, and Liver function tests, Random blood glucose Urine routine examination and microscopy, ECG Chest x-ray, Abdominal ultrasound
Tertiary-level health facility	In addition to the above: D-dimer, Plasma fibrinogen, Serum lactate dehydrogenase, Arterial blood gas analysis, Troponin-T/Creatinine phosphokinase MB CT/MRI scan brain, 2D-Echocardiography

II. Identifying the likely biting species: Clinical and laboratory diagnosis.

Challenges in Identification: Identifying the offending snake from victim or bystander descriptions, photographs, or specimens is often unreliable, as most bites occur in low-light conditions and evolutionary mimicry between venomous and non-venomous species is common. While expert support—such as consultation with trained personnel using photographs shared through platforms like WhatsApp—may assist in provisional identification, such inputs should be interpreted with caution and should not form the sole basis for clinical decision-making.

There are inherent limitations to snake identification in the field; the snake brought by bystanders may not be the actual culprit, and venomous snakes may be associated with **dry bites** that do not result in envenoming. Consequently, management decisions should prioritise a syndromic approach, guided by clinical features of envenomation and established protocols, rather than relying on species identification. This approach ensures timely and appropriate treatment, minimises delays in ASV administration, and reduces the risk of mismanagement.

Syndromic Approach: The syndromic approach involves recognising clinical patterns such as neurotoxicity or coagulopathy to assess envenomation. In the Indian context, where a single polyvalent antivenom is used, this approach should be applied to determine the presence or absence of envenoming and to guide timely clinical management, rather than for definitive snake species identification. While it has limited sensitivity for distinguishing among certain Indian viper species, the pattern of clinical and laboratory findings may provide supportive clues to anticipate complications, monitor progression, and plan referral and supportive care. While useful, it has low sensitivity in differentiating certain Indian viper species.

III. Role of Poison Information Centres (PICs)

Poisons Information Centres (PICs) are specialised units that provide expert advice on toxicological emergencies, including the diagnosis and management of snakebite envenoming, via telemedicine. While they have the potential to support clinical decision-making, their utilisation in India remains limited, with many healthcare workers unaware of their availability. In the context of bites and stings, where rapid decision-making is critical, current response times from PICs are not consistently dependable. Additionally, reliance on voice-only communication limits the effectiveness of clinical assessment. Strengthening this system is therefore essential, with emphasis on instantaneous response mechanisms and video-enabled consultation platforms to ensure timely and meaningful support for frontline healthcare providers.

Treatment Considerations and Recommendations

Snakebite envenoming shall be recognised and managed as a medical emergency across all levels of the health system. All suspected snakebite cases, including asymptomatic individuals, shall be admitted and observed for a minimum period of 24 hours, given the risk of delayed envenomation, particularly in krait bites. Peripheral health facilities shall be strengthened through training and protocols to ensure early recognition of clinical features suggestive of neuromuscular, vasculotoxic, myotoxic, and severe local envenomation, enabling timely initiation of appropriate management and referral.

All public and private health facilities in the state shall strictly adhere to the Standard Treatment Guidelines for Management of Snakebite (MoHFW, 2017) and relevant WHO recommendations. Deviations from

standard protocols, including irrational ASV use, inappropriate dosing, or avoidable delays in treatment, shall be actively discouraged through regular clinical audits, supervisory reviews, and structured capacity-building programmes. Standardisation of care shall be prioritised to ensure uniform treatment quality across the state.

- Anti-Snake Venom (ASV) shall be administered only in cases with clear evidence of envenomation, in accordance with national guidelines. Early and adequate dosing shall be ensured, while both under-dosing and over-dosing shall be avoided. ASV shall not be administered in cases of dry bite or symptoms attributable solely to anxiety. Mandatory monitoring for ASV-related adverse reactions shall be ensured at all facilities administering ASV, with adrenaline, resuscitation equipment, and trained personnel readily available at the point of administration. Use of ASV in special populations, including children, pregnant women, late presenters, and cases requiring surgical intervention, shall strictly follow approved national protocols.
- Recognising that respiratory failure is a leading cause of mortality in neurotoxic snakebite, all peripheral and secondary-level health facilities shall be equipped and capacitated for early airway management and respiratory support. This shall include availability and use of bag–valve masks, oxygen support systems, and supraglottic airway devices such as LMA or i-gel. Clear and time-bound referral protocols for ventilatory support shall be operationalised, supported by functional ambulance services and robust pre-referral stabilisation practices.
- Health facilities managing snakebite cases shall be capable of early identification and appropriate management of common complications. This includes prompt detection and treatment of coagulopathy and bleeding using bedside tests such as the 20-minute whole-blood clotting test (20WBCT), early recognition and referral of acute kidney injury for renal replacement therapy when indicated, and appropriate management of severe local envenomation, including necrosis and secondary infections. Surgical interventions shall be judicious, evidence-based, and aligned with standard guidelines, with unnecessary procedures such as unwarranted fasciotomies actively discouraged.
- A well-defined referral system shall be ensured across the state, with clear referral criteria and timelines. Referral decisions shall not delay life-saving interventions such as ASV administration or airway management. Effective communication between referring and receiving facilities shall be mandatory and shall include details of ASV administered, clinical status at referral, complications noted, and supportive care provided.
- All snakebite survivors shall have documented follow-up and outcome reporting as part of routine care. Follow-up records shall capture recovery status, presence of residual neurological deficits, renal complications, and local tissue damage or disability. Rehabilitation services, including physiotherapy, wound care, and counselling, shall be integrated for patients experiencing long-term morbidity following snakebite.
- The private health sector shall be recognised as a key stakeholder in snakebite management in Kerala. Private health institutions contribute substantially to emergency care, critical care, training, research, and public education. Their role shall be formally integrated into the state snakebite prevention and control framework through mechanisms for protocol adherence, data sharing, outcome reporting, and participation in capacity-building initiatives.
- Capacity building efforts shall extend beyond Medical Officers to include nursing staff, ambulance personnel, emergency medical technicians, and supporting health workers involved in patient transport, triage, and early care. Training programmes shall focus on first response, safe

immobilisation, early recognition of envenomation, supportive care, and effective teamwork in snakebite management.

- Quality assurance mechanisms shall be institutionalised through regular review of ASV utilisation patterns, case fatality rates, complications, adverse events, and brand-wise treatment outcomes. Periodic clinician feedback and systematic analysis of treatment data shall inform continuous improvement, patient safety, and evidence-based policy decisions related to snakebite management in the state.

Treatment Considerations and Intersectoral Responsibilities

Effective management of snakebite envenoming in Kerala requires a coordinated, intersectoral approach that ensures timely treatment, rational use of Anti-Snake Venom (ASV), robust referral systems, and continuous quality assurance across both public and private health sectors. The Health Department shall serve as the nodal authority for clinical governance, ensuring adherence to national Standard Treatment Guidelines and WHO recommendations across all levels of care. This includes early recognition of envenomation, mandatory observation of suspected cases, timely initiation of ASV where indicated, management of complications, structured referral, and documentation of outcomes. The Health Department shall also lead capacity-building for all cadres of health personnel involved in snakebite care and oversee surveillance, audits, and mortality reviews to reduce preventable deaths and disabilities.

Kerala Medical Services Corporation Ltd. (KMSCL) shall play a critical role in ensuring the uninterrupted availability and quality assurance of ASV and other essential snakebite management commodities. Responsibilities shall include monitoring procurement, stock levels, cold-chain maintenance, batch-wise tracking, and expiry management. In view of earlier concerns with certain ASV brands, KMSCL shall institute strengthened pharmacovigilance mechanisms, including systematic tracking of deaths, complications, and adverse events following the introduction of new ASV brands. Periodic feedback from clinicians shall be formally collected and reviewed to inform procurement decisions and corrective actions.

