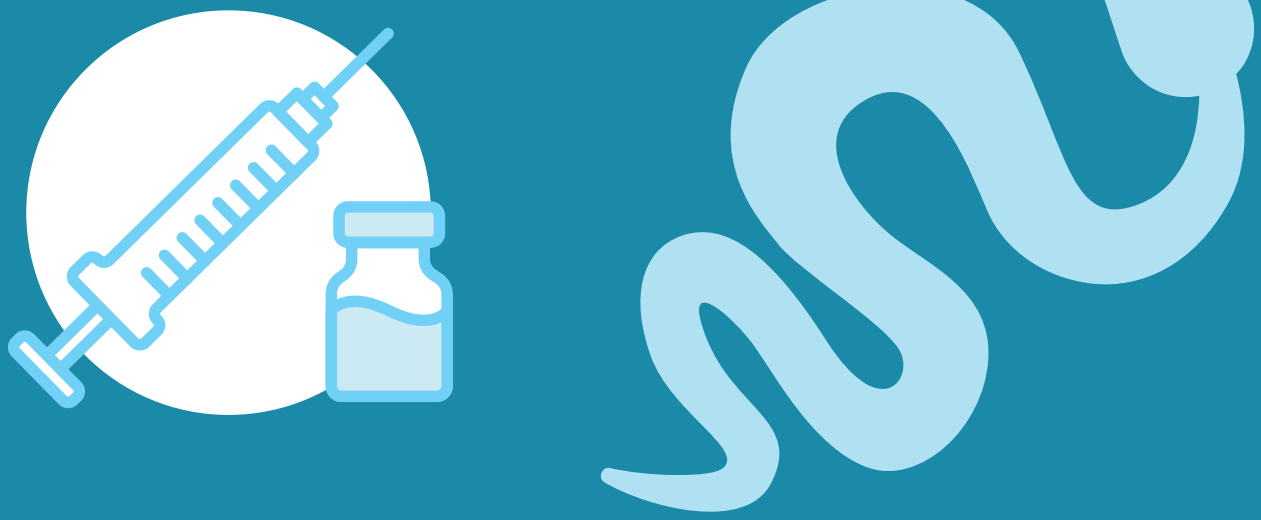
Ministry of Health
& Family Welfare
Government of India

NATIONAL ACTION PLAN FOR PREVENTION AND CONTROL OF SNAKEBITE ENVENOMING (NAPSE)

"A strategic approach to halve the deaths and disabilities due to snakebite envenoming by 2030"



Developed by

Centre for One Health

National Centre for Disease Control, Directorate General of Health Services

Ministry of Health and Family Welfare, Government of India

NATIONAL ACTION PLAN FOR PREVENTION AND CONTROL OF SNAKEBITE ENVENOMING (NAPSE)

"A strategic approach to halve the deaths and disabilities due to snakebite envenoming by 2030"

Developed by
Centre for One Health
National Centre for Disease Control, Directorate General of Health Services
Ministry of Health and Family Welfare, Government of India

डॉ. मनसुख मांडविया
DR. MANSUKH MANDAVIYA

सत्यमेव जयते

मंत्री
स्वास्थ्य एवं परिवार कल्याण
व रसायन एवं उर्वरक
भारत सरकार
Minister
Health & Family Welfare
and Chemicals & Fertilizers
Government of India

MESSAGE

The Ministry of Health & Family Welfare (MoHFW) in India has recently reaffirmed its commitment to the "National Action Plan for Prevention and Control of Snakebite Envenoming." This initiative reflects the Government of India's dedicated efforts to address the significant Public Health issue of snakebite envenoming in the country. With a focus on strategic priorities, the MoHFW aims to align its approach with the global initiative to reduce the number of deaths and cases of disability associated with snakebite envenoming by 50% by the year 2030.

This guidance document addresses the gravity of the snakebite envenoming problem in India and strategically highlights roles and responsibilities of each stakeholders in addressing this health challenge. The emphasis on a national Action Plan reflects a comprehensive and strategic approach to prevention and control, indicating the Government's recognition of the multi-faceted nature of snakebite envenoming and the need for a coordinated response.

Furthermore, the MoHFW's commitment for reducing snakebite-related deaths and disabilities aligns with the broader agenda of improving Public Health outcomes in India. Thus, by setting ambitious targets, the Government aims to create a robust framework that addresses the challenges posed by snakebite envenoming in systematic manner.

Let's us join the hands for reducing Snakebite Deaths for "Swasth Bharat".

(Dr. Mansukh Mandaviya)

कार्यालय: 348, ए-स्कंध, निर्माण भवन, नई दिल्ली - 110011 • **Office:** 348, A-Wing, Nirman Bhawan, New Delhi - 110011
Tele.: (O): +91-11-23061661, 23063513 • **Telefax** : 23062358 • E-mail : india-hfm@gov.in

अर्जुन मुंडा
Arjun Munda

D.O. No. 141 /AM

सत्यमेव जयते

मंत्री
जनजातीय कार्य मंत्रालय एवं
कृषि एवं किसान कल्याण मंत्रालय
भारत सरकार
Minister
Ministry of Tribal Affairs and
Ministry of Agriculture &
Farmers Welfare
Government Of India

MESSAGE

Ministry of Agriculture and Farmers Welfare realizes the overarching principle for addressing Snakebite in India through 'One Health' can be achieved by effective collaboration and coordination and hence endorses this principle by understanding that good health is a common goal for humans and animals.

This collaborative effort between the Ministry of Agriculture and Farmers Welfare and health authorities marks a turning point in our collective battle against snakebite envenoming. As citizens, community leaders, and stakeholders, we are called upon to rally behind this shared vision, aligning our efforts to make the National Action Plan a resounding success.

(Arjun Munda)

- Tribal Affairs Minister's Office : 751, A Wing, Shastri Bhawan, New Delhi-110 001
  Tel. : 011-23381499, 23388482, 23070577 (Fax)
- Agriculture & Farmers' Welfare Minister's Office : 120, Krishi Bhawan, New Delhi-110 001
  Tel. : 011-23383370, 23782594, 23073789, 23782691, E-mail : arjun. munda@gov.in

अर्जुन मुंडा
ARJUN MUNDA

आज़ादी का अमृत महोत्सव

सत्यमेव जयते

मंत्री
जनजातीय कार्य मंत्रालय और
कृषि एवं किसान कल्याण मंत्रालय
भारत सरकार
MINISTER
MINISTRY OF TRIBAL AFFAIRS AND
MINISTRY OF AGRICULTURE &
FARMERS WELFARE
GOVERNMENT OF INDIA

Message

I express great satisfaction and support of the Ministry of Tribal Affairs for the collaborative efforts initiated by the Ministry of Health and Family Welfare in addressing the grave issue of snakebite envenoming in India, particularly within Tribal Population.

Acknowledging the need for a coordinated and integrated approach, our collaboration seeks to leverage the strengths of both ministries to enhance the effectiveness of the initiatives. Recognizing the gravity of snakebite incidents, especially in tribal and rural areas, our ministries have joined hands to address this pressing public health issue comprehensively.

By establishing a robust partnership with health and other authorities, we aim to synchronize efforts and create a framework tailored to the unique challenges faced by the affected communities. The "***National Action Plan for Prevention and Control of Snakebite Envenoming by 2030 (NAP-SE)***" is one such initiative.

By working together, we aim to implement the National Action Plan that is inclusive, responsive, and tailored to the specific needs of Indian populations, particularly tribal communities. Ministry of Tribal Affairs reassures to provide assistance in awareness generation and mobilization of community for Snakebite prevention and the other required aspects.

I look forward to a fruitful partnership and the positive impact our joint initiatives will have on reducing the burden of snakebite envenoming in India. I wish the endeavour all success.

(Arjun Munda)

Place: New Delhi
Dated: 13th February, 2024

- **Tribal Affairs Minister Office:** 751, A Wing, Shastri Bhawan, New Delhi-110001.
  Tel. : 011-23381499, 23388482, 23070577 (Fax), **Web Portal** : https://tribal.nic.in
- **Agriculture & Farmers Welfare Minister Office:** 120, Krishi Bhawan, New Delhi-110001.
  Tel. : 011-23383370, 23782594, 23073789, 23782691 (Fax), **Web Portal** : https://agricoop.gov.in
  E-mail : arjun.munda@gov.in

मंत्री
पर्यावरण, वन एवं जलवायु परिवर्तन
और
श्रम एवं रोजगार
भारत सरकार

एक कदम स्वच्छता की ओर

सत्यमेव जयते

भूपेन्द्र यादव
BHUPENDER YADAV

MINISTER
ENVIRONMENT, FOREST AND CLIMATE CHANGE
AND
LABOUR & EMPLOYMENT
GOVERNMENT OF INDIA

आज़ादी का अमृत महोत्सव

MESSAGE

Snakebite envenoming is a serious but neglected tropical disease, impacting countless lives and communities across the world. Combating it requires a comprehensive approach with a commitment towards public health and the well-being of our citizens.

Finalisation of the National Action Plan for Prevention and Control of Snakebite Envenoming by 2030 (NAP-SE) by the Ministry of Health and Family Welfare jointly with other Ministries is a significant step in this direction. The Ministry of Environment, Forest and Climate Change assures its full support in collaborating with all the stakeholders to achieve the global target of reducing the mortality and morbidity associated with Snakebite through "One Health Approach".

I commend the Ministry of Health and Family Welfare for their initiative in formulating this action plan. I am confident that our collaborative efforts towards successful implementation of this action plan will help reduce the burden of snakebite envenoming and ultimately save lives.

Date: 13. 02.2024

(Bhupender Yadav)

पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110003, फोन : 011-20819190, 011-20819225, फैक्स: 011-20819299
Paryavaran Bhawan, Jor Bagh Road, New Delhi-110003, Tel.: 011-20819190, 011-20819225, Fax : 011-20819299
ईमेल / E-mail : mefcc@gov.in

परशोत्तम रूपाला
PARSHOTTAM RUPALA

सत्यमेव जयते

मंत्री
मत्स्यपालन, पशुपालन एवं डेयरी
भारत सरकार
Minister
Fisheries, Animal Husbandry and Dairying
Government of India

D.O. No. 2930 MIN(FAH&D)/20.2.14-25

15 FEB 2024

Message

Snake bite envenoming is one of the important livestock health issues and it is challenging to handle such cases at field level. Around 68.8 % of India's population lives in the rural areas and mostly dependent on agriculture and livestock for their livelihood. Snake bites are common in most rural areas particularly in forest and forest fringe villages. It is estimated that one lakh animals in the world fall prey to venomous snake bite every year. This serious life-threatening problem is more seen in animals during grazing with bite at head, face, muzzle area The risk period is summer and rainy seasons. It is indeed a immense pleasure to know that the National Centre for Diseases Control, Ministry of Health & Family Welfare has finalized the "National Action Plan for Prevention and Control of Snakebite Envenoming by 2030 (NAP-SE)" with a One Health Approach to address the burden of Snakebite in India. Ministry of Fisheries, Animal Husbandry & Dairying reaffirms that for effective promotion and protection of animal and human health for snakebite prevention & control with a One Health approach requires coherent, com-prehensive and integrated multi sectoral action.

The Department under the component "Assistance to States for Control of Animal Diseases (ASCAD)" financially supports the states for vaccination against economically important and zoonotic diseases of animals, supplementing production of disease diagnostic kits/vaccines for disease diagnosis, surveillance and related activities to check ingress of exotic disease and emergent/re-emergent animal diseases and other activities under "Research & Innovation, publicity & awareness training. The Department of Animal Husbandry, Government of India wish to support the program to be implemented through the State Animal Husbandry Departments. The effective snake bite prevention and control could be achieved with the active involvement of various stakeholders like venom Manufacturers, Wildlife sector, tribal and rural population, KVKs, community engagements etc. joint Training/Sensitization workshop of District level Medical/ Veterinary Department on Snake bite and Joint gap analysis for formulation of Action Plan for Prevention and Management of Snake bite is very important. Availability trained manpower concerning appropriate snake bite management and inoculation of ASV, timely supply and proper storage are the key areas.

State Animal Husbandry/Veterinary Services Department should identify the risk areas near to domestic animal settlements/villages/grazing areas . Signage related to preventive measures, first aid, emergency contact details should be ensured. Creation of some type of natural barriers to avoid direct contact between domestic animals and snakes may also decrease such incidences in animal sector. Further, State Animal Husbandry/Veterinary Services Department should ensure provision of polyvalent snake venom anti-Serum at Veterinary Hospitals and Dispensaries with proper storage facility and training. Emergency services in case of snakebite in animals through Mobile Veterinary Units is one of the important steps in this regard. Training of Veterinary Doctors, Paravets, Gopal Mitra, Pashu Sakhi etc. in diagnosis (including snake identification), early management and indications for and practicalities of administering antivenom will play the important role to achieve the targets.

State Veterinary/Agriculture Universities, KVKs may educate animal owners about snake bite management and identification of snakes and bites (venomous/non-venomous) such as the local snakes, places they prefer to live and hide, the time of year and time of day or night and the kind of weather when they are most likely to be active. Community outreach programs and dissemination/development of IEC materials through KVKs for farmer(s) about the key factors such as water sources, reservoirs and ponds which attract prey animals such as frogs and toads and thus, snakes to hunt them need awareness and sensitization.

Snake bite surveillance is also the key index for the success of any intervention programme to determine the snake bite situation, to monitor and evaluate the progress and impact of intervention, to manage potential human exposures adequately and to calculate the cost-effectiveness of control efforts.

(Parshottam Rupala)

Delhi Office : Room No. 234, 'B' Wing, Krishi Bhawan, Dr. Rajendra Prasad Road, New Delhi-110 001
Tele.: +91-11-23380780, **Fax**: +91-11-23380783, **E-mail:** rupalaoffice@gmail.com
Gujarat State Camp Office : Plot No. 219, Sector-20, Gandhinagar-382 020, Tele.: 079-23260013
Website : https://dahd.nic.in

गिरिराज सिंह
GIRIRAJ SINGH

ग्रामीण विकास तथा पंचायती राज मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF
RURAL DEVELOPMENT AND PANCHAYATI RAJ
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

Message

Ministry of Panchayati Raj understands that Snakebite prevention and Control requires coherent, comprehensive and integrated multisectoral action at village level and assure hereby to collectively support all the stakeholders through Panchayati Raj Institutions in efforts to achieve the goal by year, 2030.

Snakebite incidents, often overlooked in the broader health discourse, pose a considerable threat to our citizens, especially those residing in rural areas. Recognizing the gravity of the situation, the Ministry of Panchayati Raj has played a pivotal role in shaping a comprehensive action plan that is not just about controlling snakebite envenoming but also empowering communities at the grassroots level.

The collaborative spirit extends further to interdepartmental cooperation. The Ministry of Panchayati Raj is actively fostering partnerships between Panchayats and health authorities, creating a network that amplifies the reach and impact of snakebite prevention and control measures.

As we celebrate this collaborative effort between the Ministry of Panchayati Raj and Ministry of Health & Family Welfare, we urge all stakeholders, including Panchayat leaders, community representatives and policymakers to actively engage in the implementation of the National Action Plan. Together, let us forge a path towards safer and healthier communities, where the well-being of every individual is prioritized and protected.

(GIRIRAJ SINGH)

Office: 'G' Wing, Ground Floor, Krishi Bhawan, New Delhi-110001, Tel.: 011-23383548, 23782373, 23782327, Fax: 011-23070309
Resi.: 27, Lodhi Estate, New Delhi, Ph.: 011-24626783, 24655677

प्रो. एस.पी. सिंह बघेल
PROF. S.P. SINGH BAGHEL

सत्यमेव जयते

राज्य मंत्री
स्वास्थ्य एवं परिवार कल्याण
भारत सरकार
**MINISTER OF STATE FOR
HEALTH & FAMILY WELFARE
GOVERNMENT OF INDIA**

Message

Snakebite and envenoming is a neglected tropical disease (NTD) causing enormous suffering, disability, morbidity and mortality all over the world. Thus, snakebite incidents have become an underestimated threat to public health. Effective prevention and control of Snakebite Envenoming could be achieved only by a concerted and coordinated effort roping in all the stakeholders with a "One Health Approach".

I am happy to note that the National Centre for Diseases Control, Ministry of Health & Family Welfare has come up with the "National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE)" to address the burden of snakebites in India. The NAPSE, which has been drafted in consultation with different Ministries of Government of India and other important stakeholders, provides for a strategic framework for prevention and control of Sankebite envenoming. It seeks to develop a robust response system for prevention and control of Snakebite Envenoming.

The Action Plan is an excellent example of the principle of "Whole of Government" approach as envisioned by our Hon'ble Prime Minister and is one of the many steps to achieve the goal of "One Health".

The effective execution of this strategy necessitates a collaborative, multi-sector approach with the active participation and backing of various stakeholders. I am hopeful that all our stakeholders and partners will unite and fulfil their respective roles in halving the morbidity and mortality due to Snakebite in India by the year 2030.

(Prof. S.P. Singh Baghel)

कमरा सं. 650, छठा तल 'ए' विंग, निर्माण भवन, मौलाना आजाद रोड, नई दिल्ली–110011, फोन : +91–11–23061998, 23062427
Room No 650, 6th Floor, 'A' Wing, Nirman Bhavan, Maulana Azad Road, New Delhi-110011, Tele : +91-11-23061998, 23062427
E-mail : mos-hfw@gov.in

डॉ. भारती प्रविण पवार
Dr. Bharati Pravin Pawar

स्वास्थ्य एवं परिवार कल्याण राज्य मंत्री
व जनजातीय कार्य राज्य मंत्री
भारत सरकार
MINISTER OF STATE FOR
HEALTH & FAMILY WELFARE AND
MINISTER OF STATE FOR
TRIBAL AFFAIRS
GOVERNMENT OF INDIA

MESSAGE

"The National Action Plan for Prevention and Control of Snakebite Envenoming in India 2030" underscores the need for a collaborative and strategic approach to mitigate the adverse effects of snakebites.

This comprehensive national action plan is not only a testament to the commitment of the "Ministry of Health & Family Welfare" but also signifies a coordinated effort to align with global initiatives aimed at reducing the mortality and morbidity associated with snakebites by the year 2030. By emphasizing the crucial role of prevention, the plan addresses the root causes of snakebite incidents, acknowledging that proactive measures play a pivotal role in reducing the overall impact on public health. Through the implementation of this strategic document, it is anticipated that there will be significant progress in lowering the incidence of snakebites, thereby contributing to the "One Health Vision" that advocates for the interconnectedness of human, animal, and environmental health for the well-being of the entire nation.

Government of India under leadership of Hon'ble PM Modi Ji is committed to bringing out all & every policy and action to foster a holistic & integrated approach towards public health. By aligning with global objectives, this plan reflects a commitment to shared responsibility in addressing snakebites and resulting fatalities.

I am confident that this will pave the way for reducing the Snakebite deaths and have "Healthy India".

सर्वे भवन्तु सुखिनः। सर्वे सन्तु निरामयाः।

BPw

(Dr. Bharati Pravin Pawar)

Office: 250, 'A' Wing, Nirman Bhavan, New Delhi-110011, Tel. : 011-23061016, 23061551, Telefax : 011-23062828, E-mail : mos-health@gov.in
Office: 135, 'C' Wing, Nirman Bhavan, New Delhi-110011, Tel. : 011-23062153, 23062154, Fax : 011-23062158

अपूर्व चन्द्रा, भा.प्र.से.
सचिव
APURVA CHANDRA, IAS
Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण विभाग
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
Government of India
Department of Health and Family Welfare
Ministry of Health and Family Welfare

MESSAGE

The "National Action Plan for Prevention and Control of Snakebite Envenoming" (NAP-SE) has been developed to provide a strategic framework for the reduction of snakebite cases/ deaths and ultimately achieving the Global Target to prevent and control snakebite envenoming in order to halve the numbers of deaths and cases of disability that it causes by 2030. The strategy describes an integrated 'One Health' approach that brings together the necessary socio-cultural, technical, organizational and political pillars to address this challenge.

Snakebites are a significant health issue in many parts of the world. It is a potentially life-threatening disease following the bite of a venomous snake. Awareness, prevention, and access to appropriate medical care, including antivenom, are crucial in reducing the impact of snakebite envenomation on individuals and communities.