The Education Department shall be an active partner in strengthening snakebite preparedness in school settings. In alignment with school safety guidelines, teachers shall be trained on basic prevention measures, early identification of snakebite and other stings or bites, and appropriate dos and don'ts. Snakebite awareness shall be integrated into broader school health and safety education, enabling early response and appropriate referral from educational institutions. Risk anticipation within school campuses and surrounding environments, along with preventive and remedial measures, shall be promoted with technical guidance from the Health Department.

Local Self Government Departments (LSGDs) shall support the implementation of snakebite prevention and treatment strategies at the community level. This includes facilitating local awareness activities, supporting emergency response and transport mechanisms, enabling follow-up of snakebite survivors, and strengthening linkages between communities and health facilities. LSGDs shall also assist in addressing local risk factors, particularly in high-incidence areas such as forest fringes, agricultural zones, and flood-prone regions.

The private health sector is a major pillar of snakebite care in Kerala and should be formally integrated into the state's snakebite prevention and control framework. Private hospitals and practitioners contribute significantly to emergency care, critical care, training, research, and public education related to snakebite.

Their participation in standardised treatment, case reporting and outcomes, sharing of best practices, and clinician feedback shall be actively sought to strengthen programme effectiveness and data completeness across the state.

Kerala-Specific Considerations for Snakebite Treatment and Preparedness

Kerala's unique climatic, ecological, and health system characteristics necessitate context-specific treatment planning for snakebite envenoming. The state experiences a seasonal surge in snakebite cases during the monsoon months, driven by flooding, agricultural activities, and the displacement of snakes into human habitations. Health facilities must proactively anticipate this increased burden by ensuring adequate ASV stocks, trained manpower, functional referral systems, and emergency preparedness during high-risk periods.

The presence of diverse ecological zones—including coastal belts, wetlands, forest fringes, plantations, and hilly terrains—results in varying patterns of snakebite risk and access challenges. Peripheral health facilities in these areas must be strengthened to support early stabilisation, rational ASV administration, and timely referral, particularly for neurotoxic envenomation, where delays can be fatal.

Kerala's strong public–private healthcare mix offers a strategic advantage in reducing snakebite mortality and morbidity. Leveraging the strengths of private institutions in advanced clinical care, training, and research through structured collaboration will enhance the overall quality and reach of snakebite management services. At the same time, despite high literacy levels, persistent misinformation and unscientific practices continue to delay care-seeking in some communities, underscoring the need to complement treatment strategies with strong IEC and regulatory measures.

The state's well-established ambulance services and referral networks offer an opportunity to strengthen further time-bound referrals, pre-referral stabilisation, and continuity of care. Optimising coordination between emergency transport services and health facilities is essential to ensure that patients receive definitive treatment without avoidable delays.

Chapter 13

Creating A Support Neighbourhood for Snake Bite Management in Kerala

Efforts to address snakebite envenomation in India have accelerated following the government's decision to launch a national programme in September 2022. India is the first country to introduce such a programme. The National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) was subsequently launched on 12 March 2024, aiming to reduce snakebite deaths by 50% by 2030 through a One Health approach. Strengthening surveillance, the MoHFW declared snakebite envenomation a notifiable disease on 27 November 2024. Recently, the Supreme Court has also sought responses from the Centre and states on improving access to anti-venom and snakebite treatment across the country.

Kerala, known for its strong public and private healthcare systems, reported only 34 snakebite deaths in 2023–24, compared to much higher figures in states like Odisha (800–900) and Uttar Pradesh (over 2000). *Jaideep C. Menon et al., 2025*. This low mortality is attributed to trained community volunteers, ASHA workers trained in first aid and early detection, a 24×7 ambulance network, and digital tools such as the Sarpa and other Apps, which help locate nearby hospitals with ASV and treatment facilities.

Kerala hosts over 120 snake species- fewer than ten of which are dangerously venomous, contributing to India's rich biodiversity protected under the Wildlife Protection Act, 1972. To ensure safe human–snake coexistence, Kerala introduced the Guidelines for Rescue and Release of Snakes in August 2020, leading to the formation of Team SARPA, a certified volunteer network. Over the years, SARPA has become a key system for snake rescue, awareness, and support during snakebite emergencies. The SARPA mobile app enables real-time coordination between citizens and certified snake handlers, enhancing both human safety and reptile conservation across the state.

From a review article published in June 2024, a snakebite victim's journey to receive antivenom is marked by several obstacles, beginning with poor transport and limited access to health facilities in remote, low-income areas, which often push patients toward traditional healers. Even after reaching a health centre, challenges persist, including difficulty in identifying the snake, inadequate clinical descriptions, limited SBE awareness among health-care providers, and inconsistent availability and affordability of quality, species-specific ASV. Timely administration of ASV, ideally within 2–6 hours, is critical; however, delays are common and can worsen outcomes, increase the number of vials required, and prolong hospital stay. Even after receiving good-quality antivenom, patients may still experience late reactions, complications, and long-term disabilities. Thus, while early access to safe, effective, and affordable ASV remains the only lifesaving treatment, it remains out of reach for many, underscoring the need for improved, species-specific ASV production, procurement, and delivery systems worldwide.

The PROMISE (Practical Routes for Managing Indigenous Snakebite Envenoming) approach focuses on simple, cost-effective strategies to strengthen SBE management beyond ASV availability.

- Integrating trained traditional healers into the referral system can improve early recognition and reduce under-reporting. Strengthening communication networks and transport systems, and establishing poison information centres, enhances timely care and prevents unnecessary patient movement.
- Building trust is essential; publishing annual treatment outcomes can reassure communities, while sharing successful ASV cases and improving medical education can increase doctors' confidence in both the therapy and their own skills.
- A standardised national or regional SBE protocol helps reduce ASV misuse, treatment cost and hospital stay, provided it reflects local snake diversity.
- Accurate snake identification is another critical component. Every health facility should maintain updated information on local snake species, available ASVs, and management guidelines in regional languages. Simple tools such as snake atlases, mobile applications, AI-based identifiers, and real-time ASV availability maps can support both clinicians and communities.
- Ensuring good ASV quality requires gradual strengthening of Good Manufacturing Practices compliance while supporting manufacturers to upgrade their processes.
- Public-private partnerships involving government, manufacturers, and academia can help expand ASV cross-reactivity and develop broadly specific, affordable, safe, and effective ASVs.
- Reliable estimates of ASV demand are essential and should be calculated using multiple methods with provisions for contingency stock during emergencies such as floods.
- Mandatory snakebite reporting and standardised documentation of case characteristics, species involved, and ASV usage can improve epidemiological understanding and guide policy.
- A dedicated task force of frontline health workers can support surveillance, data collection and burden estimation using robust, internationally aligned protocols.
- Mass education and responsible media communication are also crucial for countering misinformation and promoting appropriate health-seeking behaviour, supported by school-level awareness activities, such as monthly snake learning sessions.
- Finally, strict regulation of the trade in snakes, illegal ownership, and crossbreeding is necessary to prevent bites from exotic or hybrid species with unpredictable venom profiles.

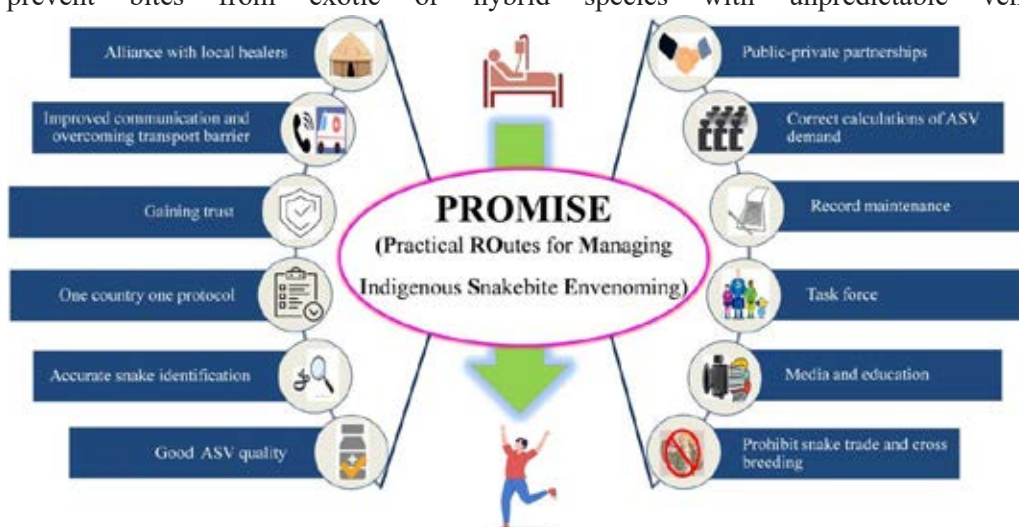


Figure: The PROMISE approach for SBE management. The PROMISE (Practical Routes for Managing Indigenous Snakebite Envenoming) approach is an amalgamation of cost-effective, easy-to-implement remedies that can significantly reduce the burden of SBE. (A study on Snake bite Management: The Need for Reassessment, International Relations and Effective Economic Measures to Reduce the Considerable SBE Burden)

Chapter 14

Avenues for ASV Production and Anti-Venom Logistics

Anti-snake venom (ASV) remains the only specific treatment for snakebite envenoming. However, its public health impact depends not only on clinical efficacy but also on reliable production systems and reliable logistics that ensure timely availability at the point of care.

Improving early access to safe, affordable, and effective ASVs is a major component of the WHO strategy to control snakebite envenoming.

1. ASV Production: Current Landscape and Opportunities

ASV is produced by hyperimmunizing large animals, usually horses or sheep, with venoms from medically important snake species, and purifying the resulting immunoglobulins. The choice of venoms used for immunisation determines the geographical and species-specific effectiveness of the final product.

Key avenues for strengthening ASV production include:

- **Region-specific venom sourcing:** Venom composition varies significantly across regions within the same snake species. Antivenoms produced using venoms from one region may be less effective in other geographies. Establishing regional venom-collection centres and incorporating geographically representative venoms into immunisation protocols can substantially improve antivenom effectiveness.
- **Strengthening public-sector production:** In several countries, public-sector manufacturers have reduced or discontinued production, increasing reliance on private suppliers. Revitalising public-sector units, upgrading facilities to meet Good Manufacturing Practice (GMP) standards, and ensuring sustained government procurement can improve national self-reliance and price stability.
- **Innovation in product design:** Advances such as refined F(ab')₂ fragments, improved purification techniques, and freeze-dried (lyophilised) formulations enhance safety, shelf-life, and heat stability. These innovations are particularly relevant for tropical, resource-limited settings.
- **Quality assurance and batch consistency:** Variations in potency between batches remain a major concern. Strengthening regulatory oversight, routine preclinical testing, and post-marketing surveillance are essential to ensure consistent neutralising capacity.

2. Supply Planning and Quantification of ASV Needs

Efficient antivenom logistics begin with an accurate estimation of need. An annual assessment of ASV consumption, wastage, and carry-over stocks at the peripheral, district, and state levels is critical.

Important strategic considerations include:

- **Data-driven forecasting:** Regular review of snakebite incidence, severity patterns, and average ASV consumption per case allows realistic estimation of requirements.
- **Buffer stocks for emergencies:** Natural disasters, such as floods, often trigger snakebite outbreaks. Maintaining buffer stocks in high-risk districts and disaster-prone areas is essential to prevent avoidable mortality.

- Rational use to minimise wastage: Training clinicians in evidence-based ASV use reduces inappropriate administration, prevents shortages, and optimises limited supplies.

3. Selection of Appropriate Antivenom

The selection of ASV is a critical interface between production and clinical use.

- Polyvalent versus monovalent antivenoms: Polyvalent antivenoms are preferred in most endemic settings due to diagnostic uncertainty and broader coverage. When the biting species is confidently identified, monovalent antivenoms may offer advantages such as lower protein load and reduced cost.
- Ensuring relevance to local snake fauna: Antivenom should only be deployed where its stated specificity and paraspecific neutralisation include the locally prevalent venomous species. Mismatch between antivenom specificity and regional snake ecology remains a major cause of therapeutic failure.

4. Storage, Shelf-life, and Cold Chain Management

Storage and transport conditions directly influence antivenom potency and safety.

- Lyophilised antivenoms have a shelf-life of approximately 5 years and can be stored at temperatures below 25°C, making them suitable for peripheral health facilities.
- Liquid antivenoms require storage at 2–8°C, must not be frozen, and generally have a shorter shelf-life of two to three years.

Proper stock rotation, temperature monitoring, and adherence to expiry dates are essential components of antivenom logistics. In life-threatening envenoming, recently expired antivenoms may be used if no alternatives are available, provided storage conditions are appropriate, and the product shows no signs of degradation.

5. Distribution and Last-Mile Availability

Timely administration of ASV is a decisive factor in survival. Delays due to stock-outs or poor distribution negate the benefits of effective production.

Key logistics strategies include:

- Decentralised stocking: Ensuring availability of ASV at first-referral units and strategically located peripheral facilities reduces delays in treatment.
- Hub-and-spoke distribution models: District hospitals can serve as hubs, with real-time stock monitoring and rapid replenishment to peripheral facilities.
- Integration with emergency transport systems: Coordination between ASV availability and ambulance or referral networks ensures that patients reach facilities capable of administering antivenom.

6. Dosage, Repeat Dosing, and Implications for Supply

ASV dosage recommendations are largely empirical and vary by species, envenoming severity, and product potency. Regimens based on adequate initial loading doses are more rational than repeated

low dosing over several days, as they neutralise circulating venom more effectively and may reduce overall consumption.

Recurrence of systemic envenoming, particularly after viper bites, can occur 24–48 hours after initial improvement due to redistribution or continued absorption of venom from the bite site. Clear criteria for repeating the initial dose—such as persistent incoagulable blood, ongoing systemic bleeding, or worsening neurotoxicity—must be integrated into clinical protocols to ensure rational use without unnecessary depletion of stocks.

7. Training, Governance, and System Integration

Production and logistics alone are insufficient without strong health system integration.

- Training healthcare providers in the correct indications, dosing, administration, and management of adverse reactions reduces waste and improves outcomes.
- Clear governance mechanisms linking manufacturers, procurement agencies, regulators, and health services ensure accountability and continuity of supply.
- Integration with One Health approaches—including surveillance of snakebite incidence, snake ecology, and environmental drivers—can inform both production planning and logistics deployment.

Strengthening ASV production and antivenom logistics requires a coordinated, systems-level approach that spans venom sourcing, manufacturing, quality assurance, supply forecasting, storage, distribution, and rational clinical use. By aligning production strategies with regional snake ecology and reinforcing last-mile delivery through reliable logistics and trained health personnel, preventable deaths from snakebite envenoming can be substantially reduced.

Chapter 15

Training & Capacity Building, And Research & Innovation (Including One Health)

Snakebite envenoming (SBE) continues to be a critical public health concern in Kerala due to its diverse ecology, high human–animal interface, and occupational exposure among farmers, plantation workers, tribal communities, and forest-fringe populations. Strengthening knowledge, skills, preparedness, and institutional capacity across the health system is essential to achieving the State’s vision of zero preventable deaths from snakebite envenoming by 2030.