The National Action Plan we present here is more than just a document; it is a beacon of hope for those who have suffered from snakebites, a roadmap for Governments and healthcare systems, and a call to action for the relevant stakeholders in snakebites. It outlines a comprehensive strategy that aims to not only reduce the incidence of snakebites but also improve the quality of care for those affected and enhance the availability and accessibility of anti-venom treatment.

I would like to extend my appreciation to all individuals who have contributed towards producing this important national plan document. This book is a testament to our commitment to combating snakebite envenoming further. I am confident that through collaborative efforts and coordinated actions as highlighted here we can bring about real impact for addressing the management of snakebite related events in India and protect the vulnerable communities from the same.

Date : 07.02.2024
Place : New Delhi

(APURVA CHANDRA)

Room No. 156, A-Wing, Nirman Bhawan, New Delhi-110 011
Tele : (O) 011-23061863, 23063221, E-mail : secyhfw@nic.in

एल. एस. चाँगसन, भा.प्र.से.
अपर सचिव एवं मिशन निदेशक (रा.स्वा.मि.)
L. S. Changsan, IAS
Additional Secretary & Mission Director (NHM)

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
निर्माण भवन, नई दिल्ली - 110011
Government of India
Ministry of Health & Family Welfare
Nirman Bhawan, New Delhi - 110011

MESSAGE

Snakebite envenoming is a global health issue that has persisted in the shadows of public awareness for far too long. It is a menace that silently claims the lives of thousands, maims many more, and brings about immeasurable suffering primarily in low and middle-income countries. The burden of snakebite envenoming disproportionately affects rural and remote communities, where access to healthcare is often limited. This is a crisis that demands attention, action, and a coordinated response.

In recognition of the gravity of this issue and the urgent need to address it, we proudly present the "National Action Plan for Prevention and Control of Snakebite Envenoming." This technical document is the culmination of collective efforts, comprising the expertise and dedication of experts, healthcare professionals and policymakers who have come together to chart a course toward mitigating the impact of snakebite envenoming.

The plan describes the strategies and activities that will need to be implemented on the ground across India's 36 States and Union Territories with the help of State programme management unit, district programme management unit, Regional Institutes, communities, development partners and private sectors. We must urgently scale up our efforts to avert the deaths due to Snakebite in humans as well as in animals and progressively reduce Snakebite Envenoming in India through extensive community outreach programmes, availability of Anti Snake Venom, ensuring prompt treatment and referral etc. National Health mission through state programme units is committed for addressing this issue and regular monitoring would be ensured to achieve this goal of halving deaths as per stipulated timelines i.e. halving deaths by 2023.

I commend all those who have contributed to the development of this National Action Plan. Your dedication to tackling this critical issue is an inspiration to us all. I believe that this technical document will serve as a valuable resource, igniting awareness, advocacy, and, most importantly, action to address snakebite envenoming. Let it be a guiding light on our journey to a world where the threat of snakebites is diminished, and the suffering it causes is but a memory of the past.

I hope that the Action Plan would be instrumental to all tiers of staff involved in the programme and I believe that the Action Plan achieve its subsequent goal of reducing the morbidity and mortality associated with Snakebite Envenoming.

(Ms. L. S. Changsan)

'A' Wing, Nirman Bhawan, New Delhi-110011
Tel. : 011-23061723, 23061773, e-mail : lschangsan@nic.in

प्रो.(डॉ.) अतुल गोयल
Prof. (Dr.) Atul Goel
MD (Med.)
स्वास्थ्य सेवा महानिदेशक
DIRECTOR GENERAL OF HEALTH SERVICES

सत्यमेव जयते

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
स्वास्थ्य सेवा महानिदेशालय
Government of India
Ministry of Health & Family Welfare
Directorate General of Health Services

Message

Snakebite Envenoming, a neglected tropical disease responsible for significant mortality and morbidity in humans. Snakebite envenoming is a global health crisis that has remained in the shadows for too many years, affecting some of the most vulnerable populations worldwide.

In India as per CBHI data 2-3 lakh cases of snake bites are reported every year with resulting into 1000-2500 deaths. Reporting of snake bite is also being undertaken under IDSP and on an average 1.5 to 2 lakh cases reported every year. Recently through IHIP platform even case base reporting for snake bite cases and death cases has been initiated which would be resourceful for initiating appropriate policy intervention measures.

In 2018, WHO listed SBE as a priority neglected tropical disease (NTD) after intense advocacy by concerned stakeholders including the Global Snakebite Initiative, Health Action International and 20 member countries. WHO global strategy for prevention and control of snakebite envenoming was launched in 2019, with the goal for all patients to have better overall care, so that the numbers of deaths and cases of disability are reduced by 50% before 2030.

Recently National Consultations was held for developing a dedicated National Action plan for Prevention and Control of Snakebite Envenoming (NAP-SE). Accordingly, programme division formulated "National Action Plan for Prevention and Control of Snakebite envenoming in India" in consultation with key stakeholders and experts such as Stakeholder Ministries Clinicians, State Nodal Officers, NGO's, Communication experts, Anti-Venom manufacturers etc.

The National Action Plan for Snakebite Envenoming (NAPSE) provides a broad framework for management, prevention and control of Snake bite envenoming in India. This NAP-SE echoes the global voice of reducing the deaths due to snakebite envenoming by half and envisages all strategic components, roles and responsibilities of concerned stakeholders.

The NAP-SE is a guidance document for the states / UTs and stakeholders to develop their own action plan, specific to their needs and aims at systematic reduction of Snakebite envenoming risk through sustained availability of Anti Snake Venom, Capacity building, referral mechanism and public education.

Successful implementation of this strategy requires a multi-sectoral collaborative approach with involvement and support of many stakeholders. I sincerely hope that this National Action plan will being all our stakeholders and partners working in field of Snakebites ultimately contributing to reduction in Snake bites deaths by half by year 2030 as envisaged by NAPSE.

(Atul Goel)

ACKNOWLEDGEMENT

The National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) emerged in response to the pressing need to address the significant public health impact of snakebite incidents. Developed through collaboration between healthcare professionals, researchers, faculty members from medical colleges, governmental agencies, non-governmental organizations, wildlife experts community leaders this comprehensive plan aims to reduce the morbidity and mortality associated with snakebite envenoming. The guidance document has been developed by Centre for One Health (COH), National Centre for Disease Control (NCDC) after series of meetings and deliberations with stakeholders at National and State level, NGOs, Clinical Experts and international experts.

We express our extreme gratitude towards our Hon'ble Union Minister of Health and Family Welfare and Ministry of Chemicals and Fertilizers Dr. Mansukh Mandaviya Ji, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying, Shri. Parshottam Rupala Ji, Hon'ble Union Minister of Agriculture & Farmer's Welfare and Ministry of Tribal Affairs, Shri Arjun Munda Ji, Hon'ble Union Minister of Environment, Fisheries and Climate Change, Shri Bhupender Yadav Ji, Hon'ble Union Minister of Panchayati Raj, Shri Giriraj Singh Ji and Hon'ble Minister of State, Dr. Bharati Praveen Pawar and Shri S.P. Singh Baghel who's farsightedness and overall leadership and guidance had set the environment for realizing the goal of reducing the disability and mortality due to Snakebite by halve by 2030.

We extend our gratitude for the invaluable support provided by Ms. Leena Nandan, Secretary, Ministry of Environment, Forest, and Climate Change, Shri Vibhu Nayar, Secretary, Ministry of Tribal Affairs and Shri Vivek Bhardwaj, Secretary, Ministry of Panchayati Raj.

To set a true 'One Health' example we are thankful to the department of forest, environment and wildlife, Shri Sunil Sharma, Assistant Inspector general of Forest, Department of Animal Husbandry and Dairying, MoFAHD, Dr. Abhijit Mitra, Animal Husbandry Commissioner and Dr. Vijay Kumar Teotia, Joint Commissioner, DAHD, Dr. Ashok Kumar, Deputy Director General and Dr. Rajneesh Rana, Principal Scientist, Indian Council of Agriculture Research (ICAR), Dr. Vineeta Srivastava, Advisor, Ministry of Tribal Affairs and Shri Santosh Kumar Sinha, Deputy Director, Ministry of Panchayati Raj.

Acknowledging, Dr. Roderico H. Ofrin, WHO Representative to India, Dr. Polin Chan, Team Lead Communicable Diseases, WHO India, Dr. Aya Yajima,Regional Advisor NTDs, WHO SEARO, and Dr. Rashmi Shukla, National Programme Officer, WHO India for their insightful guidance, consistent efforts, and continuous technical support to the programme.

We extend our heartfelt appreciation to the Indian Council of Medical Research (ICMR) and the Drug Controller General of India (DCGI) for their unwavering support in the development of the action plan.

Efforts of Dr. Ravikar Ralph, Professor, Clinical Toxicology Unit & Poisons Information Centre, Department of Medicine, Christian Medical College, Vellore, Tamil Nadu for continuous support in drafting of the action plan. We also acknowledge the reviewers of the draft that included several experts from the field of medicine, research, academia, public health, NGO's and experts from animal health and wildlife sectors and other areas of One Health. We are grateful for the support received from State Nodal Officers under Snakebite prevention and control, Principal Chief Conservators of Forest, and Wildlife Institute of India.

We also acknowledge the contribution of photographs by Romulus Whitaker, Herpetologist and Founder of Madras Crocodile Bank, Gnaneswar Ch. Project Leader & Herpetologist-Snakebite Mitigation, Madras Crocodile Bank Trust, Dr. Gajendra Singh, Wildlife Officer, Centre for One Health, National Centre for Disease Control, MoHFW, Mr. Vivek Sharma, Herpetologist Snake Hub, Mr. Vishal Santra, Herpetologist, Snakebite Researcher, Society for Nature Conservation Research and Community Engagement (CONCERN), Ajay Kartik, Curator & Herpetologist, Madras Crocodile Bank Trust, and Gerard Martin, Herpetologist, The Liana Trust, Kedar Bhide, Director, Nature Works.

Furthermore, we extend our appreciation to the communities affected by snakebite envenoming for their inputs and all known and unknown reviewers. Your insights and experiences have enriched the understanding of the challenges faced at the grassroots level, leading to a more holistic and community-centric approach.

The overall coordination for developing this document was conducted by the team at the Centre for One Health, NCDC, headed by Dr. Ajit Shewale, Deputy Director, Dr. Tushar N Nale, Deputy Director, Dr. Dipti Mishra, Consultant, Dr. Nidhi Khandelwal, Technical Officer (Ecology), Dr. Aastha Singh, Research Officer, Dr. Gajendra Singh, Wildlife Officer, Dr. Arvind Srivastava, Senior Public Health Specialist, Dr. Hanul Thukral, Epidemiologist and other the support staff members.

We are also grateful to Dr. S. Venkatesh, Principal Consultant, NCDC and Dr. Anil Kumar, Principal Advisor, NCDC, MoHFW for providing continuous support in development of the document.

Last but not the least, Centre for One Health, NCDC express sincere gratitude to Shri Apurva Chandra, Secretary Health and Family Welfare GoI, Prof. (Dr.) Atul Goel, Director General Health Services (DGHS), GoI, Ms. L.S. Changsan, Additional Secretary & Mission Director, National Health Mission, MoHFW, GoI and Dr. Jitendra Prasad, Additional Director General Health Services (Addl. DGHS) for providing leadership, encouragement and support to the core team for developing this guidance document.

The "National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) from India by 2030" is the end product of the collective efforts of implementing agencies, experts, partners and NGOs who contribute to the prevention, preparedness and response for combatting Snakebite in India. Together, we are taking significant strides towards mitigating the impact of snakebite envenoming and ensuring the well-being of our communities.

Dr. Simmi Tiwari
Joint Director and Head
Centre for One Health
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

TABLE OF CONTENTS

List of Figures

List of Tables

ABBREVIATIONS

20WBCT	20-minute whole blood clotting test
ASHA	Accredited Social health Activist
aPTT	Activated partial thromboplastin time
ACLS	Advanced Cardiovascular Life Support
AEFI	Adverse Event Following Immunization
ARRS	Agumbe Rainforest Research Station
AWW	Anganwadi Worker
ASV	Anti-Snake Venom
AMBU	Artificial Manual Breathing Unit
ANM	Auxiliary Nurse Midwifery
BCC	Behaviour Change Communication
CBHI	Central Bureau of Health Intelligence
CDDL	Central Disease Diagnostic Laboratory
CDC	Centre for Disease Control
CoA	Certificate of Analysis
CCSEA	Committee for the Purpose of Control and Supervision of Experiments on Animals
CBO	Community Based Organizations
CHC	Community Health Centre
CRR	Community Radio Reporters
CT	computed tomography
CME	Continued Medical Education
DAHD	Department of Animal Husbandry
DGHS	Director General of Health Services
DH	District Hospital
DAP-SE	District level Action Plans for Snakebite Envenoming
DNO	District Nodal Officer
DPM	District Programme Manager
DVDMS	Drug and Vaccine Distribution Management System
DCGI	Drug Controller General of India
ECG	Electrocardiogram
EIA	Enzyme immunoassays
FDP	Fibrin Degradation Products
FAO	Food and Agriculture Organization
FFP	Fresh Frozen Plasma
GIS	Geographic Information Systems
GMP	Good Manufacturing Practices
GMSD	Government Medical Store Depot
GoI	Government of India
IgG	Immunoglobulin G
IAP	Indian Academy of Paediatrics
ICMR	Indian Council of Medical Research

IMA	Indian Medical Association
INAPH	Information Network for Animal Productivity and Health
IEC	Information, Education and Communication
iCAPS	Initiative for coordinated antidotes procurement in the South-East Asia Region
IDSP	Integrated Disease Surveillance Programme
IHIP	Integrated Health Information Portal
ICU	Intensive Care Units
INR	International Normalized Ratio
IQR	Interquartile Range
IV	Intravenous
KPI	Key Performance Indicators
KAP	Knowledge, Attitude and Practice
KVKs	Krishi Vigyan Kendra
LMA	Laryngeal Mask Airway
LFT	Liver Function Test
MRI	Magnetic Resonance Imaging
MO	Medical Officers
MoU	Memorandum of Understanding
MS	Microsoft
MLHP	Mid-Level healthcare Provider
MoA&FW	Ministry of Agriculture and farmers welfare
MoC&F	Ministry of Chemicals and Fertilizers
MoE	Ministry of Education
MoEF&CC	Ministry of Environment, forest and climate change
MoF	Ministry of Finance
MoFAH&D	Ministry of Fisheries, Animal Husbandry & Dairying
MoHF&W	Ministry of Health and Family Welfare
MHA	Ministry of Home Affairs
MoL&E	Ministry of Labour and Employment
MoPR	Ministry of Panchayati Raj
MoTA	Ministry of Tribal Affairs
MSG	Mission Steering Group
NADRES	National Animal Disease Referral Expert System
NCDC	National Centre for Disease Control
NDMA	National Disaster Management Authority
NFDI	National Free Drug Initiative
NHM	National Health Mission
NPO	National Program officer
NRA	National Regulatory Agencies
NTD	Neglected Tropical Diseases
NGO	Non-Governmental Organization
PRI	Panchayati Raj Institutes
PRU	Peripheral Reporting Units
PLA2	Phospholipase A2
PHC	Primary Health Centre
PIP	Programme Implementation Plan

PT	Prothrombin Time
PPP	Public Private Partnership
RRL	Regional Reference Laboratory
RFT	Renal Function Test
ST	Schedule Tribes
SVMP	Snake venom metalloproteinases
SBE	Snakebite Envenoming
SBE-WG	Snakebite Envenoming Working Group
SBPC	Snakebite Prevention and Control
SAARC	South Asian Association for Regional Cooperation
SOP	Standard Operating Procedure
STG	Standard Treatment Guidelines
SDDL	State Disease Diagnostic Laboratory
SNO	State Nodal Officer
SRL	State Reference Laboratory
SSO	State Surveillance Officer
SAP-SE	State-Level Action Plans for Snakebite Envenoming
SDG	Sustainable Development Goals
TEG	Thromboelastography
TOT	Training of Trainers
UT	Union Territory
UN	United Nations
UNDP	United Nations Development Programme
VDK	Venom Detection Kit
WII	Wildlife Institute of India
WHA	World Health Assembly
WHO	World Health Organization
WOAH	World Organisation for Animal Health

ABOUT THE DOCUMENT

The overall context

- The National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) is a guidance document for all major and key stakeholders at State and District level for developing their own State Action Plan for Prevention and Control of Snakebite Envenoming specific to their needs in collaboration with stakeholders at State and District level, NGOs, civil societies, Panchayati raj Institutes etc.

- The National Action Plan for Snakebite Envenoming (NAPSE) provides a broad framework for management, prevention and control of Snake bite envenoming in India. This NAPSE echoes the global voice of reducing the deaths and disability due to snakebite envenoming by half by 2030 and envisages all strategic components, roles and responsibilities of concerned stakeholders. The NAPSE is a guidance document that aims at systematic reduction of Snakebite envenoming risk through sustained availability of Anti Snake Venom, Capacity building, referral mechanism and public education.

Purpose and scope

- This guidance document aims to facilitate a common understanding of what constitutes effective and efficient activities for Snakebite Prevention and Control in India that will lead to reduce the mortality and disability associated with snakebite envenoming by halve.

- The NAPSE provides a step wise approach for the States to develop their own Action Plan as per their needs. The activities envisaged under human, wildlife, tribal and Animal health component will be undertaken by concerned stakeholders at all levels. The States will identify and nominate State and District Nodal Officer (SNO & DNO) to coordinate with SNO and DNO of SBPC.

- The guidelines serve as a basis for overall long-term planning and coordination for activities of Snakebite prevention and control at the national, state and division levels.

- In general, the guidelines apply to all stakeholders relevant to Snakebite and are not limited to Health department.

- The guidelines will be able to bring in more effectiveness and efficiency when they are fully integrated into the District level Action Plans for Snakebite Envenoming (DAPSE) and State level Action Plans for Snakebite Envenoming (SAPSE).

Approach

- The development and implementation of this guidance document are motivated by a collaborative approach, aiming to safeguard both humans and snakes from the consequences associated with Snakebite Envenoming.

- The guidelines take a comprehensive approach to tackle the snakebite issue in India. This holistic strategy not only enhances healthcare facilities for the timely and proper handling and referral of snakebite cases but also covers initiatives to raise community awareness. It includes capacity building for healthcare professionals, veterinarians, wildlife officers, etc. Additionally, the guidelines offer direction on implementing and overseeing prevention methods, ultimately minimizing the impact of conflict on both human and snake populations.

- This guidance document is intended to facilitate participatory planning, development and implementation of activities of Snakebite prevention and control with key sectors and stakeholders at the National, State and local levels including NGO, Civil society, Panchayati Raj Institutes, Gram Sabha, etc.

- Efforts have been made to forge linkages with plans and guidelines of key relevant sectors for enhancing synergies and eliminating trade-offs at the field level.

- The activities of Human health component are already being implemented under Snakebite Prevention and Control through the State and District Nodal Officer (SNO & DNO) under National Health Mission.

- The NAPSE has identified key stakeholders, supporting stakeholders and other partner institutes based on their mandates, existing roles and responsibilities.

- Key stakeholders will act as a nodal agency for the overall formulation, planning, coordination and implementation of the activities as envisaged under National and State Action Plan for Prevention and Control of Snakebite Envenoming. They will be directly involved for providing technical and logistic support to the State/District and below level. They will also help in formalizing the State Action Plan for Prevention and Control of Snakebite Envenoming.

- Supporting stakeholders are those who would be assisting the key stakeholders in coordination and implementation of various aspects of the NAPSE. They will provide technical assistance in activities planned for Prevention and Control of Snakebite Envenoming from India under various components.

- Other stakeholders will include Non-Government organization and CBO active in the field of Snakebite in Health, Wildlife, and Veterinary sectors, Professional organizations and associations in medical and veterinary sector and International Development organizations. They would be primarily assisting in implementation of the NAPSE with the available logistics and expertise and provide support to the key stakeholders at the field level.

This NAPSE echoes the global voice of reducing the deaths due to snakebite envenoming by half and envisages all strategic components, roles, and responsibilities of concerned stakeholders.