Core Areas of Action

I. Retrospective Analysis and Facility Preparedness Assessment (Phase I)

To build an evidence-based action plan, Kerala will undertake systematic data collection and facility assessments across all districts. The objective is to generate baseline information on the burden of SBE (Snake Bite Events), care-seeking patterns, delays, and gaps in health system preparedness.

a. Retrospective Data Collection

- Two-year retrospective data will be collected from all public health facilities that provide snakebite care — PHCs, CHCs, Taluk Hospitals, District Hospitals and Government Medical Colleges. Data will include:
 - Number of snakebite cases and outcomes
 - Time to presentation, referral patterns
 - Antivenom usage, complications, length of stay
- Additional data on snakebite deaths will be obtained from LSGIs, registrar of births and deaths, police stations, and panchayat-level records to ensure maximum capture of mortality data.
- All data will be digitised through a centralised online system, with periodic verification by district nodal officers.

b. Health Facility Preparedness

Survey: A cross-sectional survey will assess:

- Availability of antivenom, emergency medicines and IV fluids
- Functionality of oxygen delivery systems
- Availability of trained staff, emergency triage systems
- Laboratory services and referral linkages

• Stock and cold chain status for ASV The findings will inform district-level micro-plans on strengthening clinical readiness.

c. Community Focus Group Discussions (FGDs)

FGDs will be conducted in selected panchayats across representative blocks to understand:

- Community perceptions on snakes and snakebite
- First aid practices and harmful traditional remedies

II. Development and Implementation of Educational Interventions (Phase II)

Educational materials will be designed and deployed to address community myths, improve first aid practices, and strengthen early referral.

i. IEC and Behaviour Change Communication (BCC) Materials

IEC materials will be developed in Malayalam, using culturally relevant images and common locally used terminology.

- Materials will include:
 - o Immediate first aid steps
 - o Do's and don'ts after snakebite
 - o Referral pathways and contact numbers of health facilities
 - o Prevention practices (footwear use, safe farming practices, nighttime lighting, safe firewood handling)
- Short videos will be developed for:
 - Community members (first aid, referral)
 - Healthcare providers (facility-level management) IEC materials will be disseminated through: Village panchayats, Anganwadis, tribal hamlets, educational institutions, Kudumbashree groups
- Forest outposts, local community leaders and faith healers
- ASHAs and grassroots health workers during Gram Sabhas, community gatherings and seasonal agricultural meetings. Posters will be displayed at bus stops, markets, tea shops, and other regularly used public spaces.

III. Knowledge and Skill Assessment of Healthcare Providers (Phase III)

A statewide assessment will be conducted to understand existing knowledge gaps.

Ø Target Groups

- Medical Officers in PHCs, CHCs, THs, and DHs
- Staff Nurses and Emergency Department staff
- ASHAs, ANMs
- Personnel working in high-risk areas such as tribal PHCs and forest-fringe facilities

Ø Assessment Areas

- Recognition of venomous vs non-venomous snakebites
- Early stabilisation and first aid
- ASV indications, adverse reactions, and management
- Referral criteria and documentation practices
- Awareness of Standard Treatment Guidelines (STG 2017 and Kerala addendums)

IV. Capacity Building and Training Framework (Phase IV)

Kerala will establish a multi-tiered training system to ensure that every health facility has trained personnel for SBE management.

1. Master Trainer Development

Master Trainers will be trained at the State and Regional levels:

- Senior MOs from District/Taluk Hospitals
- MOs from CHCs/PHCs
- Emergency medicine nurses

2. Training of Medical Officers

- Six-monthly training cycles for two years.
- Includes lectures, case simulations, skill stations (airway support, ASV administration, anaphylaxis management).
- Quick reference guides and Kerala SBE treatment charts will be provided for all MOs.

3. Training of Grassroots Health Workers (ASHAs, ANMs, MPWs) Training will focus on:

- Correct first aid
- Immobilisation techniques
- Early transport and communication protocols
- Community counselling during high-risk seasons. Quick reference charts will be displayed in all PHCs, CHCs, and emergency rooms.

V. Research, Monitoring, and Impact Evaluation (Phase V)

To ensure continuous learning and improvement, Kerala will adopt a strong monitoring and evaluation framework.

a. Community and Provider Evaluation

- Post-intervention FGDs will measure community-level behaviour change.
- Pre- and post-training assessments will track knowledge retention among providers.

b. Prospective Data Monitoring

Prospective data will be collected for one year post-intervention to assess:

- Reduction in case fatality rates

- Time to treatment and referral intervals
- Trends in ASV usage
- Increase in correct first aid and decrease in harmful practices.

c. Research Priorities for Kerala

- Ecological mapping of snake species distribution
- Seasonality and spatial clustering of bites
- Comparative analysis of ASV effectiveness
- High-risk population behaviour studies
- Digital innovations for SBE reporting and tracking

Kerala will also collaborate with academic institutions, forest departments, and herpetologists for field-based research.

VI. Innovations for Strengthening SBE Management in Kerala

1. Digital Tools

- Mobile-based Incident Reporting System for ASHAs
- GIS-based mapping of bite hotspots
- E-learning modules for continuous training
- SBE dashboards linked with DHS and NHM portals

2. Technological and System Innovations

- Low-cost LED pathway lights for forest-fringe households
- Protective footwear distribution in tribal communities
- Snake-safe storage units for agricultural workers
- Emergency “SBE Preparedness Kits” for PHCs
- Improved cold chain for ASV storage at peripheral facilities

3. Collaboration with Forest, Agriculture and Veterinary Departments

- Joint awareness programmes in plantation zones
- Training for forest frontline staff on safe handling and rescue
- Prevention strategies for snake–human conflict in wildlife areas
- Integration of One Health principles into SBE surveillance

Chapter 16

Partnership Frameworks with NGOs, Herpetologists and Community Networks

The challenge of snakebite envenoming—a major public health concern—cannot be addressed solely by the health sector. Effective prevention, control, and successful antivenom (ASV) logistics require a comprehensive, coordinated response grounded in a multi-sectoral, collaborative framework. Public-private partnerships and the involvement of national, regional, and global agencies are considered vital to effectively meeting this challenge.

The Role of Non-Governmental Organisations (NGOs) and Civil Societies

Non-Governmental Organisations (NGOs) and Civil Societies are instrumental in addressing the immediate threats posed by venomous snakebites in rural areas, which predominantly affect economically vulnerable communities. Their close ties to affected populations make them indispensable partners in programmatic implementation.

Key Functions of NGOs and Civil Societies:

- Community Awareness and Education: NGOs actively engage in community outreach activities to educate individuals on snake ecology, preventive measures, and the importance of seeking timely and appropriate treatment. This includes disseminating Information, Education, and Communication (IEC) materials.
- Resource Distribution and Logistics: They contribute to logistics by prioritising the distribution of culturally acceptable, effective snakebite prevention materials, such as rechargeable torchlights and headlamps, to vulnerable communities.
- Capacity Building and Training: NGOs organise hands-on workshops for various first responders and professionals, including snakebite sensitisation and emergency response training.
- Community Mobilisation and Engagement: They facilitate village meetings and interactive sessions to enhance community participation and mobilise communities for prevention efforts.
- Addressing Traditional Practices: NGOs are crucial in educating traditional healers and addressing common myths by engaging communities through outreach programmes.

Partnership with Herpetologists

Herpetologists provide the necessary knowledge base regarding snake species, venom variation, and ecology, which is critical for both prevention and antivenom efficacy. Partnerships with herpetologists are fundamental to the success of prevention programs at the community level:

- Species-Specific Information for community education: Herpetological knowledge is translated into practical community education that helps people learn about their local snakes and their preferred habitats, and understand where snakes rest, forage, and breed. Communities can implement effective behavioural changes and environmental modifications (e.g., maintaining clean outdoor spaces and properly storing materials) to minimise encounters.
- Safe Handling and mitigation: Herpetologists provide vital insights into snake behaviour through fieldwork, including techniques such as radio telemetry to track and analyse movement. This information helps develop evidence-based recommendations for safer agricultural and domestic practices. Furthermore, they can provide training or consultation for safe snake removal services (e.g., snake catchers) to reduce risk without resorting to killing the animal.