EXECUTIVE SUMMARY

National Action Plan for Prevention and Control of Snakebite Envenoming

Snakebite envenoming is a potentially life-threatening disease following the bite of a venomous snake. Venomous snake bites can result in medical issues which can be deadly or lead to permanent impairment if timely and appropriate treatment is not given. Majority of snakebite envenomation deaths and catastrophic sequelae can be avoided with prompt availability to safe and effective antivenoms, timely transport and referral.

As per WHO data, global snake bite incidences stand at around 5.4 million with about 1.8 to 2.7 million accounting to snake envenoming annually resulting in approx. 8000-1.3 lakh deaths and triple the number of amputations and permanent disabilities. WHO listed snakebite envenoming as a priority neglected tropical disease in 2017 and advocates developing a global strategy to halve the number of snakebite-induced deaths and disabilities by 2030.

The highest burden of snake bite envenoming is seen in Asia, Africa and Latin America. Asia alone has around 20 lakh snakebite envenoming cases every year, while in Africa, snakebite cases requiring treatment are estimated to be around 44 to 58 lakhs annually. South Asia constitutes nearly 70% of global snakebite mortality, with India reporting 2-3 lakhs cases of snakebite annually with 1000-2500 deaths. Within the region, Bangladesh, India, Nepal, Pakistan, and Sri Lanka together constitute nearly 70% of global snakebite mortality.

In India, approximately 50,000 fatalities result from an estimated 3 to 4 million snakebites each year, representing roughly half of all global snakebite-related deaths. Only a small proportion of snake bite victims across countries report to the clinics and hospitals and actual burden of snake bite is grossly underreported. As per the Central Bureau of Health Investigation (CBHI) reports (2016-2020), the average annual frequency of snakebite cases in India is around 3 lakhs and about 2000 deaths occur due to snakebite envenoming.

The “big four” snake species, including the common krait, Indian cobra, Russell’s viper, and saw-scaled viper, are responsible for approximately 90% of snakebite incidents. 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 the snakebite cases, however, 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. are the major hindrances in planning for mitigation of snakebite in India.

Ministry of Health and Family Welfare, Government of India is implementing Snakebite Prevention and Control activities in all States/UTs through National Health Mission. Ministry of Health and Family welfare has also issued a National Snakebite Management Protocol in collaboration with WHO for use by medical officers for management of Snake bite cases in 2009 and updated in 2016. To ensure the availability of Anti Snake Venom (ASV), States and UTs have been directed to include Anti Snake Venom (ASV) in the list of essential drugs of the

State, procurement of these drugs is supported under National Health Mission.

Recently, a National Consultation was held for developing a dedicated National Action plan for Prevention and Control of Snakebite Envenoming (NAPSE) in July 2022. Accordingly, programme division formulated "National Action Plan for Prevention and Control of Snakebite envenoming in India" in consultation with key stakeholders and experts such as Core Committee members, Clinicians, global organisation e.g. WHO, State Nodal Officers of Snake Bite Prevention and Control, NGO's, Communication expert etc.

The National Action Plan for Snakebite Envenoming (NAPSE) provides a broad framework for management, prevention and control of Snake bite envenoming in India. **This NAPSE echoes the global voice of reducing the disability and deaths due to snakebite envenoming by half by 2030 and envisages all strategic components, roles and responsibilities of concerned stakeholders**

The NAPSE is a guidance document for the States / UTs and stakeholders to develop their own action plan, specific to their needs and aims at systematic reduction of Snakebite envenoming risk through sustained availability of Anti Snake Venom, Capacity building, referral mechanism and public education.

The NAPSE has identified key stakeholders, supporting stakeholders and other partner institutes based on their mandates, existing roles and responsibilities. Key stakeholders will act as a nodal agency for the overall formulation, planning, coordination and implementation of the activities as envisaged under National and State Action Plan for Prevention and Control of Snakebite Envenoming. They will be directly involved for providing technical and logistic support to the State/District and below level. They will also help in formalizing the State Action Plan for Prevention and Control of Snakebite Envenoming.

Supporting stakeholders are those who would be assisting the key stakeholders in coordination and implementation of various aspects of the NAPSE. They will provide technical assistance in activities planned for Prevention and Control of Snakebite Envenoming from India under various components.

Other stakeholders will encompass Non-Governmental Organizations operating within the realm of Snakebite in the areas of Health, Wildlife, and Veterinary domains. This also extends to Professional organizations and associations within the medical and veterinary sectors, along with International Development organizations. They would be primarily assisting in implementation of the NAPSE with the available logistics and expertise and provide support to the key stakeholders at the field level.

The NAPSE has identified key strategic actions to be undertaken for operationalization of human, wildlife and animal component. The strategic action for Human health component includes Ensuring Provision of Anti Snake Venom at all Health facilities, strengthening surveillance of Snake bite cases and deaths in Humans, strengthening of emergency care services at District Hospitals/ CHCs including services for Ambulance, Institutionalisation of Regional Venom Centre's and Inter-sectoral coordination. The strategic action for wildlife health component includes Education awareness, Antivenom distribution, strengthening of the key stakeholders, Systematic research and monitoring and Snake venom collection and snake relocation. The strategic action for animal and agriculture component includes

Prevention of snake bites in livestock, community engagement etc.

The NAPSE envisages a step wise approach for the States to develop their own Action Plan as per their needs. The activities envisaged under human, wildlife, tribal and Animal health component will be undertaken by concerned stakeholders at all levels. The States will identify and nominate State and District Nodal Officer (SNO & DNO) to coordinate with SNO and DNO of SBPC.

The activities of Human health component are already being implemented under Snakebite Prevention and Control through the State and District Nodal Officer (SNO & DNO) under National Health Mission.

Surveillance is a key element in NAPSE so that problems can be easily identified, and actions could be undertaken taken in a timely manner. The NAPSE has defined joint monitoring mechanisms with specific indicators for both human, wildlife and animal health components at all levels, independent component wise monitoring by the concerned stakeholder and independent external evaluation of the state action plan. This document describes phase wise activity matrix and road map for State action plans.

Thus the key interventions to reduce deaths due to snakebite include upskilling of medical officers for timely and standard treatment to ensure any victim of snakebite envenoming receives ASV in time and his/her progress is monitored with timely referral/dosage. Second intervention involves mass awareness which holds key for prevention of snakebite especially in high risk areas. Thus the document is an effort to bring sporadic efforts undertaken by different industries/agencies/ministries under one umbrella with a systematic approach.

To summarize the NAPSE is a strategic document based on One Health approach and will enable India to reach the Global target of reducing the deaths due to snakebite envenoming by half by 2030.

Dr. Ajit Dadaji Shewale
Deputy Director
Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Pope’s Pit Viper from Mizoram landscape

CHAPTER 1:

INTRODUCTION

Snakebite envenoming is a neglected tropical disease caused by the bite of a venomous snake; these bites are usually accidental in nature; however, snakebite envenoming is a significant public health concern particularly in tropical and subtropical countries (1). As per WHO data, global snakebite incidences stand at around 5.4 million with about 1.8 to 2.7 million accounting to snake envenoming annually resulting in approx. 8000-1.3 lakh deaths and triple the number of amputations and permanent disabilities (1). WHO listed snakebite envenoming as a Priority neglected tropical disease in 2017 and advocates developing a global strategy to halve the number of snakebite-induced deaths and disabilities by 2030. South Asia constitutes nearly 70% of global snakebite mortality, with India reporting 2-3 lakhs cases of snakebite annually with 1000-2500 deaths (1).

In India, snakebite is a prominent problem in rural and peri-urban areas and the high burden states includes Bihar, Jharkhand, West Bengal, Madhya Pradesh, Odisha, Uttar Pradesh, Andhra Pradesh, Telangana, Rajasthan, and Gujarat (2)483 verbal autopsies in the nationally representative Indian Million Death Study from 2001 to 2014, and conducted a systematic literature review from 2000 to 2019 covering 87,590 snakebites. We estimate that India had 1.2 million snakebite deaths (average 58,000/year. It predominantly affects lower socio-economic segments of the society and high-risk group/vulnerable population includes, agricultural workers, herders, fishermen, children aged 10-14 years and people living in poorly constructed houses etc (3).The clinical manifestation of the venomous snakebite includes paralysis, haemorrhage, tissue damage and irreversible kidney failures, pregnant women are highly sensitive as haemorrhage due to venomous snakebite can cause miscarriage.

India has more than 310 species of snakes, mostly non-Venomous. However, there are 66 species that are labelled as venomous or mildly venomous and majority of the snakebites result from four species, collectively named as “Big 4” species namely Russell’s Viper (*Daboia russelii*), Spectacled cobra (*Naja naja*), common krait (*Bungarus caeruleus*) and saw-scaled viper (*Echis carinatus*) (4). The “Big 4” are not uniformly distributed throughout the country and their distribution pattern is dependent on multiple factors like habitat, rainfall, altitude, availability of prey etc. In particular, there are certain species that are distinct to specific geographical areas and their venom is poorly neutralized by the available polyvalent anti-snake venom (ASV) (4).

As per Central Bureau of Health Intelligence (CBHI), in India there are approximately 300,000 snakebite cases resulting in 2000 deaths annually. There is a huge gap between the number of snakebite deaths reported from direct surveys and official data. As per research studies conducted in India only 7.23% snakebite deaths were officially reported. Reporting of snakebite has also been undertaken under IDSP and recently case base reporting for snakebite and deaths due to snakebite have been initiated through IHIP platform which would be resourceful for initiating appropriate policy intervention measures.

Usually, the snakebite incidences occur during field/outdoor activities or while sleeping on ground. Considering that the complications due to snakebite envenoming develop rapidly and irreversible, it is important that medical interventions should be immediate and appropriate. Majority of the deaths and serious consequences from snakebites are primarily attributed to distance of patient from health facility, efficacy and scarcity of anti-snake venom, inadequate health services and cultural factors that influence seeking traditional faith healers/religious priests, adopting harmful practices such as applying tourniquets, cutting and suction, herbal remedies for snakebite treatment, only a small proportion of snakebite victims across countries report to the clinics and hospitals and only 23% of snakebite deaths occur in hospitals in India therefore the actual burden of fatal snakebites is grossly underreported (4).

Majority of the deaths and serious consequences from snakebites are entirely preventable by timely administration of effective anti-snake venom (ASV) which is included in the WHO List of essential medicines. Only a few countries have the capacity to produce snake venoms of adequate quality for ASV manufacture. In India, polyvalent ASV is available which contains antibodies against spectacled cobra, Russell's viper, common krait and saw scaled viper.

In summary, it is understood that India faces a significant Snakebite burden in terms of human mortality, economic loss in human and animal sector with varied epidemiological situations across regions. It is also a fact that Snakebite related issues encompasses multiple stakeholders (departments/ ministries) in various sectors (e.g., Health Agriculture, Animal Husbandry, Ministry of Labour, Tribal affairs etc). Therefore, there is a need to have a single strategic document with clearly defined roles and responsibilities of each stakeholder and with clear objectives as envisaged by global organisations in this sector e.g. WHO. It would help to bring together different stakeholders (Govt/Private organisations, NGOs etc.) already working in the field of snakebite control in different states on one platform for experience sharing and avoiding duplication of efforts.

It is anticipated that this document will identify and bring necessary uniformity in the activities to be implemented by the different stakeholders and will encourage commitment by all stakeholders to address and mitigate the menace of snakebites in India.

Bamboo pitviper, *Craspedocephalus gramineus* (venomous)

CHAPTER 2:

HISTORICAL PERSPECTIVE OF SNAKEBITE PREVENTION AND CONTROL IN INDIA

India, traditionally known as the land of “snake charmers” in the West, has deep roots of snakes being revered as symbols of supernatural power and important objects of worship. In Sanskrit, the word ‘Naga’ is used to refer to the cobra or snakes in general (5).

The Hindu mythology portrays many gods decorated with snakes or cobras around their necks or as ornaments, parading their fearlessness and immortality. In Greek mythology, Asclepius (a mortal man, who was believed to be resurrected later as the god of medicine) learned the secret of controlling death when he observed a mortally injured snake being brought back to life with healing herbs administered by another snake (5).

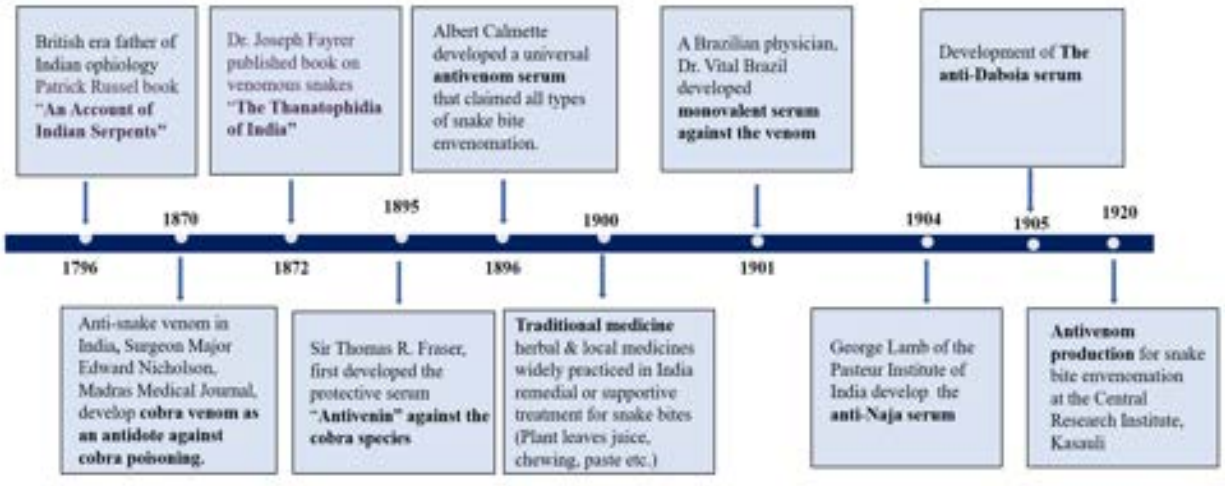


Figure 1- Chart depicting historical timeline for Snakebite Prevention & Control

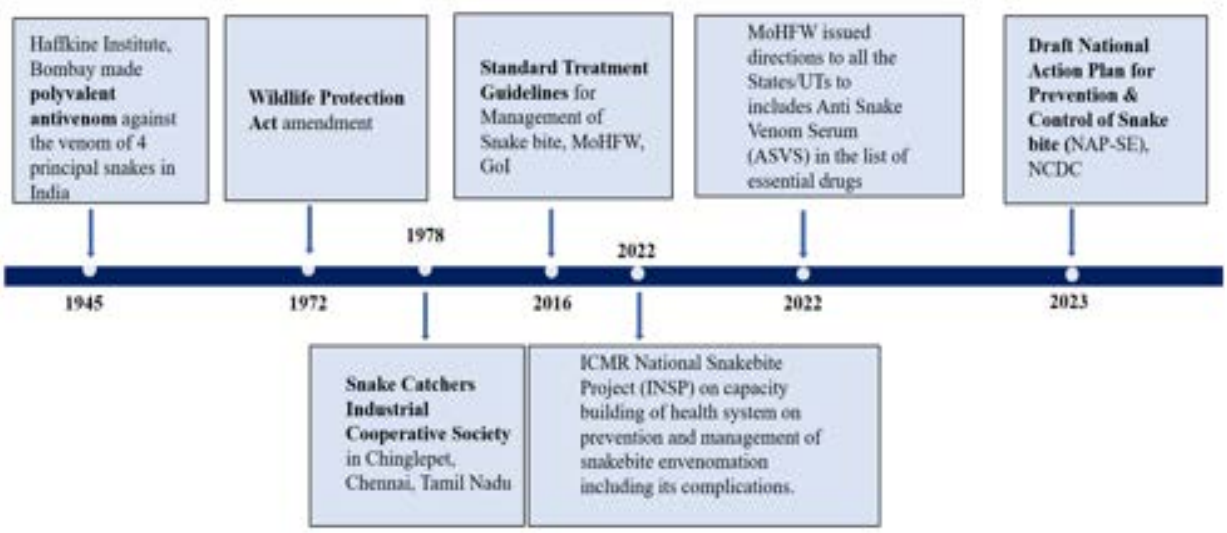


Figure 1 contd.- Chart depicting historical timeline for Snakebite Prevention & Control

Thus, it can be inferred that "Snakebite Prevention and Control" in India has encountered significant milestones by different Institutions/Experts in their respective area. Therefore, activities under "Snakebite and Prevention & control" by respective State governments/stakeholders needs to consolidate on those gains in coming years to achieve the goal envisaged under this action plan.

Banded Krait, *Bungarus fasciatus* (venomous)

CHAPTER 3:

EPIDEMIOLOGY OF SNAKEBITES

Snakebite envenomation poses a significant public health challenge, leading to disabilities and psychological consequences in the aftermath of snakebites, particularly in developing regions (6). It typically affects predominantly poor, rural communities in tropical and sub-tropical countries throughout the world (1).

Higher case fatality rate is observed in victims <5 years of age. Children get exposed to snakes while playing or at the site of agricultural fields. Snakebite envenoming is an occupational and environmental disease and the high-risk groups include - agricultural workers, herders, fishermen, hunter-gatherer tribes, firewood collectors etc. Pregnant women are a highly vulnerable group.

Burden of Disease- Globally

Snakebite is a neglected global public health problem affecting many tropical and subtropical countries. About 54 lakh people are bitten by snakes globally and every year around 18 to 27 lakh cases of envenoming are reported. The annual mortality rate due to snakebite

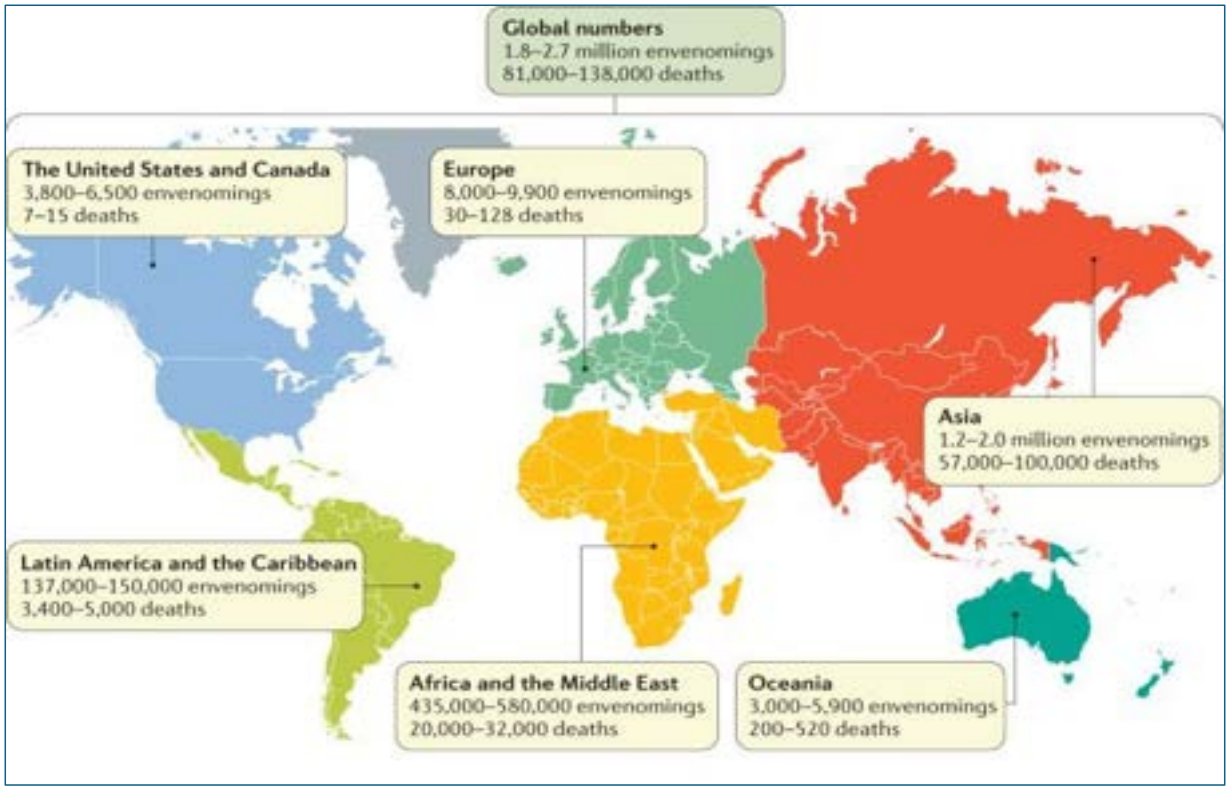


Figure 2 Number of Snake Envenoming per year globally

envenoming is between 81,000-1,38,000 and also results in around three times as many amputations and other permanent disabilities each year (1).

In other words, around 7400 people are exposed to snakebites every day, and 220 to 380 people die. In 2019, the age-standardized mortality rate for snakebite has been estimated as 0.8 per lakh population, leading to 29 lakh years of life lost.

Burden of Disease- in India

In India, as per a systemic literature studies conducted by researchers showed that around 58,000 deaths occur of an estimated 3-4 million snakebites annually which accounts for half of all snakebite deaths globally. Only a small proportion of snakebite victims across countries report to the clinics and hospitals and actual burden of snakebite is grossly underreported.

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 (7).

People living in densely populated low altitude and agricultural areas in the states of Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, Andhra Pradesh Telangana, Rajasthan and Gujarat accounts for 70% of deaths particularly during the rainy season when encounters between snakes and humans are more frequent at home and outdoors areas.

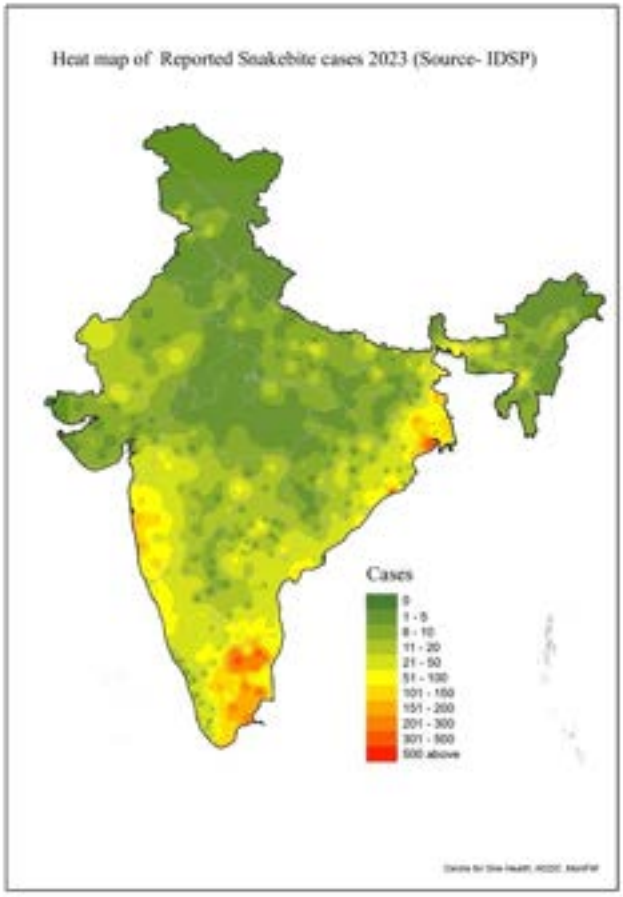


Figure 3 Reported Snakebite cases (District Wise) in 2023 Source-IDSP-IHIP

As per the Central Bureau of Health Investigation (CBHI) reports (2016-2020), the average annual frequency of snakebite cases in India is around 3 lakhs and about 2000 deaths occur due to snakebite envenoming.

The factors that may be contributing to the high incidence of Snake bite include lower altitude, the more extensive and intensively farmed arable land, species and population densities of snake species of medical importance and many a times the snake densities are relatively high, particularly in grain agriculture areas which attracts the large rodent and amphibian populations that are eaten by snakes.

Agricultural laborers in India face heightened vulnerability to snakebites due to their dependence on traditional, non-mechanized, and cost-effective farming methods. The risk is exacerbated during the monsoons, as this coincides with both heightened agricultural

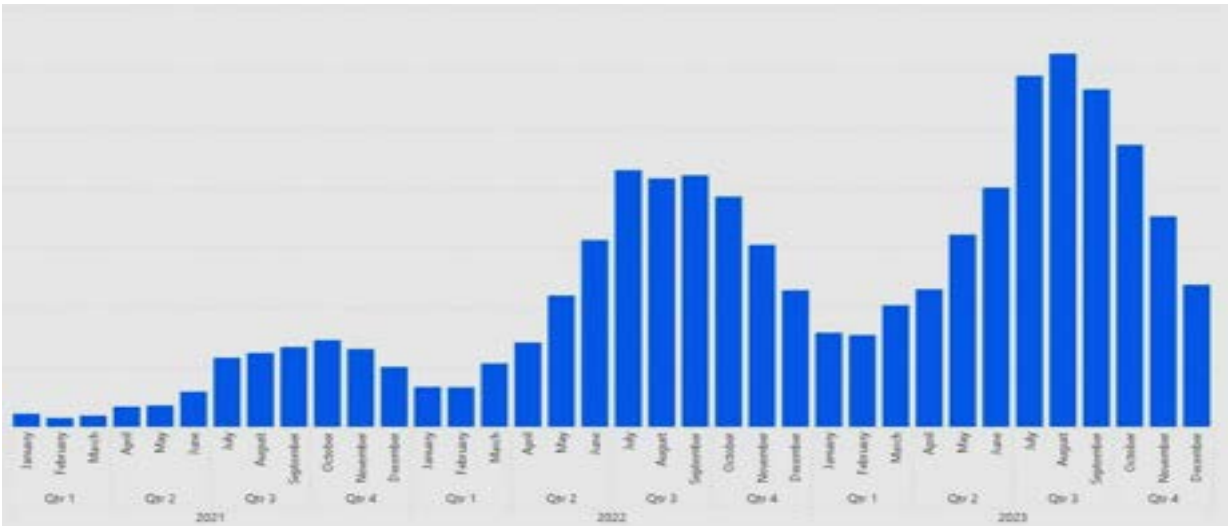


Figure 4 Seasonality under Snakebite cases (Reported from 2021-23 as per IDSP-IHIP)

activities and snake breeding seasons. Additionally, their exposure to precarious living conditions, inadequate lighting, sleeping on the ground, and the use of outdoor toilets further elevate the likelihood of encountering snakes (8).

The peak of Snakebite cases as per the reported data on IDSP-IHIP shows that there is an increase in number of cases from June to April over the years.

Ecology of Medically Important Snakes in India

Wild animals have always been a part of ancient civilizations. From the pre-historic era, humans drew experiences in caves and natural walls. In ancient Greek culture, snakes were symbolized as heroes or gods that accentuate their protective role(9). As of today, world is the home of 3509 species of snakes(10) out of the 600 species of snakes that are venomous (Shupe, 2013).

Among the 310-snake species documented in India, only four have been identified as primary contributors to life-threatening snakebites. Termed the “Big four,” these species encompass the spectacled cobra (Naja naja), Russell’s viper (Daboia russelii), common krait (Bungarus caeruleus), and saw-scaled viper (Echis carinatus). The exclusive antivenom available in India is formulated to counteract the venom of these aforementioned species. Nevertheless, while these four species stand out as the most medically significant snakes in India, numerous others pose substantial threats to human life.

In India, around 90% of snakebites are caused by the ‘big four’ among the crawlers - 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 the snakebite cases, however, 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. are the major hindrances in planning for mitigation of snakebite in India.

Distribution of Big four in India

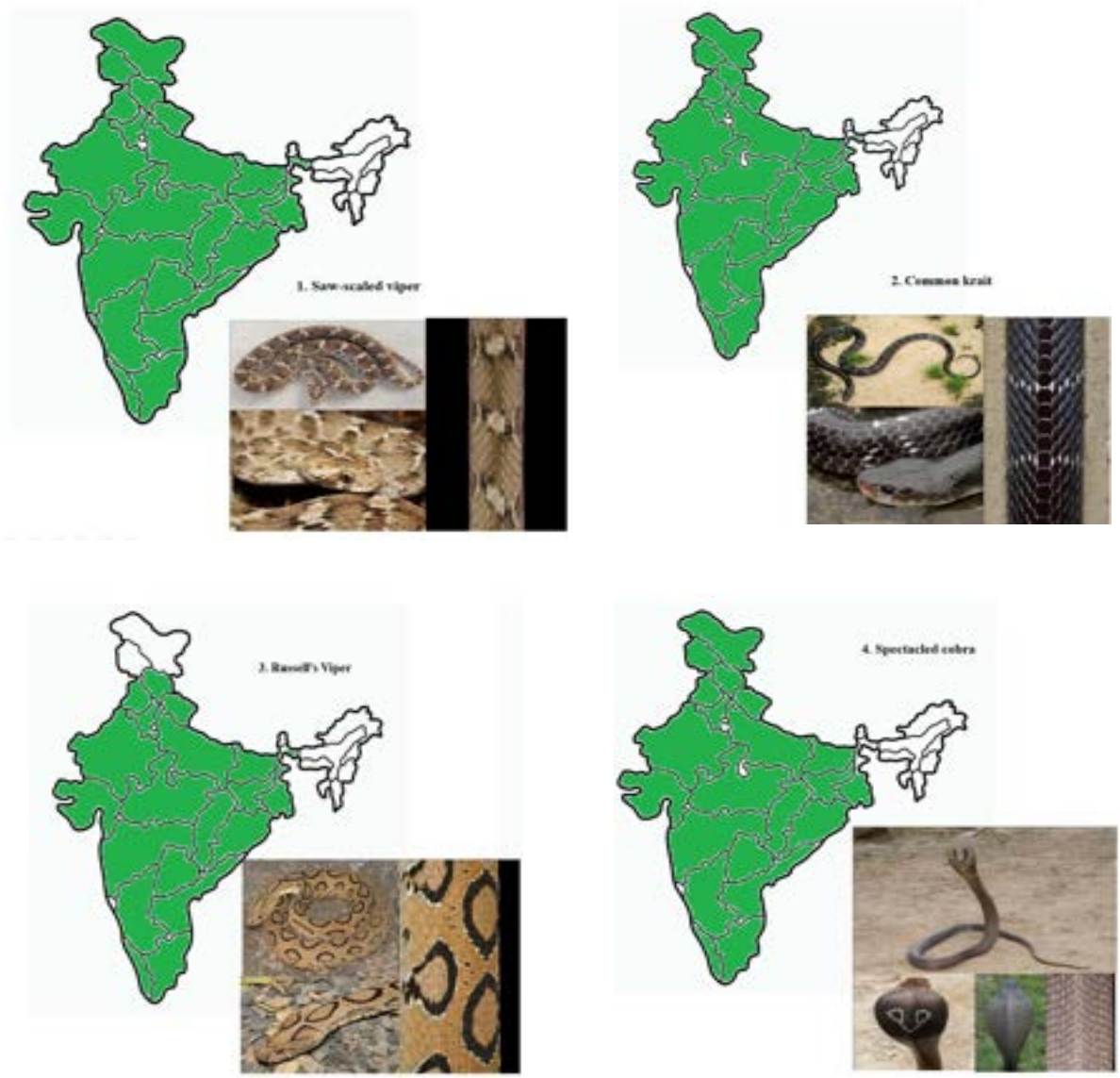


Figure 5 Map showing distribution of Big 4 in India

Distribution of Range restricted snake species in India

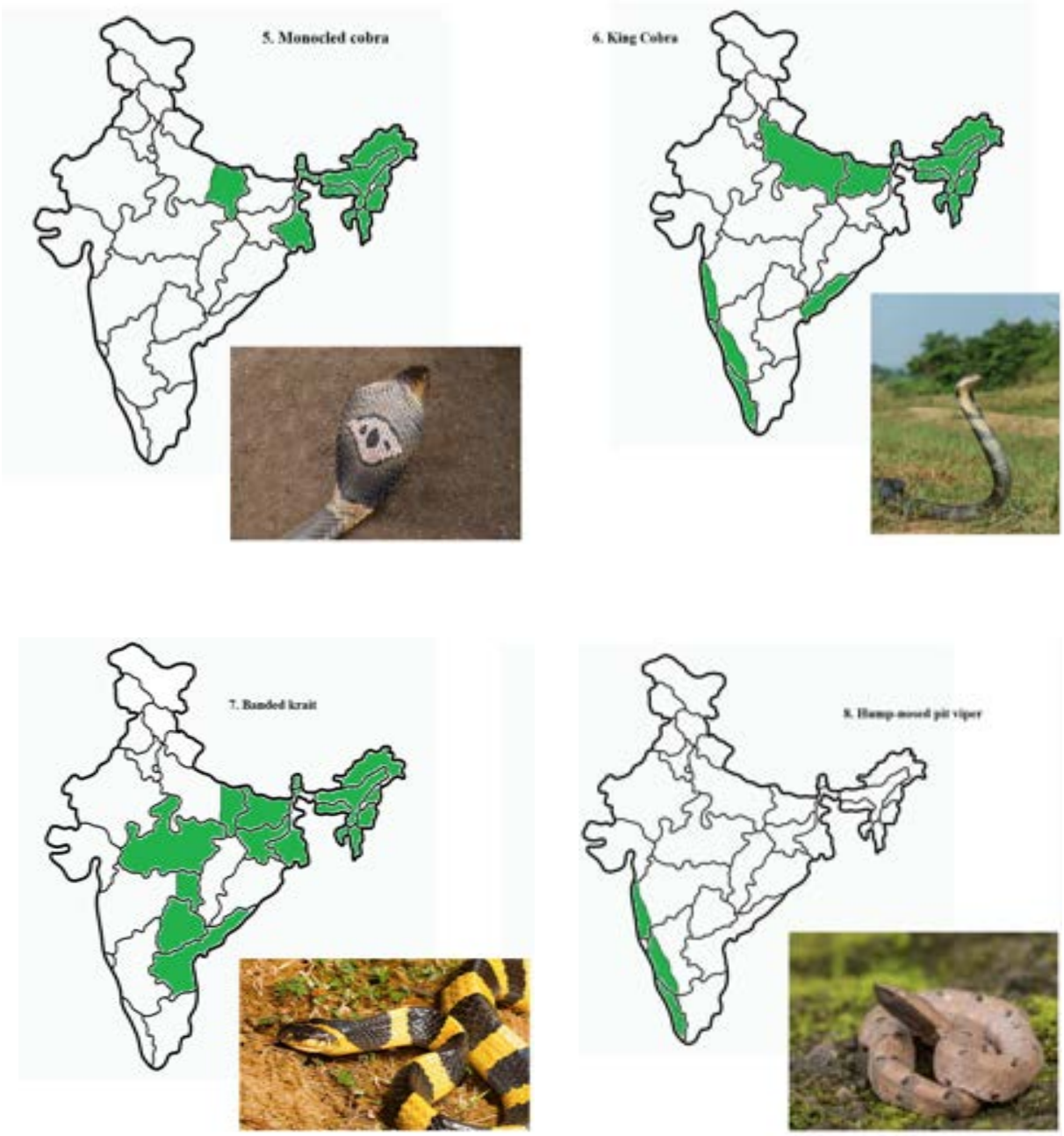


Figure 6 Map of Distribution of Range restricted Snake species in India

India can be divided into four biodiversity hotspots, namely, the Western Ghats, Himalayas, Indo Burma and the Sundaland (Andaman Nicobar Island) (Vijayaraghavan and Ganesh, 2015). These four biodiversity hotspots have more biodiversity richness as compared to other parts of India and few species are endemic to these regions which include reptiles as well. India is a home to 310 species of snakes out of which 66 species are venomous and 42 species are mildly venomous (Vijayaraghavan and Ganesh, 2015). These 66 venomous snake species of India are organized into four families, namely, Elapidae, Viperidae, Colubridae, and Hydrophiidae (WHO, 2015; Vijayaraghavan and Ganesh, 2015).

Elapidae: This family has short fixed front fangs and includes cobras, king cobra, krait, coral snakes, Australasian snakes, and sea snakes. These snakes are generally long-thin and uniformly coloured (WHO, 2015). There is an absence of loreal scale between the pre-ocular and nasal scales (WHO, 2015).

Viperidae: Viperidae snakes generally have long fangs (solenoglyph) and they are further divided into two subfamilies; typical vipers (Viperinae) and pit-vipers (Crotalinae). The body of the Viperidae is thick, short with many rough scales on the top of head (dorsum) and coloured patterns on the dorsal surface (WHO, 2015).

Colubridae: It is the largest snake family which covers 2000 species around the globe (Thornton, 2014). Some of the species can cause life-threatening anti-haemostatics conditions and acute kidney injury (WHO, 2015).

Hydrophiidae: It is commonly called the sea snakes and they are found in coastal regions. Family Hydrophiidae consists of anterior non-rotatable fangs, neurotoxic venom, flattened oar-like tails and their ventral (belly) scales are reduced in size or absent (WHO, 2015). This family is divided into two subfamilies Hydrophiinae (true sea snakes) and Laticaudinae (sea kraits).

Table 1- Catalog of venomous snake of India.

S. No	Common name	Scientific name
1.	Himalayan keelback	*Rhabdophis himalayanus*
2.	Red-necked keelback	Rhabdophis Subminiatus
3.	Himalayan krait	*Bungarus bungaroides*
4.	Banded krait	*Bungarus fasciatus*
5.	Common krait	*Bungarus caeruleus*
6.	Andaman krait	*Bungarus andamanensis*
7.	Black krait	*Bungarus niger*
8.	Wall's Sind krait	*Bungarus sindanuswalli*
9.	Lesser black krait	*Bungarus lividus*
10.	Slender coral snake	*Calliophis melanurus*
11.	Striped coral snake	*Calliophis nigrescens*
12.	Beddome's coral snake	*Calliophis beddomei*
13.	Castoe's coral snake	*Calliophis castoe*
14.	Bibron's coral snake	*Calliophis bibroni*
15.	MacClelland'sCoral Snake	*Sinomicrurus macclellandi*
16.	Spectacled cobra	*Naja naja*
17.	Monocled cobra	*Naja kaouthia*
18.	Andaman cobra	*Naja sagittifera*
19.	Central Asian cobra	*Naja oxiana*
20.	King cobra	*Ophiophagus hannah*
21.	Common sea krait	*Laticauda laticauda*
22.	Yellow-lipped sea krait	*Laticauda colubrine*

S. No	Common name	Scientific name
23.	Jerdon's sea snake	*Kerilia jerdonii*
24.	Viperinesea snake	*Praescutata viperina*
25.	Hook-nosed sea snake	*Enhydrina schistose*
26.	Black-banded sea snake	*Hydrophis nigrocinctus*
27.	Yellow sea snake	*Hydrophis spiralis*
28.	Annulated sea snake	*Hydrophis cyanocinctus*
29.	Bengal sea snake	*Hydrophis stricticollis*
30.	Cochin banded sea snake	*Hydrophis ornatus*
31.	Persian Gulf sea snake	*Hydrophis lapemoides*
32.	Bombay Gulf sea snake	*Hydrophis mamillaris*
33.	Malacca sea snake	*Hydrophis caerulescens*
34.	Banded sea snake	*Hydrophis fasciatus*
35.	Short sea snake	*Lapemis curtus*
36.	Large-headed sea snake	*Astrotiastokesii*
37.	Common small-headed sea snake	*Hydrophis gracilis*
38.	Cantor's narrow headed sea snake	*Hydrophis cantoris*
39.	Black and yellow sea snake	*Pelamis platura*
40.	Russell's viper	*Daboia russelii*
41.	Levantine viper	*Macrovipera lebetina*
42.	Saw-scaled viper	*Echis carinatus*
43.	Himalayan pit viper	*Gloydiushimalayanus*
44.	Hump-nosed pit viper	*Hypnale hypnale*
45.	Mountain pit viper	*Ovophis monticola*
46.	Brown-spotted pit viper	*Protobothrops mucrosquamatus*
47.	Jerdon's pit viper	*Protobothrop sjerdonii jerdonii*
48.	Jerdon's red-spotted pit vipe	*Protobothrops jerdonii xanthomelas*
49.	Kaulback's pit viper	*Protobothrops kaulbacki*
50.	Himalayan spottedpit viper	*Protobothrops himalayanus*
51.	Large-scaled pit viper	*Craspedocephalus macrolepis*
52.	Malabar pit viper	*Craspedocephalus malabaricus*
53.	Horseshoe pit viper	*Craspedocephalus strigatus*
54.	Bamboo pit viper	*Craspedocephalus gramineus*
55.	Yunnan pit viper	*Trimeresurus yunnanensis*
56.	Medo pit viper	*Trimeresurus medoensis*
57.	Pope's pit viper	*Trimeresurus popeorum)*
58.	Cantor's pit viper	*Trimeresurus cantori*
59.	Andaman pit viper	*Trimeresurus andersoni*
60.	Spot-tailed pit viper	*Trimeresurus erythrurus*
61.	White-lipped pit viper	*Trimeresurus albolabris*

S. No	Common name	Scientific name
62.	Nicobar pit viper	*Trimeresurus labialis*
63.	Himalayan white lipped pit viper	*Trimeresurus septentrionalis*
64.	Gumprecht's green pit viper	*Trimeresurus gumprechti*
65.	Hutton's pit viper	*Tropidolaemus huttoni*

(Source: (11)Whitaker and Captain, 2008; Vijayaraghavan and Ganesh, 2015)

In India 23 snake species are recognized for their medical importance, capable of inducing fatalities in cases of snakebite envenoming. The comprehensive list below enumerates these 23 species, encompassing the Big four, collectively acknowledged as medically important snakes in India.