Strengthening Community Networks and First Responders

Community engagement is the foundation for successfully implementing prevention strategies, improving first aid, and ensuring rapid access to healthcare.

- Effective Community Outreach: Community networks serve as a mechanism for health promotion. Successful methods include using local media such as radio and TV and engaging community members through interactive sessions, such as role-playing, drama, and puppets, at the village level to portray snakebite scenarios.
- Training of First Responders: Training of frontline workers, such as ASHA workers and Anganwadi workers, is a critical step in building strong community response networks. These personnel are essential for providing immediate field-based emergency interventions and facilitating the prompt evacuation of victims to referral hospitals for antivenom administration.
- Establishing Communication Channels: A 24x7 snakebite helpline is a key strategy to answer queries about snakes and snakebite, linking community members directly to experts and emergency resources.

The ultimate goal of these diverse partnerships is to synchronise efforts and create a robust, inclusive, responsive, and tailored framework that addresses the unique challenges of affected communities, thereby making the National Action Plan a resounding success.

Chapter 17

Strategic Communication for Addressing Communication Barriers In Snakebite Prevention

Snakebite envenoming remains one of India's major public health challenges, disproportionately affecting rural and agrarian communities. Effective, culturally grounded communication is essential for preventing snakebites, promoting safer behaviours, and ensuring timely medical care. Addressing barriers requires strategic communication approaches that are evidence-based, community-centred, culturally sensitive, and aligned with the One Health framework.

Human–snake encounters mainly occur when natural habitats are disturbed by farming, construction, wood collection, or other daily activities, underscoring the need for improved communication about reducing, early care, and safe practices. Yet, communication attempts often fail due to:

- Low literacy levels
- Language and cultural diversity
- Myths surrounding snakes and treatments
- Reliance on informal and traditional healers
- Inadequate access to accurate first-aid information
- Limited risk perception in vulnerable groups

Thus, strategic communication is not an optional component but a core pillar in snakebite prevention.

Ø Key Communication Barriers

Poor Awareness

Many rural and tribal communities lack knowledge of:

- How snakebites occur
- How to modify behaviours to reduce risk
- The importance of immediate medical care
- Evidence-based first-aid practices

Misinformation often leads victims to lose critical time through traditional methods before reaching a health facility.

Language and Cultural Barriers

India's linguistic diversity results in gaps between message design and community comprehension.

Challenges include:

- Health materials presented in languages not used locally
- Use of technical or clinical terms unfamiliar to laypersons

- Messages that ignore local customs, idioms, and cultural symbols. Such mismatches cause misinterpretation and weaken trust.

Myths and Misconceptions

Popular myths—snakes drinking milk, immunity after a single bite, reincarnated snakes taking revenge, or traditional cutting/ sucking practices—create major barriers to timely care. Many films and local narratives further amplify these beliefs.

These myths influence:

- Help-seeking behaviours
- Reliance on faith healers
- Delay in hospital transport
- Risky first-aid practices

These factors directly contribute to preventable deaths.

2. Incorrect First-Aid Practices

Despite available guidelines, generations have followed unsafe first-aid methods:

- Applying tight tourniquets
- Making incisions
- Sucking out venom
- Applying ice, herbs, oils, or chemicals
- Giving alcohol or stimulants

These practices worsen outcomes and highlight gaps in accessible, credible messaging.

Ø Strategic Communication Framework

To effectively address these barriers, communication must shift from isolated campaigns to a structured, multi-layered strategy that integrates behavioural science, gender and cultural sensitivity, stakeholder participation, and sustained engagement.

- a. Community Needs Assessment: A systematic assessment helps identify:
 - Local knowledge, beliefs, and risk behaviours
 - Trusted communication channels and influencers
 - Local myths and prevailing narratives
 - High-risk groups (farmers, children, forest gatherers, tribal populations, etc.)

Strategies should be informed by participatory assessments involving ASHAs, ANMs, paravets, schoolteachers, local leaders, and PRI representatives.

- b. Tailoring Messages to Local Contexts. Messages must be:

- Culturally relevant
- Linguistically accurate
- Free of medical jargon

- Visually engaging for low-literacy audiences

Materials should be produced in regional languages and dialects, reflecting local customs, snake species, and real scenarios. Examples include story-based content, visuals of locally common snakes, and simple step-by-step first-aid explanations.

c. Use of Multichannel Communication

A hybrid model ensures that critical messages reach diverse audiences.

- Mass Media: Radio, community FM, regional TV spots, and mobile announcements before monsoons.
- Interpersonal Communication: Through ASHAs, ANMs, MLHPs, schoolteachers, NGO workers, snake rescuers, and PRI volunteers.

· Folk and Community Media:

- Puppet shows
- Street plays
- Village fairs and weekly markets

These tools are particularly effective in areas with low literacy.

Digital and Visual Media: Short videos, reels, A/V clips on first aid, WhatsApp groups, and social media infographics.

Engaging Community Influencers: Behaviour change is more sustainable when messages come from trusted local figures such as Panchayat leaders, Snake rescuers, Local NGOs, Religious/community leaders.

Ø Strategic Communication Interventions

- Addressing Misconceptions can be addressed by developing myth-busting modules, using relatable stories and local examples, demonstrating correct first-aid techniques publicly, and conducting seasonal campaigns (pre-monsoon, harvest).
- Skill-based Training for Frontline Workers - Provide ASHAs, AWWs, MLHPs, PHC staff, and paravets with IEC toolkits, demonstration flipbooks, Bite-site models, and Posters on do's and don'ts. Regular refresher trainings ensure consistent messaging.
- Ensuring Message Continuity - Communication must be long-term, not one-off.

Recommended actions:

- Integrate snakebite messaging into routine VHNDs,
- Weekly announcements during high-risk seasons,
- School-based weekly snake safety modules,
- Community meetings led by PRIs

Behaviour change communication (BCC) is successful only when measurable improvement occurs in community practices. A robust communication strategy ensures not only improved awareness but also timely health-seeking behaviour, reduced mortality, and stronger community resilience.

Chapter 18

Operational Research & Gap Analysis

Kerala presents a unique epidemiological and ecological context for snakebite envenoming (SBE), owing to its population density, diverse geography, high rainfall, forest–human interface, agrarian livelihoods, and rich snake biodiversity, particularly in the Western Ghats. While the State has a comparatively strong public health system and emergency care network, snakebite envenoming continues to contribute to preventable morbidity, mortality, and long-term disability, especially among rural, tribal, coastal, and plantation-dependent populations.

Operational research is essential to generate locally relevant evidence for improving prevention, clinical management, surveillance, and community response to snakebite envenoming in Kerala. A systematic gap analysis will enable the State to identify priority areas where policy, programme implementation, and health system strengthening are required to achieve the vision of zero preventable deaths due to snakebite.

Table: Summary of Key Gaps and Proposed Operational Research Actions in Kerala

Domain	Identified Gaps	Proposed Operational Research Actions	Expected Use in SAP Implementation
Burden Estimation & Epidemiology	- Underreporting of snakebite cases and deaths - Limited district- and block-level estimates - Inadequate documentation of disability and long-term outcomes	- State-wide retrospective and prospective studies using IDSP–IHIP, hospital records, and verbal autopsy - District-wise burden estimation, including morbidity and mortality - Follow-up studies on snakebite survivors	- Evidence-based prioritisation of high-burden districts - Improved resource allocation and micro-planning - Integration of snakebite into the state NCD and injury surveillance
Surveillance & Data Systems	- Inconsistent reporting across public and private facilities - Limited use of surveillance data for action - Absence of geo-spatial hotspot mapping	- Evaluation of completeness and timeliness of IDSP reporting - Integration of the private sector reporting - GIS-based mapping of snakebite hotspots at the Panchayat and block levels	- Strengthened surveillance system - Targeted prevention and preparedness activities - District-level risk stratification
	Variability in adherence to Standard Treatment Guidelines	Facility-based audits of snakebite management practices	- Improved quality of clinical care - Standardisation of

Clinical Management & Outcomes	- Limited documentation of snake species and clinical syndromes - Gaps in the management of complications	- Outcome studies on ASV dosing, complications, and case fatality - Research on the pit viper Envenomation patterns in Kerala	- treatment practices - Inputs for protocol refinement and training
Anti-Snake Venom (ASV)	- Limited real-world data on ASV utilisation and adverse reactions - Variability in storage and cold-chain practices	- Studies on ASV consumption patterns and stock adequacy - Pharmacovigilance studies on ASV-related adverse events - Assessment of cold-chain and inventory management systems	- Optimised ASV procurement and distribution - Strengthened pharmacovigilance - Reduced stock-outs and wastage
Referral & Emergency Response	- Delays in referral and transport - Inadequate data on pre-hospital care practices	- Time-motion studies on referral pathways and ambulance response - Assessment of pre-hospital first aid practices and outcomes	- Improved referral protocols - Strengthening emergency medical services - Reduced delay-related mortality
Community Behaviour & Prevention	- Continued reliance on traditional and faith-based practices - Limited evidence on the effectiveness of IEC and BCC activities	- Knowledge, Attitude and Practice (KAP) studies in high-risk communities - Evaluation of school-, workplace- and community-based awareness programmes	- Context-specific IEC/BCC strategies - Improved care-seeking behaviour - Enhanced community participation
Ecology & One Health Interface	- Limited state-specific data on snake ecology and human-snake conflict - Weak integration between health, forest, and wildlife data	- Joint studies with the Forest Department on snake distribution and seasonal patterns - Research on human-snake conflict in forest fringe and plantation areas	- One Health-informed prevention strategies - Reduced human-snake conflict - Improved intersectoral coordination
Equity & Vulnerable Populations	- Limited data on tribal, coastal, plantation, and migrant populations - Gender- and age-specific outcomes are not well studied	- Disaggregated studies focusing on vulnerable groups - Qualitative research on access barriers and socio-cultural determinants	- Equity-focused interventions - Tailored prevention and service delivery strategies
Policy & Programme Implementation	- Limited documentation of best practices and innovations - Weak feedback loop between research and policy	- Implementation research on SAP roll-out at the district level - Documentation of successful models and innovations	

Chapter 19

Tribal Sub-Action Plan for Snakebite Envenoming Prevention and Control

Snakebite envenoming (SBE) is recognised by the World Health Organisation (WHO) as a neglected tropical disease that disproportionately affects poor, rural, and tribal populations. The WHO Strategy for Snakebite Envenoming (2019) identifies tribal and indigenous communities as high-risk groups due to environmental exposure, occupational hazards, limited access to healthcare, and sociocultural practices that delay appropriate treatment.

In Kerala, tribal communities residing in forest-fringe and hilly areas face increased vulnerability to snakebite due to seasonal agricultural activities, forest-based livelihoods, and frequent human–snake interactions. Delayed access to emergency transport, distance from appropriately equipped health facilities, and continued reliance on traditional or faith-based treatment practices contribute to avoidable morbidity and mortality.

The National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE), Government of India, emphasises the need for community-based interventions, culturally appropriate risk communication, strengthening of peripheral health facilities, assured availability of anti-snake venom (ASV), and multisectoral coordination, with specific attention to tribal and hard-to-reach populations.

In alignment with the WHO’s global target of reducing snakebite-related deaths and disability by 50% by 2030, and national priorities outlined under NAPSE, this Tribal Sub-Action Plan provides a focused framework to address the unique needs of tribal populations in Kerala through an equity-driven, culturally sensitive, and health systems strengthening approach.

Goal: To reduce mortality, morbidity, and long-term disability due to snakebite envenoming among tribal populations through prevention, early care-seeking, effective clinical management, and sustained community engagement.

Objectives.

1. To improve understanding of the burden, distribution, and determinants of snakebite envenoming in tribal areas.
2. To enhance community awareness and promote safe practices for prevention, first aid, and early healthcare seeking.
3. To strengthen healthcare preparedness, referral mechanisms, and access to anti-snake venom (ASV) in tribal regions.
4. To integrate traditional community structures and stakeholders into formal snakebite prevention and response systems.
5. To ensure sustainability through capacity building, policy support, and continuous monitoring.

In alignment with WHO (2019) and NAPSE guidelines, a comprehensive surveillance and situational assessment mechanism shall be established in tribal areas to systematically capture, analyse, and respond to snakebite envenoming data.

Surveillance, Mapping, and Evidence Generation

- Mapping of snakebite incidence, mortality, seasonality, and high-risk locations.
- Identification of locally prevalent venomous snake species.
- Assessment of health-seeking behaviour, traditional beliefs, and treatment practices.
- Mapping of health facilities, referral pathways, ASV availability, and human resource gaps.
- Identification of traditional healers and community influencers relevant to snakebite care.
- Documentation of emergency transport and communication infrastructure

Community Engagement, Risk Communication, and Prevention

- Development of IEC materials in local languages and tribal dialects, using visual and participatory methods.
- Community workshops and awareness camps emphasising:
 - Snakebite prevention, Recognition of danger signs, and Correct first aid practices
 - Urgent referral to health facilities
- Clear messaging that anti-snake venom (ASV) is the only proven treatment for snakebite envenoming, and that harmful traditional practices delay life-saving care.
- Promotion of preventive practices such as protective footwear, use of torches, safe sleeping arrangements, mosquito nets, and safe agricultural practices.
- Intensive pre-monsoon awareness campaigns targeting high-incidence periods.

Reduction of Snake–Human Interaction

In coordination with forest, tribal, and local self-government institutions:

- Environmental management to reduce snake habitats near human dwellings.
- Promotion of housing improvements to prevent snake entry.
- Installation of warning signage at high-risk locations such as weekly markets and forest entry points.
- Engagement of trained local snake handlers for safe rescue and relocation.

Health System Strengthening and Capacity Building

To ensure effective clinical management of snakebite cases:

- Training of doctors, nurses, ASHAs, ANMs, and paramedical staff in snakebite first aid, diagnosis, management, and referral as per national protocols.
- Periodic refresher training and mentoring in tribal and hard-to-reach areas.
- Provision of standard treatment guidelines and IEC materials for health workers.
- Training of healthcare personnel in the identification of locally prevalent snake species.
- Capacity building of Panchayati Raj Institutions (PRIs), community leaders, and volunteers.

Timely Treatment, Referral, and Access to Anti-snake venom (ASV)

- Ensuring the uninterrupted availability of ASV at all designated health facilities serving tribal areas.
- Strengthening primary and secondary health facilities with essential equipment for emergency resuscitation, stabilisation, and referral.

- Establishment of efficient emergency transport systems, including equipping ambulances with advanced life support.
- Promotion of telemedicine support for remote facilities to enable real-time clinical guidance.
- Provision of emergency wireless communication facilities in all tribal villages—engagement with Traditional Healers and Community Stakeholders.
- Mapping and engagement of traditional healers and faith leaders.
- Sensitisation programmes to encourage early referral to government health facilities.
- Integration of community influencers as partners in awareness generation and prevention efforts. Stakeholder Roles and Multisectoral Coordination

Effective implementation requires coordinated action across multiple sectors:

- National Level: Ministry of Health and Family Welfare; Ministry of Tribal Affairs; Ministry of Environment, Forest and Climate Change; Ministry of Panchayati Raj; National Disaster Management Authority; National Human Rights Commission.
- State Level: State Health Department; State Forest Department; State Tribal Development Department; State Disaster Management Authority.
- District Level: District Health Office; Zila Parishad; District Forest and Wildlife Department, Tribal Department,
- Rural Development Department, Local NGOs, and civil society organisations.
- Village Level: LSGDs; ASHA workers; Anganwadi staff; teachers; self-help groups; wildlife rescuers; community educators; traditional leaders.