Table 2- Medically important Snakes in India

Medically Important Snakes		
Russell's viper (*Daboia russelii)*	Spectacled cobra (*Naja naja*)	Sind krait (*Bungarus sindanus*)
Hump-nosed pit viper (*Hypnale hypnale*)	Common krait (*Bungarus caeruleus*)	Salazar pit viper (*Trimeresurus Salazar*)
Mountain pitviper (*ovophis monticola)*	Hook-nosed sea snake *(Enhydrina schistose*)	Andaman's cobra (*Naja sagittifera*)
Banded krait (*bungarus fasciatus*)	Himalayan pit viper (*Gloydius himalayanus*)	Annulated sea snake *Hydrophis cyanocinctus*
Greater black krait (*bungarus niger*)	Large-scaled pit viper (*Crespadocephalus macrolepis*)	Central Asian cobra *(Naja oxiana*)
Lesser black krait (*bungarus lividus*)	Malabar pit viper (*Crespadocephalus travancoricus*)	Sochurek's saw-scaled viper (*Echis carinatus sochureki*)
Red-necked keelback (*Rhabdophis subminiatus*)	Saw-scaled viper (*Echis carinatus*)	King cobra (*Ophiophagus Hannah*)
Northern larged- scaled pit viper (*Craspedocephalus marcolepis*)	Short sea snake (Hydrophis curtus)	

**Note: The Malabar Pit Viper (Craspedocephalus malabaricus), a medically important snake species found in the Western Ghats of India. This species further splits into three distinct species, each inhabiting various region within the Western Ghats: i) Craspedocephalus travancoricus ii) Craspedocephalus peltopelor iii) Craspedocephalus anamallensis*

Thus, it is obvious that epidemiological investigation of snakebite envenoming, and related factors is pertinent for forming any policy and its implementation in any part of the world.

Monocled cobra, *Naja kaouthia* (venomous)

CHAPTER 4:

SNAKEBITES ENVENOMING

India is a home to 310 species of snakes out of which 66 species are venomous and 42 species are mildly venomous. These 66 venomous snake species of India are organized into four families, namely, Elapidae, Viperidae, Colubridae, and Hydrophiidae (the detailed information is available in Chapter 3).

Morphology of the snake

Snakes in India exhibit a diverse range of morphological features, adapted to their various ecological niches and lifestyles (12). Here is a general overview of the morphology of snakes found in India:

Body Shape and Size:

- Snakes in India vary greatly in size, ranging from tiny species like the Brahminy Blind Snake to large ones like the Indian Python.
- The body is typically elongated and cylindrical, allowing for efficient movement

Head:

- Snakes in India have distinct heads that are separated from the body by a noticeable neck.
- The head may be triangular or oval in shape, depending on the species.

Eyes:

- Most snakes have lidless eyes covered by transparent scales. Some species, like pit vipers, have heat-sensing pits located between the eyes and nostrils.

Figure 7- Key identification feature of snakes

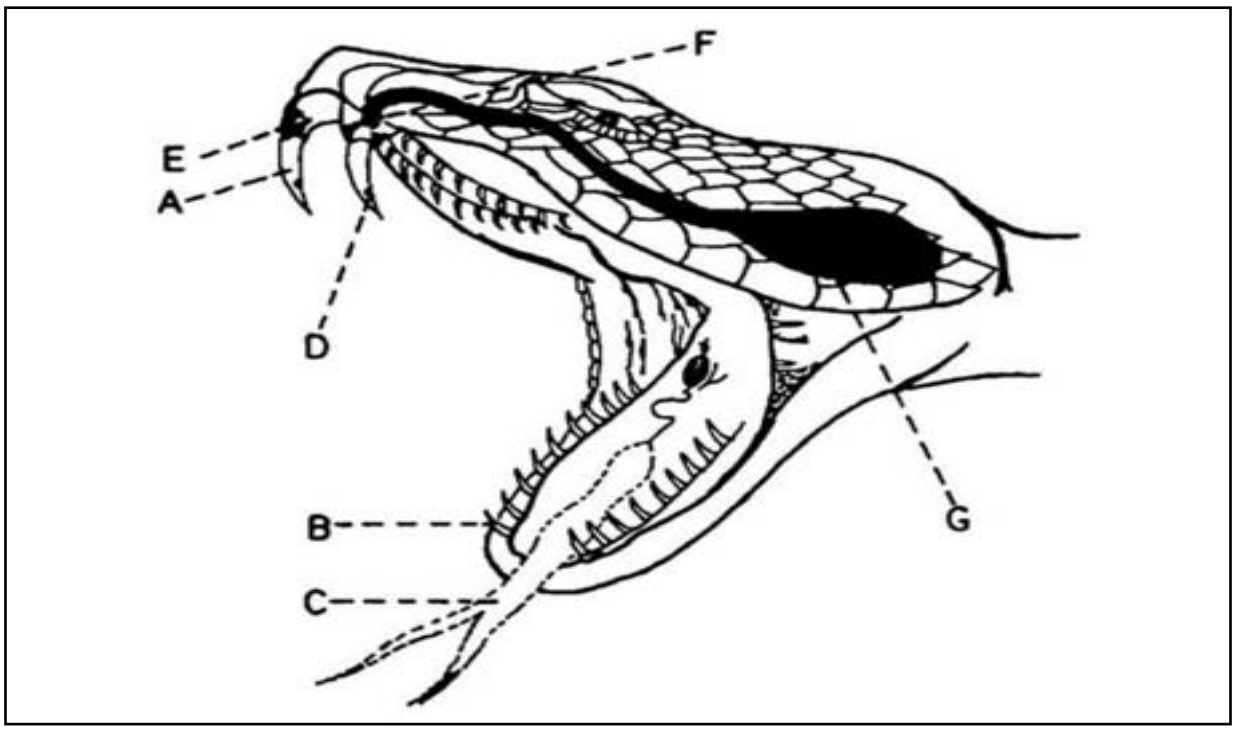


Figure 8- Morphology of Indian Cobra (Naja naja)- Mouth Parts of viper: A) Fang, B) Curved teeth, C) Tongue, D) Orifice of fang, E) Sheath over fang, F) Poison duct at base of fang, G) Venom gland. Source: Sharma, R.C (2007)

Mechanism of Action of Snakebite

A majority of snakebites are attributed to non-venomous snakes, with more than half of venomous snakebites involving the injection of insufficient snake venom, leading to the manifestation of mild symptoms (13). The extremities, accounting for up to 98% of snakebites, serve as the predominant site for such incidents. The degree of envenomation resulting from bites by venomous snakes is contingent upon various factors, including the nature of the bite (such as its location, depth, and the number of bites), the amount of venom injected (influenced by factors like the duration of the snake's bite, the level of anger or fear motivating the snake, and the species and size of the snake), characteristics of the victim (such as age, size, and the victim's sensitivity to the venom or any co-morbidities), and the promptness and effectiveness of first-aid and medical care received(2).

While non-venomous snakebites leave a number of small impressions in a row, venomous snakebites are characterized by two faint impressions left by fang teeth(14). All venomous snakes have two fangs which are curved teeth attached to the maxillary bones. At the time of bite, they become erect and point directly forward and discharge venom into the victim through grooves/canals within them. The distance between fang marks generally ranges from 1 to 4 cm. A side swipe may produce a single puncture and also small marks of other teeth. As such, even a thin layer of clothing may afford great protection. If successfully injected, the venom travels through the lymphatic system and superficial veins to cause systemic neurologic or haemolytic effects(15).

Action of snake venom of on different body systems

i. Local tissue damage including necrosis of soft tissues, haemorrhage, blistering and oedema

ii. Haemostatic alterations due to consumption coagulopathy and platelet disturbances

iii. Systemic haemorrhage leading to cardiovascular shock

iv. Neuromuscular paralysis

Clinical Presentation

Snakebite victims present with local and systemic symptoms of envenoming along with anxiety and symptoms associated with the treatment they received before arrival to the health care facility.

Fear associated with snakebite can cause misleading symptoms, such as vomiting, sweating, tachycardia, painful cramps in the hands, wrists and feet, leading temporary loss of consciousness and functional neurological disorders(16).

The specific clinical manifestations(16) associated with bites of different classes of venomous snakes are as follows –

Viperids- Bites from viperids consists of local and systemic effects. Local effects in the bitten limb include immediate radiating pain; rapidly extending tender swelling, which usually becomes evident within 2 hours of the bite; inflammation of the lymph vessels; prolonged bleeding from fang puncture wounds; blistering; bruising and superficial soft tissue and muscle necrosis and secondary infection (cellulitis or abscess). Systemic effects include early syncope and collapse with transient loss of vision and consciousness; hypotension and shock; cardiac tachyarrhythmia or bradyarrhythmia, spontaneous systemic bleeding from the nose, gums, respiratory, gastrointestinal and genitourinary tracts and cerebral, and antepartum or postpartum haemorrhages leading to abortion and foetal death.

Elapids- Bites of elapids are associated with the classic neurotoxic syndrome, characterized by flaccid paralysis. Local symptoms include absent, without blistering or necrosis. Venom released by spitting elapids into an individual's eyes can lead to ophthalmia, resulting in intensely painful conjunctivitis with swelling of the eyelids, risk of corneal ulceration and secondary infection leading to permanent blindness.

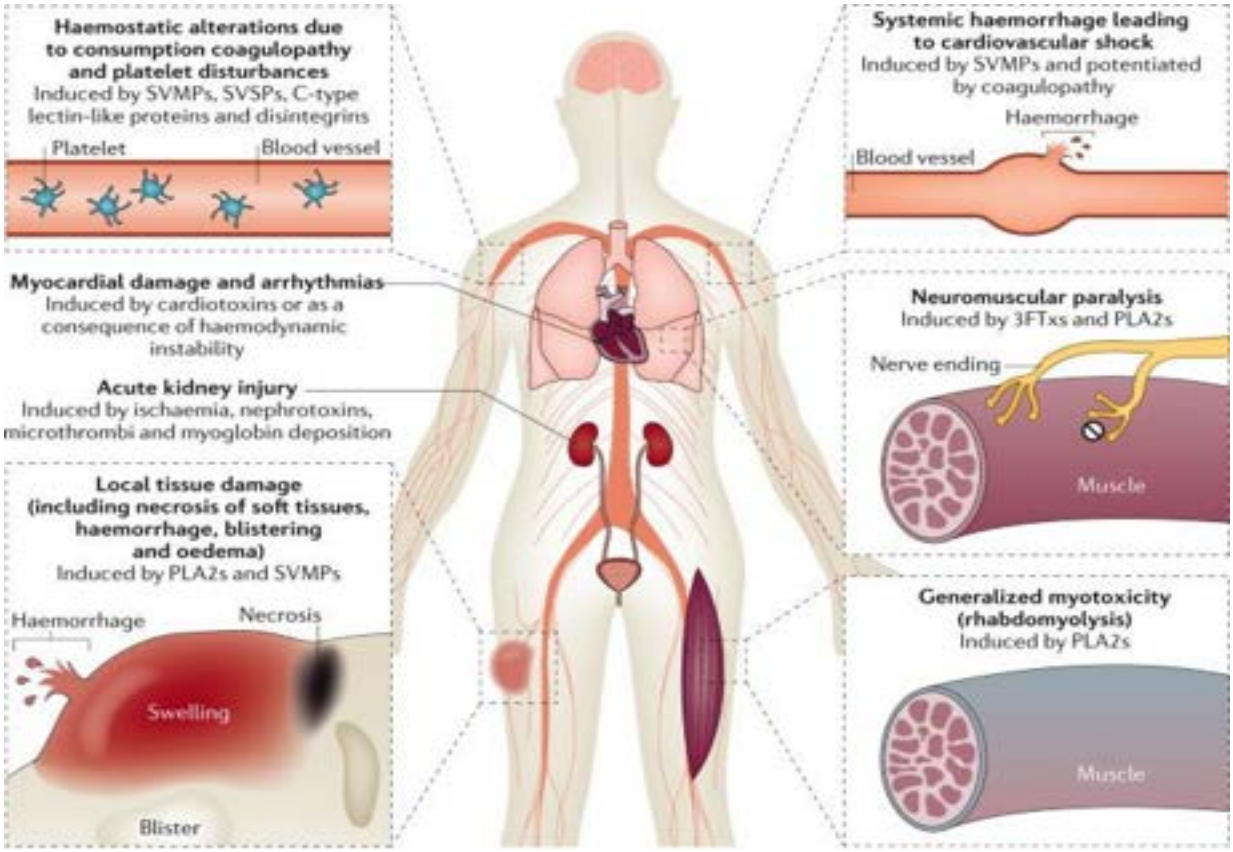


Figure 9- Action of snake venom toxins on different body systems

Source- J.M.G. Instituto Clodomiro Picado, Facultad de Microbiología, Universidad de Costa Rica

Non-front-fanged colubroids- Bites from non-front fanged colubroid snakes are associated with slowly or late evolving discoloration of the skin resulting from underneath bleeding, systemic bleeding and acute kidney injury with minimal local envenoming.

Clinical time course

Local swelling after bites by vipers and elapids is usually detectable within 2-4 hours and can reach its peak on second and third day. Sloughing of necrotic tissue and secondary infections develop during subsequent weeks or month. Vomiting or sudden temporary loss of consciousness within minutes of the bite may indicate systemic envenoming. Neurotoxic signs can progress to generalized flaccid paralysis and respiratory arrest within 30 minutes to a few hours.

For details on management of Snakebite refer to the latest standard treatment guidelines of Ministry of Health & Family Welfare on https://nhsrcindia.org/node/2179.

Diagnosis, screening and prevention

Snakebite envenoming is a clinically complex emergency due to its potential for quick death. The quantity and quality of venom injected to the victims depends on may factors such as age of the snake, different species of snakes in particular geographic areas, morphologically mimicking snake species, which can make it difficult for physicians to determine the best course of treatment.

Current clinical guidelines recommend withholding antivenom administration until symptoms of systemic envenoming are detected in patients with a snakebite. Rapid, affordable, point of care (bedside) diagnostic kits providing physicians in rural hospitals with information that enables earlier detection of envenoming and identification of the biting species are urgently needed to enable earlier treatment with antivenom and anticipate likely clinical course and the need for supportive therapy like ventilation.

For details on diagnosis and prevention refer to Chapter 10.

Afterword

After delving into the intricate complexities of snakebite envenomation and its profound impact on public health, it is evident that this issue extends far beyond the physical consequences, reaching into the socio-economic fabric of predominantly poor, rural communities in tropical and sub-tropical regions worldwide. The vulnerabilities are exacerbated among those with poorly constructed living conditions and limited access to education and healthcare.

Common krait, *Bungarus caeruleus* (venomous)

CHAPTER 5:

GLOBAL EFFORTS FOR PREVENTION AND CONTROL OF SNAKEBITE ENVENOMING

Bites by venomous snakes can cause acute medical emergencies involving severe paralysis that may respiratory distress, cause bleeding disorders that can lead to fatal haemorrhage, cause irreversible kidney failure and severe local tissue destruction that can cause permanent disability and limb amputation. Children may suffer more severe effects, and can experience the effects more quickly than adults due to their smaller body mass(17). Most deaths and serious consequences of snakebites are entirely preventable by making safe and effective antivenoms more widely available and accessible. High quality snake antivenoms are the most effective treatment to prevent or reverse most of the venomous effects of snakebites. They are included in the WHO List of essential medicines and should be part of any primary health care package where snakebites occur

Snakebite envenoming affects, almost exclusively, poor, and politically un-empowered people living in rural parts of generally low-income, tropical countries i.e., sub-Saharan Africa, Asia, Latin America and Papua- New Guinea. Like many diseases of poverty, Snakebite envenoming has failed to attract requisite public health policy inclusion and investment for driving sustainable efforts to reduce the medical and societal burden. This is largely due to the demographics of the affected populations and their lack of political voice. However, in recent years, there has been a growing awareness of the disease burden created by snakebite accidents, as reflected by the awakening interest of WHO, regional and national health authorities, non-governmental organisations, and some antivenom manufacturers and research groups, in discussing and searching for solutions to this complex health problem (17).

Addressing the problem of snakebite effectively at global level demands an integrated multifocal approach, targeting complex problems and involving stakeholders. It must comprise:

a) Acquisition of reliable information on the incidence and mortality attributable to snakebite envenoming, and the number of people left with permanent sequelae.
b) Improvements in production of effective and safe antivenoms, through strategies aimed at strengthening the technological capacity of antivenom manufacturing laboratories.
c) Increasing the capacity of low-income countries to produce specific immunogens (snake venoms) locally, and to perform their own quality control of antivenoms.
d) Commitments from regional producers to manufacture antivenoms for countries where Antivenom production is not currently feasible.
e) Implementation of financial initiatives guaranteeing the acquisition of adequate volumes of antivenom at affordable prices in low-income countries.
f) Performance of collaborative studies on the safety and effectiveness of antivenoms assessed preclinically and by properly designed clinical trials.
g) Development of antivenom distribution programmes tailored to the real needs and epidemiological situations of rural areas in each country.
h) Training programmes for health staff, particularly in rural areas where snakebites are frequent.

i) Preventive and educational programmes at the community level, with the active involvement of local organisations and employing modern methods of health promotion.
j) Studies on the ecology, climate and behaviour of medically important snakes.
k) It is recognized that many countries where snakebite is a serious health problem have several limiting factors for patients to receive treatment on time including lack of transport in rural areas and reliance of people on local, useless treatments. In view of this, a special emphasis needs to be placed on prevention through education.

In 2018, WHO listed SBE as a priority neglected tropical disease (NTD) after intense advocacy by concerned stakeholders including the Global Snakebite Initiative, Health Action International and 20-member countries. WHO's Department of the Control of Neglected Tropical Diseases had already established a 28-member SBE Working Group (SBE-WG) to support WHO in drafting a road map to implement strategies to prevent, reduce, and control the snakebite burden. In June 2018, WHO convened a Welcome-hosted meeting of the SBE-WG to review a first draft of the road map document. The 71st World Health Assembly adopted a robust resolution (WHA71.5) on SBE, providing WHO with a strong mandate to act.

Figure 10- Strategic Objectives

WHO global strategy for prevention and control of snakebite envenoming was launched in 2019, with the goal for all patients to have better overall care, so that **the numbers of deaths and cases of disability are reduced by 50% before 2030.** Rather than perceiving SBE risk as a standalone issue, the SBE-WG considers that efforts to combat SBE needs to be incorporated within national and regional health plans and aligned with global commitments to achieving universal health coverage and the Sustainable Development Goals (SDG). In the view of these, four key pillars have been identified and prioritized.