The Tribal Sub-Action Plan for Snakebite Envenoming Prevention and Control, aligned with the WHO Strategy (2019) and the National Action Plan of India, provides a comprehensive, equity-focused framework to address the disproportionate burden of snakebite among tribal communities. By integrating culturally appropriate community engagement, strengthened surveillance, improved access to timely treatment and anti-snake venom, and coordinated multisectoral action, the plan aims to substantially reduce preventable deaths and disabilities. Sustained political commitment, community ownership, and continuous monitoring will be critical to ensure that tribal populations in Kerala benefit from safe, timely, and effective snakebite prevention and care.

Chapter 20

Recommendations from the action plan development workshop

1. Recommended Immediate Actions

- Formation of a State-Level Task Force
- Development of Standardised IEC Materials & School Curriculum Integration
- Training and Capacity Building for Healthcare Providers
- Pilot Implementation of Upgraded Pre-Hospital Care Services

2. Strengthening Surveillance: Strategies for Creating a Comprehensive/Integrated Database and Efficient Implementation of Snakebite Notification

- Standardised Data Collection: Develop a uniform reporting format for both public and private healthcare facilities.
- Centralised Digital Platform: Mandatory Digital Reporting System: Introduce a real-time notification system (e.g., a mobile app or web portal) for hospitals and health workers to report snakebite cases and deaths. Establish a state-level database integrating hospital records in a phased manner.
- Integration with Existing Health Surveillance: Link with the IDSP (Integrated Disease Surveillance Program) or similar platforms, such as HMIS, to systematically track cases.
- Hotspot mapping using IHIP (Integrated Health Information Platform) & HMIS data - Reporting and Forest SARPA data
- Interdepartmental Coordination: Facilitate data sharing between Health and Forest, for real-time tracking and response. This shall include bite data and snake rescue data.
- Geospatial Mapping: Incorporate GIS-based mapping of snakebite hotspots to enable targeted interventions.
- Obtaining feedback from the community – Community-based surveillance
- Surveillance of treatment-related details- delays, deaths
- Surveillance and follow-up of treated patients who are experiencing complications
- Detailed analysis of failure cases
- Effective utilisation of SARPA volunteers for surveillance
- Information on compensation is to be popularised to ensure proper treatment
- Hump-nosed Viper should be included as the fifth snake in this list due to its increasing public health impact, and monovalent ASV production may be explored.
- The judiciary or legal wing should also be included in policy discussions

3. Summary Strengthening of Health System: Strengthen Pre-Hospital Care & Emergency Services

- Defining the hub and spoke hospitals and streamlining the referral pathways, including private hospitals if needed
- Identification of PHCs/CHCs/Taluk Hospitals near hotspots where ASV need to be stocked and administered

- Strengthening primary care and referral hospitals along the referral pathways and strategic purchases of snake bite treatment in red-flagged areas. Snakebite is a life-threatening disease; hence, the concept of seeking treatment at the nearest hospital needs to be emphasised.
- Separate treatment protocol for Hump nose pit viper, Malabar pit viper
- Popularising snake photographs and IEC material in the public health system and training modules for doctors
- Developing a training module for various categories, including emergency care training
- Hands-on LMA training for Medical officers and Nursing officers
- Identifying centres for emergency dialysis for snakebite patients
- Primary research could be conducted in collaboration with institutions like CUSAT on snake-specific ASVs
- Creation of a state-level audit, conducting a death audit for all snakebite-related fatalities
- Formation of an expert panel of doctors for teleconsultation support
- Well-equipped and connected ambulance network.

4. **Summary: Empowering and Engaging Communities: The "One Health" & Community Approach**

- Community-based interventions (bed nets, footwear, safe grain storage, environmental modifications)
- Community groups can organise collective habitat management, including clearing tall grass around houses, managing rodent populations, safely storing food grains, and improving lighting around paths and latrines.
- Promotion of protective behaviours (using torches at night, wearing footwear in fields, elevating sleeping areas, using bed nets) works best when local leaders, women's SHGs, and farmer groups champion them.
- Structured community education sessions, delivered in the local language using visual materials, improve knowledge of correct first aid (immobilisation, rapid transport) and discourage harmful practices such as tourniquets, cutting, or applying substances.
- Awareness programs: Visits by health department staff, identify household risk factors and teach appropriate first aid using locally available materials
- Peer education: "Snakebite Survivors' Meets" trains victims to become community educators, disseminating prevention knowledge in culturally appropriate ways
- Community/One health volunteers can report snake sightings, bites, and near-miss events through village registers, digital apps, or hotlines, helping to refine local risk maps and target interventions.
- LSG-level participatory monitoring (monthly review of bites, deaths, and delays in reaching facilities) and discussion in LSG One Health committees support micro-planning and accountability under state or district snakebite programmes.
- Co-design messages and interventions with local stakeholders (Panchayat leaders, forest and agriculture staff, herpetologists, tribal elders, school teachers) to ensure cultural acceptability and feasibility.
- Identify and support local "snakebite champions" (survivors, teachers, ASHAs) to lead peer-to-peer education, supported by simple visual IEC tools and, where feasible, mobile apps linking communities to certified snake handlers and health facilities.
- Communities learn to modify behavioural and environmental risks, including stacking firewood near houses, locating animal shelters close to dwellings, walking barefoot, sleeping on floors without properly tucked mosquito nets, and poor lighting. MGNREGS workers and grass cutters require targeted interventions.
- Frontline health workers receive training on first aid, prevention, and sentinel signs and symptoms.

- Successful One Health implementation requires collaboration among herpetologists, veterinarians, clinicians, forest departments, panchayat officials, NGOs, and anti-snake venom manufacturers. Decentralisation of decision-making empowers local stakeholders, including village elders and tribal school teachers, to implement context-specific interventions.
- School outreach: Child-friendly education reaches thousands of students, building awareness from a young age
- Mobile technology: Apps like SARPA in Kerala connect communities with certified snake handlers for safe rescue and relocation
- **Engagement of Local Self-Government s (LSG):** Strengthen community-level awareness and participation in snakebite prevention through LSGD initiatives, improving health-seeking behaviour. Ensuring the provision of PPE such as gumboots and rubber gloves for manual labourers

5. Summary: School Guidelines

Environmental and Structural Measures

- **Maintain Cleanliness:** Do not let garbage, food waste, or debris accumulate on school premises, as these attract rodents and other prey, which in turn attract snakes.
- **Cleaning of School premises:** This activity shall be conducted at the beginning of every school year, before the rainy season and at least once in a quarter.
- **LSG shall ensure the process of Inspection of School buildings:** School officials and Local self-government officials shall thoroughly inspect the safety of the building and ensure that the routine removal of vegetation, etc., as prescribed above, is carried out.
- **Rodent Control:** Prioritise effective rodent control to reduce the food chain that draws snakes
- **Secure Building Structures:** Ensure compound walls and school buildings are free of gaps, burrows, or holes where snakes can hide. Regularly plaster and maintain these structures.
- **Remove Hiding Spots:** Avoid storing logs, firewood, bricks, or construction materials near classrooms, as these shelter snakes.
- **Clear Vegetation:** Regularly trim bushes, shrubs, and tall grass around playgrounds and buildings. Ensure children do not venture into dense vegetation or abandoned properties.
- **Designated Paths:** Encourage children to use only clear, designated paths and avoid walking barefoot in grassy or wooded areas
- **Doors and windows** are to be promptly closed in the evening after school hours, thus preventing unnoticed entry and hiding of harmful insects and reptiles.
- **Safety Audit-**Each school is required to undertake a thorough safety audit of its entire infrastructure. This includes verification of the stability of buildings, the condition of classrooms, sanitation facilities, electrical systems, and perimeter fencing.
- **All physical hazards,** such as open pits, broken floors, exposed wiring, and unsecured doors or windows, must be promptly repaired. The school environment, including playgrounds and adjacent areas, should be cleared of overgrown vegetation, stagnant water, and any other potential health or wildlife risks, including snake bites.
- **First-aid kit:** Schools must maintain a well-equipped first-aid room or designated area for this purpose, with fully stocked first-aid kits accessible to staff and students.
- **Every school head** must ensure that at least two staff members are trained in basic first aid, including CPR and emergency wound care, in consultation with the nearest hospital. The contact details of nearby hospitals (both government and private) and public health officers must be prominently displayed on the school premises, and ambulance service contact details must also be available and prominently displayed.