Table 3 Key activities envisaged under key program areas

Objective	Key Activities
Safe and effective treatment	• Make safe, effective antivenoms available, accessible, and affordable to all • Better control and regulation of antivenoms Prequalification of antivenoms • Integrated health worker training and education • Improving clinical decision making, treatment, recovery and rehabilitation • Investing in innovative research on new therapeutics
Empowering and engaging communities	• Active community engagement and participation • Improve SBE prevention, risk- reduction and avoidance • Effective prehospital care and ambulance transport • Accelerate development of pre-hospital treatments • Improve health care-seeking behaviours • Build a strong understanding of socio- cultural and economic factors affecting outcomes
Stronger Health Systems	• Strengthening community health services • Facilitating research and policy development around healthcare cost mitigation • Improving infrastructure, services and health facilities • Country-level implementation via national and sub-national health plans • Enhanced disease burden monitoring and surveillance • Research on SBE ecology, epidemiology, clinical outcomes and therapeutics
Partnership, coordination, and resources	• Supporting governance and leadership • Promoting advocacy, effective communication and productive engagement • Enhancing integration, coordination and cooperation • Build strong regional partnerships and alliances • Coordinated data management and analysis • Research to build a strong and sustainable investment case

Figure 11- Road map of WHO Global Strategy for Snakebite Envenoming Prevention and Control

Through this global initiative for prevention and control of snakebite envenoming, WHO and partners will support countries in designing and implementing locally relevant plans. In current phase from 2021-24, the global strategy will be scaled up to 35–40 countries and during the full roll-out in 2025–30, all countries will be expected to integrate the strategy into their national public health agendas.

In 2019, the 72nd session of the WHO Regional Committee for South-East Asia recommended the development of a Regional Snakebite Prevention and Control Plan of Action to help Member States strengthen their capacity to prevent, control and effectively manage snakebites, by regional adaptation of the Global Strategy.

In this context, **the Regional Action Plan for prevention and control of snakebite envenoming in South-East Asia 2022–2030** was developed through a consultative process with Member States, experts and partners. The Regional Action Plan is intended to guide Member States, WHO, donors and partners to work together in a systematic and progressive manner to address issues and challenges and to strengthen health-system and programmatic components to accelerate prevention and control of snakebite envenoming in the South-East Asia Region.

The key objectives of the Regional Action Plan for prevention and control of snakebite envenoming in the South-East Asia 2022-2030 to achieve the goal of reducing the number of

deaths and cases of disability associated with snakebite envenoming by half by 2030 are as follows –

1. Prevent snakebites and provide effective first-aid
2. Ensure access to life-saving treatment and care
3. Improve availability of quality, effective, safe and affordable antivenoms

Priority action points and strategies identified to achieve these objectives are categorised into three supporting areas

Supporting Area 1: Strengthen leadership, governance and programme planning and management

i. Engage, educate and empower communities about risks of snakebite envenoming and measures for its prevention along with first-aid care to be followed upon snakebite

Priority actions

1. **Identify at-risk regions and communities for each country** considering occupational and demographic profiles, distribution of venomous species, ecological and climatic factors and location of snakebite hot spots.
2. **Adapt WHO toolkit for effective communication and training** in the regional, national and local context to ensure that core messages are standardized and consistent across communities and countries.
3. **Organize participatory community training** using validated tools and information resources tailored to local contexts (e.g., language, culture, social) to ensure basic skills and knowledge on prevention of snakebite and appropriate first-aid care.
4. **Engage with traditional healers** using culturally sensitive and non-confrontational approaches to encourage them to promptly refer snakebite victims to medical centers and act as first respondents, providing informed First Aid till medical care is available.
5. **Engage community health workers and other influential community members,** local leaders, civil society and social activists to encourage and support communities in adopting better health care-seeking behaviour.

Supporting Area 2: Establish surveillance and monitor and evaluate progress

ii. Strengthen effective pre-hospital care and rapid transport

Priority actions

1. Ensure **availability of rapid transport and appropriate pre-hospital care** from communities-at-risk to health facilities
2. Ensure **availability of emergency drugs** and equipment in ambulances.
3. Conduct **regular training of emergency responders** in basic life support and the clinical recognition of envenoming and rapid effective response to life-threatening emergencies.
4. Ensure ambulance paramedic staff are trained in emergency procedures.

iii. Strengthen healthcare and referral system capacity

Priority actions

1. Develop or update national snakebite treatment protocols and training tools to standardize

clinical diagnosis, treatment, recovery and rehabilitation.
2. Develop standardized referral protocols to secondary and tertiary care centres. Integrate these protocols into national snakebite treatment guidelines.
3. Organize regular (in-service) training for health-workers on snakebite prevention, clinical diagnosis, treatment and rehabilitation of snakebite patients.
4. Establish and strengthen the referral network with early communication to health facilities before transfer.
5. Share with communities at risk a list of proximate health centres equipped to manage snakebite cases.

iv. Improve inventory management system and storage conditions of antivenoms

Priority actions

1. Establish or integrate an inventory management system to enable visualization of location of health facilities with types and quantity of antivenom stocks
2. Include inventory management and appropriate storage of antivenoms in training packages for health workers
3. Ensure the maintenance of cold chain for appropriate storage of liquid antivenoms

Supporting area 3: Enhance regional partnership and multisectoral collaboration for advocacy, research and innovation

i. Optimize production, procurement and distribution of locally- appropriate antivenoms

Priority actions

1. Continually update the **WHO herpetological map** to identify locally prevalent snake species of medical importance and model populations at risk of snakebites and antivenom needs in the Region.
2. Conduct **evidence-based needs assessment and demand forecast** of specific antivenoms of medical importance at the regional level.
3. Amend current wildlife protection and management legislation to ensure that manufacturers of venoms or antivenoms can legally source specimens from wild populations.
4. Explore the creation of incentive programmes to **support increased manufacturing capacity**
5. Explore **coordinated and pooled procurement of antivenoms** by building on existing initiatives, such as the Initiative for coordinated antidotes procurement in the South-East Asia Region (iCAPS)

ii. Strengthen pharmacovigilance and post-market surveillance for antivenoms

Priority actions

1. Develop a strategy to strengthen pharmacovigilance and post-marketing surveillance of antivenoms (including objectives, actions to stimulate reporting, study methods, risk minimization measures).

2. Integrate antivenom products into existing national pharmacovigilance programmes.
3. Integrate appropriate early management and reporting of adverse drug events as part of the training for health workers

iii. Strengthen regulation of antivenom quality, efficacy and safety

Priority actions

1. Strengthen quality standards to support the industry and National Regulatory Agencies (NRA) in ensuring access to safe, effective, and quality antivenoms, through:
   (i) Regional venom reference standards against all medically important snake species for use in the evaluation of antivenoms, with government financing to ensure transparency and avoid conflicts of interest.
   (ii) Standardizing and improving the basis for the parallel preparation of in-house antivenom working reference preparations by manufacturers in consultation with regulators and external experts
   (iii) adequate capacity building of relevant NRA staff (e.g., marketing authorization assessors, regulatory inspectors, etc) and manufacturers.

2. Ensure all antivenoms produced or imported into a country are licensed or approved by national regulatory authorities, with support of other regulatory authorities as needed.

3. Encourage research to determine an optimal, safe initial dose of antivenoms through dose-finding and safety clinical trials.

These strategic actions of Regional Action Plan for improving the production, quality control, and regulation of anti-snake venom through a comprehensive program to stimulate modernisation, research and development combined with parallel efforts on community engagement and education, health systems strengthening and effective partnerships at local, national, regional, and global level, represents a strong advance on the road to achieving a 50% reduction in global mortality and disability.

Greater black krait, *Bungarus niger* (venomous)

CHAPTER 6:

INDIAN EFFORTS: JOURNEY SO FAR OF SNAKEBITE ENVENOMING PREVENTION AND CONTROL

It is expected that with global efforts to advocate for effective interventions from every affected country & ever-expanding liaison of global agencies with respective countries in this area would definitely impact the burden of Snakebite in respective regions in near future.

As highlighted "Historical perspective" for snakebites, considerable milestones have reached in the area of Snakebite prevention and control by different experts across the field of medicine, immunology, vaccines etc. Further along with central government, different state governments have undertaken steps through Health, Agriculture, Labour and Revenue department for adding to relief of snakebite victims in terms of early clinical management, management of complications and economic relief to snakebite victims.

In recent years "Ministry of Health and Family Welfare has issued a National Snakebite Management Protocol" for use by medical officers for management of Snakebite cases in 2009 and updated in 2016. Interventions in the medical sector like capacity building of health professionals and paramedics on initial management, referral and life support skills are also being undertaken by state health departments.

To ensure the availability of Anti Snake Venom (ASV), States and UTs have been directed to include Anti Snake Venom (ASV) in the State's list of essential drugs. The procurement of these drugs is supported under the National Free Drug Initiative through the National Health Mission. In line with that majority of states have already included ASV in the state level essential drug list. Procurement of Anti Snake Venom is being undertaken in a decentralised manner i.e State/district/local purchase and majority of states are procuring it through the State drug procurement department.

It is essential that accurate burden of disease is available for initiating policy level and programmatic action hence, Indian Council of Medical Research (ICMR) is undertaking Nationwide study for the same and also constituted "National Task Force for Research on Snakebite in India". The ICMR National Task Force (NTF) on Snakebite Research in India recommended two national projects on snakebite. These snakebite research projects were included in the priority research areas under Honourable Prime Ministers vision 2022 and are hereafter-

1. Nationwide Study to estimate incidence, mortality, morbidity and economic burden due to snakebite in India.

The study is being conducted covering 14 states, 39 districts, 372 Blocks across the country with about 7% population as 2011 census with the objective is to estimate incidence, mortality, morbidity and economic burden due to snakebite in country.

2. ICMR National Snakebite Project (INSP) on capacity building of health system on prevention and management of snakebite envenomation (SBE) including its complications

The ICMR National Snakebite Project (INSP) is using a multi-sectoral approach to reduce the burden of SBE. It is also contributing to community empowerment and capacity building of the public healthcare system on the prevention and management of SBE.

Recently, Mission Steering Group (MSG) of NHM has approved the inclusion of activities for Prevention and Control of Snakebites at District and State level under existing components of NHM. It includes activities i.e., training of medical officers/health workers, surveillance of snakebite cases & deaths, monitoring of health facilities for preparedness of snakebite management, meetings for advocacy with various government and non-government stakeholders, raising community awareness on prevention of snakebites and intersectoral coordination. National Centre for Disease Control, MoHFW is the nodal agency for implementation of above activities.

As part of strengthening of surveillance for snakebite envenoming, efforts are underway through coordination with States under case based reporting platform of IHIP. Line listed data of snakebite cases and deaths are expected to generate information on clustering of bites, age-gender wise case distribution etc. For undertaking the activities of Snakebite prevention and control dedicated state/district nodal officers are being appointed.

For generating mass awareness on Snakebite prevention, IEC materials are being prepared at National and State level and through local /regional languages using various communication channels of Print and Audio/Video materials efforts are undertaken by respective governments for involvement of community on these issues especially in highly affected districts/States.

The major initiatives proposed to be undertaken as part of current action plan for mitigating the challenges of Snakebite envenoming in India are as under –

i. Strengthening of Surveillance of Snakebite through Integrated Health Information Platform (IHIP)
ii. Capacity building of medical professionals
iii. Development of Regional venom centres based on prevalent snake species to assure quality Anti Snake Venom across all regions
iv. Addressing the legislative issues of anti-snake venom collection
v. Digital tracking and Monitoring of facilities on availability of anti-snake venom for ensuring prompt and effective management of snakebite cases supported by a helpline service.
vi. Community outreach activities to spread awareness about snakebite prevention and management.

Recently, all states have been asked to prepare the state level action plan for prevention and control of Snakebite envenoming including mapping of referral facilities for timely management of snakebite cases, availability of dialysis and ventilator for management of complicated cases. To ensure the availability of effective ASV against all venomous species in India, it is being envisaged under this action plan Regional Venom Centres/banks may be established in suitable institutes in respective regions.

Way forward:

It is evident that multisectoral collaboration and coordination will help in bringing together different stakeholders already working in the field of snakebite control and management on one platform.

Further, global organisations working in the field of snakebite envenoming are advocating for a dedicated National Programme in India to address the snakebite envenoming burden and to make snakebite envenoming a notifiable and efforts are underway for the same as part of the current action plan.

Measures like setting up of zonal banks or venom collection centres to cover regional differences in venom immunogenicity and to ensure venom supply at cost effective prices for ASV.

Interventions in the medical sector like capacity building by training of health professionals and paramedics on initial management, referral and life support skills which will improve the clinical aspects of snakebite management skills. Action Plan also envisages raising awareness among the community through media outreach programmes to the vulnerable groups. It also envisages setting up of a 24x7 tollfree helpline to answer queries related to snakebite management are few of the key steps in mitigating the challenges of venomous snakebite in India.

This initiative, the National Action Plan for Prevention and Control of Snakebite Envenoming by the Ministry of Health & Family Welfare, is anticipated to prompt coordinated efforts from the Central and state governments, Non-governmental organizations, and other stakeholders. The goal is to take tangible steps toward reducing disability and mortality caused by snakebite envenoming, aligning with the global target of “halving the deaths from snakebite by 2030”.

Himalayan pitviper, *Gloydius himalayanus* (venomous)

CHAPTER 7:

LEGISLATION RELATED TO SNAKEBITES IN INDIA & CHALLENGES TO BE ADDRESSED

Snakes play a vital role in various ecosystems, exerting influence on the dynamics of prey and predator relationships within their respective habitats. These organisms inhabit diverse environmental settings, encompassing fields, forests, wetlands, ponds, lakes, streams, rocky hillsides, farmlands, vacant lots, and residential neighbourhoods. Characterised by predatory behaviour and varying sizes, all snake species exhibit a feeding spectrum that ranges from eggs to large vertebrates.

Many species of snakes face endangerment due to anthropogenic activities, including hunting for their skins and extermination driven by fear. Preserving biodiversity is crucial for sustaining life on Earth, and snakes play a vital role in maintaining ecological balance. Therefore, conserving snakes is essential for the overall health of the ecosystem. In India, the Wildlife Protection Act of 1972 is a significant legal framework that protects wildlife including snakes from hunting, illegal wildlife trade, and unnecessary killing.

There are important legislations are as follows:

Wildlife (Protection) Act, 1972

Section 9

Prohibition of hunting. —No person shall hunt any wild animal specified in 7 [Schedules I and II] except as provided under section 11 and section 12.]

Section 11

Hunting of wild animals to be permitted in certain cases.

The Chief Wildlife Warden (CWLW) may, if he is satisfied that any wild animal specified in Schedule I has become dangerous to human life or is so disabled or diseased as to be beyond recovery, by Order in writing and stating the reasons therefor, permit any person to hunt such animal or cause such animal to be hunted; 8

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. (Ins. by Act 16 of 2003, s. 9 (w.e.f. 1-4-2003)

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.

Explanation. —For the purposes of clause (a), the process of capture or translocation, as the case may be, of such animal shall be made in such manner as to cause minimum trauma to the said animal]

(b) the Chief Wildlife Warden or the authorised officer may, if he is satisfied that any wild animal specified in Schedule II, (The words and figures "Schedule III, or Schedule IV" omitted by Act 18 of 2022, s. 7 (w.e.f. 1-4-2023), has become dangerous to human life or to property (including standing crops on any land) or is so disabled or diseased as to be beyond recovery, by order in writing and stating the reasons therefor, permit any person to hunt [such animal or group of animals in a specified area or cause such animal or group of animals in that specified area to be hunted].

(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:

Provided that nothing in this sub-section shall exonerate any person who, when such defence becomes necessary, was committing any act in contravention of any provision of this Act or any rule or order made thereunder.

(3) Amy wild animal killed or wounded in defence of any person shall be Government property.

Section 12

Grant of permit for special purposes: Notwithstanding anything contained elsewhere in this Act, it shall be lawful for the Chief Wildlife Warden, to grant (The words ", with the previous permission of the State Government '' omitted by Act 23 of 1982, s. 2 (w.e.f. 21-5-1982)) a permit, by an order in writing stating the reasons therefor, to any person, on payment of such fee as may be prescribed, which shall entitle the holder of such permit to hunt subject to such conditions as may be specified therein, any wild animal specified in such permit, for the purpose of:
(*a*) education;
(*b*) scientific research;
(*bb*) scientific management.

Explanation. —For the purposes of clause (*bb*), the expression, "scientific management" means—

(i) translocation of any wild animals to an alternative suitable habitat;
(ii) or (ii) population management of wildlife, without killing or poisoning or destroying any wild animals;]
[(c) collection of specimens—
(i) for recognised zoos subject to the permission under section 38-I; or
(ii) for museums and similar institutions;
(d) derivation, collection or preparation of snake-venom for the manufacture of life-saving drugs:]
[Provided that no such permit shall be granted—
(a) in respect of any wild animal specified in Schedule I, except with the previous permission of the Central Government, and
(b) in respect of any other wild animal, except with the previous permission of the State Government;]

(d) derivation, collection or preparation of snake-venom for the manufacture of life-saving drugs:]

[PROVIDED that no such permit shall be granted –

(a) In respect of any wild animal specified in schedule -I, except with the previous permission of the central government, and

(b) In respect of any other wild animal, except with the previous permission of the State Government.]

Section 39

Wild animals, etc., to be Government property. — (1) Every—
(a) wild animal, other than vermin, which is hunted under section 11 or sub-section (1) of section 29 or sub-section (6) of section 35 or kept or 1 [bred in captivity or hunted] in contravention of any provision of this Act or any rule or order made thereunder or found dead, or killed (The words "without a licence or" omitted by s. 27, ibid. (w.e.f. 2-10-1991)). or by mistake; and

(b) animal article, trophy or uncured trophy or meat derived from any wild animal referred to in clause (a) in respect of which any offence against this Act or any rule or order made thereunder has been committed,

[(c) ivory imported into India and an article made from such ivory in respect of which any offence against this Act or any rule or order made thereunder has been committed;

(d) vehicle, vessel, weapon, trap or tool that has been used for committing an offence and has been seized under the provisions of this Act.] shall be the property of the State Government, and, where such animal is hunted in a sanctuary or National Park declared by the Central Government, such animal or any animal article, trophy, uncured trophy or meat [derived from such animal or any vehicle, vessel, weapon, trap or tool used in such hunting] shall be the property of the Central Government.

(2) Amy person who obtains, by any means, the possession of Government property, shall, within forty-eight hours from obtaining such possession, make a report as to the obtaining of such possession to the, nearest police station or the authorised officer and shall, if so required, hand over such property to the officer-in-charge of such police station or such authorised officer, as the case may be.

(3) No person shall, without the previous permission in writing of the Chief Wildlife Warden or the authorised officer—

(a) acquire or keep in his possession, custody or control, or
(b) transfer to any person, whether by way of gift, sale or otherwise, or
(c) destroy or damage, such Government property.

[(4) Where any such Government property is a live animal, the State Government shall ensure that it is housed and cared for by a recognised zoo or rescue centre when it cannot be released to its natural habitat.
(5) Any such animal article, trophy or uncured trophy or meat derived from any wild animal, as referred to in sub-sections (1) and (2) may be disposed of by the State Government or the

Central Government, as the case may be, in such manner as may be prescribed by the Central Government:

Provided that such disposal shall not include any commercial sale or auction and no certificate of ownership shall be issued for such disposal.]

Section 44

Dealings in trophy and animal articles without licence prohibited. —
(1) [Subject to the provision of chapter V A, no person shall, except under, and in accordance with, a license granted under sub-section (4)
(a) commence or carry on the business as—
(i) a manufacturer of or dealer In, any animal article; or Sub-clause (ia) omitted by Act 44 of 1991, s. 30 (w.e.f. 2-10-1991).
(ii) a taxidermist; or
(iii)a dealer in trophy or uncured trophy; or
(iv) a dealer in captive animals; or
(v) a dealer in meat; or
(b) cook or serve meat in any eating-house:
[(c) derive, collect or prepare or deal in snake venom;]

Provided that nothing in this sub-section shall prevent a person, who, immediately before the commencement of this Act was carrying on the business or occupation specified in this sub-section, from carrying on such business or occupation for a period of thirty days from such commencement, or where he has made an application within that period for the grant of a licence to him, until the licence is granted to him or he is informed In writing that a licence cannot be granted to him:
[Provided further that nothing in this sub-section shall apply to the dealers in tail feathers of peacock and articles made therefrom and the manufactures of such articles.]