- Child Emergency Medical Response Plan: Each school must prepare and display a Plan outlining steps to be taken in the event of sudden medical emergencies. Schools must proactively coordinate with the nearest Primary Health Centre or Taluk Hospital to ensure availability of antivenom and paediatric medical care in critical situations.
- Schools should maintain updated lists of hospitals with antivenom facilities.
- Also, schools should coordinate with the Forest Department to identify and engage authorised snake catchers/handlers for emergency snake removal operations.
- Schools should conduct thorough inspections of their premises to identify and seal potential entry points of snakes, insects and other reptiles. This includes checking boundary walls, storage areas, gardens, and all structures for gaps, holes, or overgrown vegetation that may harbour these threats.
- Clean, well-maintained toilet facilities must be provided for all students, with adequate water supply, ventilation, and lighting.
- If any serious accidents or traumatic injury occur, the victim must receive emergency medical treatment within the first hour after an injury when emergency treatment is most likely to be successful (the Golden Hour).
- No delay whatsoever shall be allowed in initiating emergency response.
- Schools must conduct mock drills to ensure preparedness for snake bites, fire, floods, earthquakes, and other emergencies, in consultation with the District Disaster Management Authority and the Local Self Government. Awareness should be raised about emergency preparedness for students' welfare.
- School heads and managements should strictly adhere to all the directives in this circular.
- District officials shall conduct periodic inspections to verify implementation.
- Students' bags and shoes should not be left unattended outside classrooms at any time, as there is a risk of snakes entering and hiding in them.

2. Student, Staff and other capacity building

- Education: Conduct regular sessions to educate students and staff about snakebite risks, snake identification, and safe behaviours (e.g., using sticks to retrieve balls from bushes)
- Sensitisation Programs: Implement awareness drives and distribute educational materials (pamphlets, posters) in local languages
- Mock Drills: Organise periodic mock drills for snakebite emergencies, involving teachers, students, and local authorities
- Periodic health awareness classes on various topics such as snake envenomation, rescue, etc.
- Long-term steps: Introduce Snakebite awareness and prevention education for students using digital technologies, Interactive games, and creative IEC materials, such as videos, to enhance learning and engagement.
- Snakebite Prevention will be incorporated into the School Curriculum, including in the NCC Cadets' Handbook. Introduce snakebite awareness and prevention education for students, using digital technologies, interactive games, and creative IEC materials to enhance learning and engagement.
- The development of Standardised IEC Materials and their integration into the school curriculum will be undertaken by the General Education Department in consultation with the Health Department & Forest Department.
- SARPA volunteers have been doing the programme named 'Sarpa Suraksha', which is done in educational institutions for safety checks against the presence of venomous snakes, especially during the school reopening after the summer vacation.
- SARPA volunteers have been doing the programme named 'Sarpa Paadam'

3. Emergency Preparedness

- First Aid Training: Train staff in basic first aid for snakebites and ensure they know how to keep the victim calm, immobilise the bitten limb, and arrange prompt medical transport
- Anti-Snake Venom (ASV) Availability: Know the nearest hospital (public or private) with ASV in stock. Confirm availability in advance and keep contact numbers for local doctors and hospitals up to date.
- Ambulance availability, location, and the operating agency/hospital's updated mobile contact numbers should be readily available and prominently displayed in the HM/Principal's room and the school office section.
- Availability of services, other standby vehicles, updated contact numbers, etc., to be displayed similarly in case the ambulance is unavailable.
- Conducting a Mock drill inter-sectorally with the cooperation of the Local Self Government bodies, Health, Forest and Schools biannually

4. Collaboration with Authorities

- Engage Certified Snake Handlers: Utilise Kerala's SARPA initiative and certified snake handlers for safe removal of snakes and to conduct awareness programs.
- Contact details of snake handlers/rescuers to be maintained at the institution level
- Financial Assistance: Utilise available government funds for fencing, clearing wild growth, and other preventive infrastructure. The support of concerned Local Self bodies may be utilised to ensure the same.

5. Policy and Surveillance

- Community Engagement: Involve the wider community and local bodies in surveillance, reporting, and preventive activities. These measures, when implemented together, create a safer school.

6. Post-event Immediate steps

- Arrange transport of the patient to medical care as quickly, safely, and passively as possible by ambulance (toll-free no. 108), boat, bicycle, motorbike, stretcher, etc.
- The victim must not be made to walk/run or drive himself to reach a Health facility. Motorbike Ambulance may be a feasible alternative for rural areas.

7. TRADITIONAL / INAPPROPRIATE PRACTICES TO BE AVOIDED shall be popularised

6. Summary: Capacity Building

- With the support of SARPA volunteers, awareness for teachers
- School social media clubs and creation of Educational videos
- Sharing of IEC videos between stakeholder departments and creating a common repository
- Popularising the snake and ladder game for snake bite awareness and creation of similar IEC messages
- **Public-Private Partnership in state and district-level capacity-building programmes**
- **Targeting KSEB / Water authority workers for awareness initiatives:** As Kerala State Electricity Board (KSEB) / water authorities' workers frequently encounter snakes during their work, targeted awareness programs will help in both preventing snakebite incidents and improving overall awareness in high-risk groups.
- **Using Notebook Back Pages as an IEC Tool:** Leverage the back pages of notebooks for snakebite prevention and management awareness, incorporating cartoons, interactive stories, and fun quizzes to educate children and the general public effectively.

- **Developing Uniform and Standardised IEC Materials:** Create statewide standardised IEC materials in regional languages to ensure consistency and effectiveness.
- **Incorporating Snakebite Prevention in the School Curriculum:** Introduce snakebite awareness and prevention education for 9th and 11th-grade students using digital technologies, interactive games, and creative IEC materials to enhance learning and engagement.

7. Research

- Enable access to venom samples for research to support the development of improved antivenoms and treatment strategies.
- Strengthen partnerships between research institutions, healthcare facilities, and venom supply networks to advance scientific studies on snakebite management.
- Promote interdisciplinary research focusing on venom composition, ASV efficacy, and regional snakebite epidemiology.
- Establish a statewide digital registry to systematically record snakebite cases, treatment protocols, and outcomes.
- Integrate data from public and private health facilities, Forest and rescue teams for real-time tracking.
- Categorise cases based on demographics, geographical distribution, envenomation type, and treatment response.
- Enable data-driven decision-making for policy formulation, resource allocation, and research.
- Ensure interdepartmental access while maintaining data privacy and security standards.

8. Way Forward

- **Identify places where long distances have to be traversed and empower them with facilities, training, and other support.**
- **Strategic purchase of treatment from private hospitals may also be considered.**
- **Private hospital treatment in case of Snake bite shall also be considered. Since this is a life-threatening case.**
- **A task force may also be constituted at the state level, including various stakeholders, to consider various aspects, including treatment Protocols.**
- **Research on post-treatment follow-up, verbal autopsy on death cases, etc., shall also be considered.**

List of Participants

State Action Plan for Prevention and Control of Snakebite Envenoming: State Level Workshop

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Gallery