Explanation. —For the purposes of this section, “eating-house” includes a hotel, restaurant or any other place where any eatable is served on payment, whether or not such payment is separately made for such eatable or is included in the amount charged for board and lodging.

(2) Every manufacturer of, or dealer in, animal article, or every dealer in captive animals, trophies or uncured trophies, or every taxidermist shall, within fifteen days from the commencement of this Act, declare to the Chief Wildlife Warden his stocks of animals articles, captive animals, trophies and uncured trophies, as the case may be, as on the date of such declaration and the Chief Wildlife Warden or the Authorised officer may place an identification mark on every animal article, captive animal, trophy or uncured trophy, as the case may be.

(3) Every person referred to in sub-section (1) who intends to obtain a licence, shall make an application to the Chief Wild Life Warden or the authorised officer for the grant of a licence.

(4) (a) Every application referred to in sub-section (3) shall be made in such form and on payment of such fee as may be prescribed, to the Chief Wildlife Warden or the authorised officer.
[(b) No licence referred to in sub-section (1) shall be granted unless the Chief Wildlife Warden or the authorised officer having regard to the antecedents and previous experience of the

applicant, the implication which the grant of such licence would have on the status of wildlife and to such other matters as may be prescribed in this behalf and after making such inquiry in respect of those matters as he may think fit, is satisfied that the licence should be granted.]
(5) Every licence granted under this section shall specify the premises in which and the conditions, if any, subject to, which the licensee shall carry on his business.

(6) Every licence granted under this section shall—
(a) be valid for one year from the date of its grant;
(b) not be transferable; and
(c) be renewable for a period not exceeding one year at a time.

(7) No application for the renewal of a licence shall be rejected unless the holder of such licence has been given a reasonable opportunity of presenting his case and unless the Chief Wild Life Warden or the authorised officer is satisfied that—
(i) the application for such renewal has been made after the expiry of the period specified therefor, or
(ii) any statement made by the applicant at the time of the grant or renewal of the licence was incorrect or false in material particulars, or
(iii) the applicant has contravened any term or condition of the licence or any provision of this Act or any rule made thereunder, or
(iv) the applicant does not fulfil the prescribed conditions.

(8) Every order granting or rejecting an application for the grant or renewal of a licence shall be made in writing. (9) Nothing in the foregoing sub-sections shall apply in relation to vermin.

Section 49A

Definitions. —
(a) "Scheduled animal" means an animal specified for the time being in Schedule I
(b) "Scheduled animal article" means an article made from any Scheduled animal and includes an article or object in which the whole or any part of such animal 6 [has been used but does not include tail feather of peacock, an article or trophy made therefrom and snake venom or its derivative.]
(c) "Specified date" means—
(i) in relation to a scheduled animal on the commencement of the Wild Life (Protection) (Amendment) Act, 1986, the date of expiry of two months from such commencement;
(ii) in relation to any animal added or transferred to Scheduled I at any time after such commencement, the date of expiry of two months from such addition or transfer
[(iii) in relation ivory imported into India or an article made from such ivory, the date of expiry of six months from the commencement of the Wild Life (Protection) (Amendment) Act, 1991 (44 of 1991).]. Indian snake species are protected under **various schedules of Wildlife (Protection) Act, 1972.**

Schedule I species: All species of genus *Pythons*, Reticulated python *Malayopython reticulates,* red sand boa (*Eryx johnii*) and Whitaker's boa (*Eryx whitakeri*).
Some species such as checkered keelback (*Fowlea piscator*), Dhaman or rat snake (*Ptyas muscosa*), Indian Egg Eating Snake (*Boiga westermanni*) , Dog-faced water snake (*Cerberus rynchops*), Indian cobras (all sub-species belonging to genus *Naja*), King Cobra (All species belongs to genus *Ophiophagus*), Olive keelback Water snake (*Atretium schistosum*) and

Russel's viper (*Daboia russelii*)**.**

Schedule II Species , Blind snakes (All species of the family, *Typhlopidae)*, Colubrid Snakes (All species of the family, Colubridae except those listed in schedule-I), Elapid snake (All species of the family, *Elapidae* except those listed in schedule-I)), Sand snakes (All species of the family, Psammophiidae), Shield-tailed snake (All species of the family, Uropeltidae), Sunbeam snake (All species of the family, Xenopeltidae), Thread snake (All species of the family, *Leptotyphlopidae*) and Vipers (All species of the family Viperidae except for those listed schedule I)

In section 51 of the principal Act, —
(a) in sub-section (1), —
(i) for the words "twenty-five thousand rupees", the words "one lakh rupees" shall be substituted;
(ii) in the first provisio,-
(A) the words and figures "or Part II of Schedule II" shall be omitted;
(B) after the words "boundaries of a sanctuary or National Park", the words and figures "or where the offence relates to a specimen of a species listed on Appendix I of Schedule IV" shall be inserted;
(C) for the words "ten thousand rupees", the words "twenty-five thousand rupees" shall be substituted;
(iii) in the second proviso, for the words "twenty-five thousand rupees", the words "one lakh rupees" shall be substituted;

Penalties:

(1)Any person who [contravenes any provision of this Act [(except chapter V A and section 38J)]] or any rule or order made thereunder or who commits a breach of any of the conditions of any license or permit granted under this Act, shall be guilty of an offence against this Act, and shall, on conviction, be punishable with imprisonment for a term which may extend to [three years], or with fine which may extend to 4 [one lakh rupees], or with both:

[PROVIDED that where the offence committed is in relation to any animal specified in Schedule I [or part-II of schedule II] or meat of any such animal or animal article, trophy or uncured trophy derived from such animal or where the offence relates to hunting in a sanctuary or a National Park or altering the boundaries of a sanctuary or a National Park[or where the offense relates to a specimen of a species listed on Appendix-I of schedule IV], such offence shall be punishable with imprisonment for a term which shall not be less than three years but may extend to seven years and also with fine which shall not be less than[twenty five thousand rupees]:

Provided further that in the case of a second or subsequent offence of the nature mentioned in this sub-section, the term of the imprisonment shall not be less than three years but may extend to seven years and also with fine which shall not be less than [one lakh rupees].

*Table 4- State wise provisions for compensation to snakebite victims in India**

State	Provision of compensation
Bihar	if any person ever dies due to snakebite in the state, the state government will grant ex-gratia of Rs. 4 lakhs to the next of kin of the deceased In case of death of a person due to snakebite during floods, the Disaster Management Department, considering it as a natural calamity, is paid ex-gratia grant to the kin of the deceased as per the prescribed rate of subsidies from the State Disaster Response Fund *https://www.business-standard.com/article/pti-stories/bihar-govt-to-give-rs-5-lakh-ex-gratia-in-snake-bite-death-120030301432_1.html*
Uttar Pradesh	After the confirmation of a snakebite death, the district magistrate will have to ensure that Rs 4 lakh compensation is provided to the family of the deceased within seven days of the incident. *https://en.gaonconnection.com/snake-bites-uttar-pradesh-compensation-venom-deaths-wildlife-poisonous-snakes/#:~:text=The%20Uttar%20Pradesh%20government%20simplifies,of%20receiving%20the%20postmortem%20report*.
West Bengal	20,000/- (Rupees twenty thousand) only in each death case, to the next-of-kin (s) of the indigent person who was died as a result of Sun Stroke/ Snakebite, on being satisfied about the genuineness of the case of death, *http://wbdmd.gov.in/writereaddata/NW481128.pdf*
Kerala	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. *https://www.onmanorama.com/news/kerala/2022/07/09/man-bitten-by-viper-compensation-forest-department.html*
Karnataka	Amount of Rs. 2.00 lakh will be provided as compensation to the families of those farmers and agricultural laborers who lose their lives in accidents like falling from coconut /areca trees or snakebite or any other agriculture related accidents *https://bengaluruurban.nic.in/en/departments/agriculture-department/*
Madhya Pradesh	The financial assistance in case of death due to Snake/Guhera (poisonous lizard) bite, falling of authorized public transport into a river or from a hill into a pit, has been increased from Rs 50,000 to Rs 4 lakh *https://www.hindustantimes.com/bhopal/assistance-for-snakebite-and-drowning-deaths-increased-to-rs-4-lakh-in-mp/story-8gSweWFlupVgZ3OuV7ijNM.html*
Chhattisgarh	According to provisions, a compensation of Rs 1.5 lakh is given to the next of kin of those killed in a natural calamity and State added snakebite in natural calamity *https://www.deccanherald.com/content/387882/declare-snake-bites-natural-calamity.html*
Punjab	Financial Assistance by mandi board of Rs. 2 lakh in case of death *https://mandiboard.nic.in/ach-financial.htm*
Odisha	the Ex-gratia assistance of Rs. 4 Lakhs the 1st important thing to **conduct the mandatory Post Mortem examination** to ascertain the **cause of death** *https://www.gaodisha.gov.in/node/801*

State	Provision of compensation
Manipur	**Section 134 in The Manipur Municipalities Act, 1994.** Nagar Panchayat or Council may require owners to pull down ruins.- Whenever it appears to the Nagar Panchayat or Council that any building by reason of abandonment or disputed ownership or other cause is undaunted or by reason of having fallen into ruins, affords facilities for the commission of a nuisance by disorderly persons or for the harbouring of snakes or other noxious animals, the Nagar Panchayat or the Council may require the owner of such building or the land to which such building is attached, to properly secure the same, or to remove or level such ruins, as the case may require.

**The details provided in the table is based on the information available in public domain and information submitted by States and may be subject to change.*

Disclaimer

All the acts identified in this Chapter are published in the Indian gazette. These acts could be referred to when dealing with man-animal conflict, Human right situations, administrative duties etc., we have viewed these laws in reference for the purpose of NAPSE. For further details, the acts are to be reviewed from official government websites.

King cobra, *Ophiophagus hannah* (venomous)

CHAPTER 8:

STRATEGIC COMPONENTS OF NATIONAL ACTION PLAN FOR SNAKEBITE ENVENOMING

Introduction

There are several components which are involved in prevention & control of Snakebite Envenoming. Out of those four components are major pillars for implementation of "National Action Plan for Snakebite Envenoming" in India (NAPSE).

The successful implementation of NAPSE is based on the following 4 major pillars.

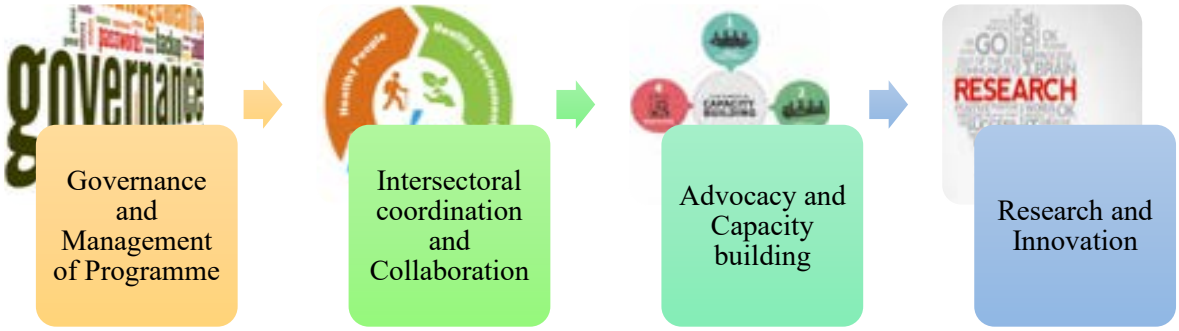


Figure 12 Major Components for implementation of NAPSE

The National Action Plan for Snakebite Envenoming (NAPSE) provides a broad framework for management, prevention and control of Snakebite envenoming in India. It is a guidance document for the states/ stakeholders to develop their action plan, specific to their needs.

Vision & Mission of NAPSE

Vision: "To prevent and control snakebite envenoming in order to halve the numbers of deaths and cases of disability that it causes by 2030"

Mission: To progressively reduce the morbidity, mortality and its associated complications in humans due to Snakebite

Strategies of the NAPSE

A. Strategies of Human Health Sector in NAPSE:

The key strategic actions to achieve the objective of the human health component are as under-

Ensuring Provision of Anti Snake Venom at all Health facilities

1. Financial assistance to states from Centre through earmarking funds for Anti Snake Venom procurement in National Free Drugs Initiative scheme and inclusion of Anti Snake Venom in Essential drug list at all levels.
2. Ensuring availability of trained manpower concerning appropriate snakebite management and administration of ASV.
3. Ensure uninterrupted supply of ASV and close monitoring ASV demand and supply positions to avoid stock out positions.
4. Ensuring and upgrading adequate cold chain facilities to store ASV stocks at appropriate levels.
5. Establishing monitoring mechanism for recording and reporting of Adverse Event Following Immunization (AEFI) for Snakebite victims

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 snakebite situation, (2) to monitor and evaluate the progress and impact of intervention, (3) to manage potential human exposures adequately and (4) to calculate the cost-effectiveness of control efforts. The activities for strengthening surveillance of snakebite cases and deaths are as under-

1. Ensuring implementation of Snakebite notification in Human health sectors through the web portal for notification of snakebite victims
2. Strengthening the periodic reporting system about snakebites through IDSP and IHIP.
3. Resource mapping – mapping the facilities (State/ District wise) for management and treatment of Snakebite victims and mapping of laboratories for diagnosis of snake's bites and related complications

To strengthen the emergency care services at District Hospitals/ CHCs including services for Ambulance:

The management of snakebite cases comprises two inseparable components: the Anti Snake Venom that should be administered as soon as possible to eliminate the venom from the victim's body, and the symptomatic, substitute and adjuvant treatments, to stop the evolution of envenoming and relieve the patient.

Emergency care required to manage Snakebite cases is very similar to many other medical conditions that need to be urgently addressed, making the integrative approach the most cost-effective. However, due to faulty communications, lack of transport vehicles, poor road conditions, etc., makes it difficult and leads to delay in managing snakebite cases, and reduce the mortality and incidence of complications, including permanent disabilities.

Activities to strengthen the CHCs/District hospital or above are as under-

1. Ensuring the availability of ambulance services for snakebite cases
2. Ensuring the availability of laboratory test required for diagnosis of Snakebite such as – 20 minutes whole blood clotting test, peak flow metre, urine analysis, Prothrombin time,

platelet count, clot retraction time, liver and kidney function test, serum amylase etc.
3. Ensuring the availability of beds with machine supported ventilation unit
4. Strengthening the capacity of admitting snakebite cases in ICU
5. Strengthening and ensuring the availability of dialysis Unit
6. Ensuring the availability of emergency medicines
7. Ensuring appropriate **management and referral** for Snakebite cases

Institutionalisation of Regional Venom Centres:

It is planned to set up at-least 5 regional venom centres across the country. The institutes already working in Snakebite management and Anti Snake Venoms will be strengthened as Regional Venom Centres. These regional venom centres will be do the following activities-

1. Region-specific venom centres will undertake research on regional venoms of the Big 4 and other venomous species of that area/zone.
2. Facilities for biochemical, proteomic, genomic, taxonomic and toxicological studies of different snake species and venoms of India.
3. Other venomous species specific to certain areas have ASV against them manufactured and incorporated into the polyclonal ASV specific to that region.

Capacity Building by training of Health Professionals

1. The existing Institutes (Government/Private/Non-government) working for Snakebite will be strengthened as training centres for management of snakebite cases.
2. Training and capacity building of health care professional at all levels on appropriate snakebite Management, administration of Anti Snake venom, and other technical aspects.
3. Management of snakebites at different levels of the health service can contribute to the management of patients with suspected snakebite. In rural areas, where snakebites are most common, transfer to a hospital may not be feasible, and so a lower level of health facility must cope with these medical emergencies.
4. Training of doctors, nurses, dispensers, health assistants, ambulance staff and paramedics in diagnosis (including snake identification), early management, indications and administration of antivenom.
5. Sensitization of private-sector health care professionals with continued medical education (CME), conference/ workshops organized by Medical Colleges/ Professional bodies etc.
6. Joint training of Health and Veterinary professionals on the operational aspect of the management of snakebite in humans as well as in animals
7. Training and capacity building of laboratory professionals on Snakebite diagnosis.
8. Training on Surveillance of Snakebites cases, deaths and Notification

Information Education and Communication (IEC) for increasing awareness about Snakebite and the importance of seeking timely and appropriate treatment for Snakebites

1. Sensitization of government policymakers, health professionals and frontline health workers at various levels and partners on Snakebite management and treatment.
2. Communication needs assessment for the target groups ex. Agriculture workers, labourers, population in difficult access areas etc.
3. Developing IEC materials in Hindi, English and other vernacular languages
4. Dissemination of IEC through Audio-Visual print Media, community Radio, Nukkad natak and through engagement with currently active NGOs in the sector
5. Mass media and Interpersonal communication

6. Setting up a 24×7 snakebite helpline to answer queries with relation to snakes and snakebite.
7. Educating traditional healers and addressing the myths to engaging the communities through outreach programme and PRIs

Public-Private Partnership

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

Inter-sectoral Coordination

The effective snakebite prevention and control could be achieved with the active involvement of vaccine Manufacturers, Wildlife sector, tribal and rural population, KVKs, PRI and community engagements.

Joint Training/Sensitization workshop of District level Medical/ Veterinary Department on Snakebite and Joint gap analysis for formulation of Action Plan for Prevention and Management of Snakebite.

B. Strategies for Animal/Agriculture Health Sector in NAP-SE:

The key strategic actions proposed to achieve the objective of the agriculture /animal health related component are as under-

A. Ensuring Provision of Anti Snake Venom at all Veterinary facilities

1. Ensuring availability of trained manpower concerning appropriate snakebite management and administration of ASV.
2. Ensure uninterrupted supply of ASV and close monitoring ASV demand and supply positions to avoid stock out positions.
3. Ensuring and upgrading adequate cold chain facilities to store ASV stocks at appropriate levels.

B. Prevention of snakebites in livestock

1. State Agriculture Authorities and State Animal Husbandry/Veterinary Services Department should identify the risk areas near to domestic animal settlements/ villages/grazing, signage related to preventive measures, first-aid, emergency contact details.
2. State Agriculture as well as State Animal Husbandry/Veterinary Services Department should ensure creation of natural barriers to avoid direct contact between domestic animals and snakes.
3. State Agriculture as well as State Animal Husbandry/Veterinary Services Department should ensure provision of polyvalent snake venom anti-Serum at Veterinary Hospitals and Dispensaries with proper storage facility and training.

C. To strengthen emergency care service at district as well as block level

1. Ensure emergency services in case of snakebite in animals through Mobile Veterinary Units/Veterinary Hospitals and further ensure the availability of Anti-snake Venom at Mobile Veterinary Units level.
2. Veterinary Hospitals and Mobile Veterinary Units should be strengthened with basic diagnostic facilities and emergency treatment.

D. Capacity Building by training of veterinary as well as Agriculture professionals

1. Training and capacity building of Fisheries, Veterinary as well as Agriculture professionals at all levels on appropriate snakebite Management, administration of Anti Snake Venom, and other technical aspects.
2. Management of snakebites at different levels of the Veterinary service can contribute to the management of patients with suspected snakebite. In rural areas, where snakebites are most common, transfer to a Veterinary Hospital may not be possible in every scenario.
3. Training of Veterinary Doctors, Paravets, Gopal Mitra, Pashu Sakhi etc. in diagnosis (including snake identification), early management and indications for and practicalities of administering antivenom.
4. Sensitization of private-sector Veterinary care professionals with, conference/ workshops organized by Veterinary Institutes/ Professional bodies etc.
5. Joint training of Health and Veterinary professionals on the operational aspect of the management of Snakebite in Humans as well as in animals.
6. Training on Surveillance of Snakebites cases and death in animals.

E. Information, Education & Communication for increasing awareness about snakebite

1. Ensure sensitization through State Animal Husbandry/Veterinary Services Departments, State Veterinary/Agriculture Universities, KVKs for animal owners about snakebite management and identification of snakes and bites (venomous/ non-venomous) such as the local snakes, places they prefer to live and hide, the time of year and time of day or night and the kind of weather when they are most likely to be active.
2. Ensure regular monitoring of animal sheds for snakes and rodents and holes by State Animal Husbandry/Veterinary Services Department and State Agriculture Department.
3. Ensure the management of grass and low bushes to be cleared so that snakes cannot hide close to the animal barn through State Agriculture Department.
4. Ensure community outreach programs and dissemination/development of IEC materials through KVKs to farmers on the important elements, such as water supplies, reservoirs, and ponds, that draw snakes to hunt prey animals like frogs and toads.

F. Strengthening surveillance of Snakebite cases and deaths in Animals by State Animal Husbandry Department

- Snakebite surveillance is the key index for the success of any intervention programme. It involves the collection of essential data to:
    - Determine the snakebite situation.
    - To monitor and evaluate the progress and impact of intervention.
    - To manage potential human exposures adequately.
    - To calculate the cost-effectiveness of control efforts. The activities for strengthening surveillance of snakebite cases and deaths.

G. Production of Anti-Venom and use of Anti Venom

1. Ensure adequate supply and production of Anti-Snake Venom for Livestock & pet animals.

2. Ensure training through KVKs & State Animal Husbandry Department on administration of intravenous (rehydrated Antivenin), depending on the severity of symptoms, time after the bite, size and type of snake and size of animal (the smaller the body the larger the dose required).

C. Strategies of Wildlife and Forest Sector in NAP-SE:

Snakebite is one of the major health concerns in the world, and it affects most rural communities. The wildlife and forest sector play an essential role in snakebite envenoming. The wildlife and forest sectors can address it through following strategies.

Education awareness:
Communities residing near forest, hilly areas are at high risk of Snakebites. Accordingly, forest department in their respective are may undertake dedicated campaign in affected areas on generating community awareness on prevention of Snakebites

Key messages include keeping distance from snakes, avoiding handling of Snake, staying on trails and watching hands and feet in forest area, especially when climbing or stepping over fences, large rocks and logs or when collecting firewood. Staying away from tall grass and piles of leaves. Avoiding climbing on rocks or piles of wood where a snake may be hiding. Wearing long pants and proper foot gear, especially at night. Understanding that protecting the snake's habitat is also important and it can reduce the risk of human-snake conflicts.

Antivenom distribution:
Many of the areas where the people live are near forest areas, where snakebite is common. It is necessary to have access to antivenom for treatment when the venomous snake has bitten. The wildlife sector professionals may work with the health sector at PHC/CHC level and can help to distribute antivenom to remote non-accessible rural areas. They can provide the first-aid during the snakebite where the primary health facility is negligible.

Strengthening of the key stakeholders:
The interdisciplinary approach can be introduced during the capacity building and engage all stakeholders, such as the health sector, veterinary sector, Panchayati raj institutions, and local community.

The engagement of local communities can help to develop effective management strategies. Community members can also be involved in reporting snake sightings, providing first-aid, and helping to transport patients to medical facilities.

Systematic research and monitoring:
Research on the snake is also important aspect where the forest department can conduct the research in the wild. This information will help to analyse the behaviour pattern (e.gradio telemetry) and habitat of particular snake species thereby minimising the snakebite envenoming. Many of radio telemetry studies have been conducted by institutes, Agumbe Rainforest Research Station (ARRS) on King cobra and Indian rock python telemetry study in the Moyar River Valley, Tamil Nadu by the Wildlife Institute of India (WII), which has provided more insight into snake biology in India.

Snake venom collection and snake relocation:
The wildlife and forest department can permit the research and medical research institutes to collect snake venom. It will help reduce the risk of snakebite envenoming and maintain the production of sufficient antivenom in the country.

The wildlife sector can also be involved in snake handling, relocation, and reporting snake sightings; due to this, snakebite risk will be minimised, and it will help to conservation of snake species.

Large scaled pitviper, *Craspedocephalus marcolepis* (venomous)

CHAPTER 9:

ROLE OF STAKEHOLDERS IN NATIONAL ACTION PLAN FOR PREVENTION & CONTROL OF SNAKEBITE ENVENOMING

It is a well-known fact that prevention and control of Snakebites needs involvement and **partnerships** across various ministries, department, non-government organisation professional bodies and most importantly communities.

This national action plan envisages role of each of these stakeholders and advocates for facilitation by health departments for these partnerships. Major stakeholders for snakebite prevention and control programme are as under

1. Ministry of Health and Family Welfare (MoHFW)
   Key Stakeholders under MoHFW

   National Level
   - National Centre for Disease Control (NCDC)
   - Drug Controller General of India (DCGI)
   - Indian Council of Medical Research (ICMR)
   - Government Medical Store Depot (GMSD)-Medical Stores Organization

   State level
   - Directorate of Health including State Surveillance Unit,
   - NHM division,
   - State Hospital section,
   - Medical Education Department,
   - State Drug Procurement Cell
   - State IEC department

2. Ministry of Tribal Affairs
3. Ministry of Agriculture and farmers welfare
4. Ministry of Environment, forest and climate change
5. Ministry of Panchayati Raj
6. Ministry of Fisheries, Animal Husbandry & Dairying
7. Ministry of Education
8. Department of Pharmaceuticals, Ministry of chemicals and fertilizers
9. Ministry of Labour and Employment
10. Dept of Revenue, Ministry of Finance
11. Ministry of Home Affairs
12. NITI Aayog

Ministry of Health and Family Welfare: At the centre, the Ministry of Health and Family Welfare, National Centre for Disease Control will be the key stakeholder and nodal agency for

the overall planning, coordination and implementation of the human health component in the country. The state, district and below district level activities will be implemented through the existing health systems.

The key role of the health sector under this snake envenoming will be as under:

1. Advocacy with different stakeholders for prioritising snakebite envenoming to achieve commitment at all levels so that resources could be mobilised for prevention and control of snakebite.
2. Ensure accessibility and rapid availability of treatment of snakebite bite victims
3. Capacity Building and Training of health professionals in appropriate snakebite management
4. Production of standard IEC materials for wider circulation.
5. Strengthening maintenance of a database on snakebite (e.g., antivenom coverage), analysis and sharing of information with other stakeholders.
6. Strengthening Public-Private Partnership (PPP) through engagement with professional organizations such as IMA, IAP, and communities /organizations involved in the field of snakebite for undertaking research and other activities.
7. Intersectoral coordination and sharing of information between the animal health, and wildlife health sector to facilitate better implementation.
8. Regularly updating technical guidelines.
9. Monitor and evaluate the snakebite envenoming implemented by the field units.
10. Coordinate and conduct operational research on snakebite in collaboration with national, international, diagnostic and research institutions.

Ministry of Fisheries, Animal Husbandry & Dairying: At the Centre, Ministry of Fishery, Animal Husbandry and Dairying, GOI will be the key stakeholder and nodal agency for technical guidance to the states for the activities planned under the animal health component. The program in the States will be implemented through the State Veterinary Department, Veterinary colleges, Municipalities, and Panchayati Raj Institutions.

Role of Veterinary/Agriculture Sector:

- At the Centre, the Ministry of Fisheries, Animal Husbandry and Dairying and Ministry of Agriculture and Farmers Welfare will be the key stakeholder and nodal agency for technical guidance to the States for the activities planned under the animal health and farmer welfare component. The program in the States will be implemented through the State Veterinary Department, State Agriculture Department, Veterinary/Agriculture Universities and KVKs. In this NAP, the role envisaged is as follows:
    - Advocacy with different stakeholders for prioritising Snakebite to achieve commitment at all levels so that resources could be mobilised for reducing death and disability due to snakebites to 50% by 2030.
    - Mapping of high risk, medium risk, and low risk areas of snakebite in association with health department and other stakeholders to prioritising areas of snakebite victims.
    - Ensure uninterrupted supply of logistics (money, manpower, and material) for undertaking strategic prevention of Snakebite.
    - Capacity building for Veterinary Professional, Paravets, Field Agricultural professionals and other allied personnel.
    - To develop standard (IEC) materials for wider circulation.
    - Intersectoral coordination and sharing of information on Snakebites, the health and

wildlife health sector to facilitate better implementation.

- The possibility of linking the INAPH, NADRES to the IHIP portal for selected parameters is to be explored.
- Regularly publishing and updating technical guidelines on snakebite.
- Monitor and evaluate the control programs implemented by the field units.
- Coordinate and conduct operational research on Snakebite in collaboration with national, international, diagnostic, and research institutions.
- Veterinary/Agriculture Colleges & Veterinary/Agriculture Universities can incorporate training of veterinary students on snakebite management.

Ministry of Environment, Forest and Climate Change (MoEF&CC): MoEF&CC is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.

The broad objectives of the Ministry include Conservation and survey of flora, fauna, forests and wildlife, Prevention and control of pollution, Afforestation and regeneration of degraded areas & Protection of the environment.

The key roles of forest department in snakebite envenoming is as under

1. Organising awareness campaigns and IEC creation and dissemination to educate the rural-urban communities regarding preventing and control measures for snakebite envenoming.
2. Educating the rural and are risk communities living in forest areas about identification of venomous and non-venomous snakes.
3. Focus on behavioural (e.g., radio telemetry) and habitat studies of venomous snakes to minimizing the human-snake contact.
4. Provide leadership and help with permission for medical research institutes to collect snake venom for production of ASV.
5. To guide state departments to establish Wildlife Rescue Teams specifically for rescuing snakes from human habitats.
6. To impart training to rangers, wildlife officers and Rescue operation teams in safe handling of venomous snakes.
7. To map out human-snake conflict hotspots based on yearly data provided by the snake rescuers.
8. Mapping and species distribution of venomous snake species to be done in collaboration with regional wildlife institutions, NGOs, and the local community Protection of snake
9. species against indiscriminate hunting, killing and illegal trade under Wildlife (Protection) Act 1972.
10. To issue alerts and advisories on illegal smuggling of live snakes to State and Central agencies.
11. To carry out joint operations with State enforcement agencies to apprehend criminals involved in smuggling for all protected snake species.
12. To provide services for snake rescue operations from human settlements.

Ministry of Panchayati Raj: Mandate of ministry includes the ongoing process of decentralisation and local governance in the States.

The key role of Panchayati raj institutions in snakebite envenoming are under

1. Panchayati raj institutions can engage and empower local communities in snakebite

prevention and management.

2. Establishing village-level committees to identify and address snakebite-related issues in rural areas and promoting community-led awareness and education programs.
3. To work with block level PHC/CHC and strengthen healthcare infrastructure in rural areas, ensuring the availability of antivenom and other medical supplies.
4. To include supporting mobile healthcare units or ambulance facilities in remote areas.
5. To ensure the accountability and evaluation mechanism to track progress of snakebite envenoming in rural communities and villages.
6. To promote a multi-sectoral approach for snakebite envenoming with the health department, ASHA workers, veterinary department, forest departments and NGOs.
7. Members can immediately report to animal health department when incidences of snakebite occur in their respective ward/village is noted.
8. Members can ensure that a human bite victim (exposed) gets proper (full dose) medical treatment.
9. Provide a list of patients exposed to snakebites and the same be maintained in the respective ward/ village and follow up measures to be done strictly.
10. Gram Sabha to be convened immediately to inform the public regarding the incidence of Snakebite and needs for various mitigation measures and legislation.
11. Advocacy, Training, and capacity building of PRI members on prevention and control of Snakebite in their village/ward.

Ministry of Tribal Affairs: The objective of Ministry of Tribal Affairs is to provide focused approach on the integrated socio-economic development of the Scheduled Tribes (STs).
The key role of Ministry of Tribal Affairs is snakebite are as follows-

1. Organising awareness campaigns and IEC creation and dissemination to educate the tribal communities regarding preventing and control measures for snakebite envenoming.
2. Educating the tribal and at-risk communities living in forest areas about identification of venomous and non-venomous snakes.
3. Develop training module for health professionals specific to the needs of tribal population
4. To ensure that a human bite victim (exposed) gets proper (full dose) medical treatment.
5. Monitoring of the activities envisaged under the National Action Plan for prevention and control of Snakebite envenoming
6. Educating traditional healers and addressing the myths to engaging the communities through outreach programme and PRIs

Ministry of Education: The objective of the Ministry of Education is to formulate the National Policy on Education and to ensure that it is implemented in letter and spirit, planned development, including expanding access and improving quality of the educational institutions throughout the country, including in the regions where people do not have easy access to education. Paying special attention to disadvantaged groups like the poor, females and the minorities.

The key role of Ministry of Education on Snakebites are as follows-

1. Include a chapter on snakes under school education curriculum
2. Regular awareness campaigns in the school for prevention and control of Snakebite

Ministry of Chemicals & Fertilisers: Ministry of Chemicals & Fertilisers comprise of a combination of three department i.e., Department of Chemicals and Petrochemicals, Department of Fertilisers, Department of Pharmaceuticals

The key role of ministry of chemical and fertiliser in snakebite envenoming.

1. To ensure regular production and maintain appropriate supply chain of antivenom.
2. To promote provision of antivenom at an affordable price and subsidise the cost of antivenom for rural and at-risk communities.
3. Promote the research and development in antivenom production.
4. To promote production of species and geographical region specific antivenom.

Ministry of Labour and Employment: The Ministry of Labour & Employment is one of the oldest and important Ministries of the Government of India. The main responsibility of the Ministry is to protect and safeguard the interests of workers in general and those who constitute the poor, deprived and disadvantaged sections of the society, in particular, with due regard to creating a healthy work environment for higher production and productivity and to develop and coordinate vocational skill training and employment services.

The key role of the ministry of labour and employment in snakebite envenoming is as under.

1. To promote occupational health and safety measures to prevent snakebite envenoming at workplace such as, industry sector, agriculture sector, unorganised sector, forest workers and construction sites.
2. To consider provision of compensation benefits and rehabilitation support the kin of snakebite envenoming patients.
3. To raise awareness on snakebite prevention at workplaces.
4. Focussed IEC for occupationally exposed groups i.e. Mine workers, Zoo workers, Soldiers etc. containing information about snake safety and snakebite first-aid.
5. MoLE can distribute/donate snakebite prevention kits such as gumboots, rubber gloves, mosquito nets and torchlights at workplaces and impart training to occupationally exposed groups.

Ministry of Finance: MoF overseeing the public financial management system in the Central Government and matters connected with state finances.

The key role of ministry of finance envisaged in snakebite envenoming is as under

1. To consider for provision of the adequate fund for the implementation of NAPSE.
2. To earmark contingency funds for snakebite hotspots areas in addition to routine prevention and control activities.
3. To ensure provision of funding for maintaining antivenom supply chain, training healthcare workers and awareness programs.

Role of Dept of Revenue, Ministry of Finance:

1. At the state level, The Ministry of Finance (MOF)/ Revenue dept. is envisaged as key stakeholder for implementation of NAPSE in the country.
2. The State Revenue departments may consider provision of adequate resources for relief of Snakebite Victims (Humans as well as Animals) for health care cost, loss of wages etc.
3. To consider the provision of contingency funds for Snakebite incidences in high burden areas in addition to routine prevention and control activities.
4. Share data on Snakebite deaths reported to dept with respective health department i.e. SNO-SBPC for surveillance purposes.

The Ministry of Home Affairs (MHA): MHA discharges multifarious responsibilities, the important among them being - internal security, border management, Centre-State relations,

administration of Union Territories, management of Central Armed Police Forces, disaster management, etc.

Role of Ministry of Home Affairs:

Police Department:

- A Medico-Legal Case can be defined as a case of injury or ailment, in which injuries or related diseases due to causes of Vehicular accidents, Burn injuries, Suspected homicide/ Murder, Poisoning, **Snakebite**, Sexual assault and criminal abortion are classified.
- Medico-legal case examination and reporting is one of the legal responsibilities of all doctors working in a hospital. If the said case falls under Medico Legal Case then it must be intimated to the nearest police station. It may be a legal case requiring medical expertise when brought by the police for examination.
- Accordance with Section 39 of Criminal Procedure Code of India, it is the legal duty of the treating doctor in any of the medico-legal cases, to report it to the nearest police station immediately after completing primary lifesaving medical care. The idea is to initiate the legal proceeding at the earliest so that maximum evidence can be collected by the police officer.
- Police to assist the forest department to apprehend criminals involved in smuggling for all protected snake species.
- Police to assist Hospitals and Judiciary system in Medico-legal cases of snakebite.

National Disaster Management Authority

According to global analyses, extreme weather conditions, and especially flooding, are increasing overall in frequency and magnitude. The high-risk regions in India with changing annual precipitation patterns, having rugged topography that favours fast drainage of terrains, avoiding prolonged standing floodwaters, which challenges the common explanation of flooded burrows that force snakes to search for higher ground. Therefore, it has been observed that repeatedly flooding leads to an increase of snakebite incidences.

The National Disaster Management Authority (NDMA) is the apex statutory body for disaster management in India. Its primary purpose is to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response. It is also the apex body to lay down policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters.

- NDMA may envisage rules for different Ministries or Departments of the Central Government to follow in order to incorporate Snakebite prevention or mitigation measures into their development plans and initiatives in case of natural disasters like floods, earthquakes etc.
- NDMA may Coordinate disaster management policy and plan enforcement and implementation of snakebite prevention.
- NDMA may recommend that funds should be made available for mitigation of snakebites in case of natural disasters like floods, earthquakes etc.
- NDMA may take other measures it deems essential for disaster prevention, mitigation, readiness and capacity building in the event of a Snakebite incidences.\
- Disaster management department can prevent snakebite envenoming during any disaster such as floods, cyclones and earthquakes. To ensure the supply of antivenom and medical facilities.

NITI Aayog: It is the premier policy think tank of the Government of India, providing directional and policy inputs.

The key role of NITI Aayog in snakebite envenoming

- To coordinate and consider inclusion of snakebite related issues priority programmes implemented by different ministries.
- To actively monitor and evaluate the implementation of programs and initiatives, including identifying the needed resources to strengthen the probability of success and scope of delivery.
- To conduct research and analysis with reputed organisations, academic institutions, and development partners and facilitate discussions with eminent experts in the domain of snakebite envenoming and their management, urban health management, health finance and insurance, medical device manufacturing and antivenom production, etc.

Thus, involvement of all key stakeholders will pave the way for activities envisaged in NAPSE for halving the deaths by 2030 and realizing the vision of 'Swasth Bharat'.

Lesser black krait, *Bungarus lividus* (venomous)

CHAPTER 10:

SNAKEBITE SURVEILLANCE FOR SNAKEBITE IN INDIA

Surveillance is the process of systematic collection, collation, and analysis of data with prompt dissemination to those who need to know, for relevant action to be taken. A well-functioning disease surveillance system provides information for planning, implementation, monitoring and evaluation of public health intervention programmes (18).

Surveillance is one of the key elements in the National action plan for prevention and control of Snakebite envenoming so that problems can be identified, and actions can be taken in a timely manner. The success of the prevention and control of Snakebite envenoming depends on an effective surveillance system capable of capturing information about ongoing activities of human, animal and wildlife components and their impact on epidemiological trends of snakebites and deaths.

The objective of the National Action Plan for Prevention and Control of Snakebite is to strengthen the surveillance of snakebite through IHIP and through capacity building of Health professionals at all levels.

Existing Surveillance Mechanism

The existing snakebite surveillance mechanism in India is through the Integrated Disease Surveillance Programme and Central Bureau of Health Information. CBHI collects primary as well as secondary data of Snakebite cases and deaths from various Government organisations/ departments. IDSP reports suspect and probable snakebite cases and deaths on a near real time basis using the Integrated Health Information Platform from all peripheral reporting units (PRU). Under IDSP-IHIP the frontline health worker at sub-centre level reports all suspected snake-bite cases to the online IHIP portal on a daily basis in S-form. While Medical Officers at PHC/CHC report all probable cases of snakebites through the same portal daily in P-form. They are also responsible for supervision of all the frontline health workers and provide regular feedback on reporting, case investigation and public health response. The IDSP-IHIP portal has an inbuilt analytic dashboard, and the medical officer must routinely visualise and interpret the data from the portal for prioritizing relevant strategies to mitigate the burden of snakebites in their community

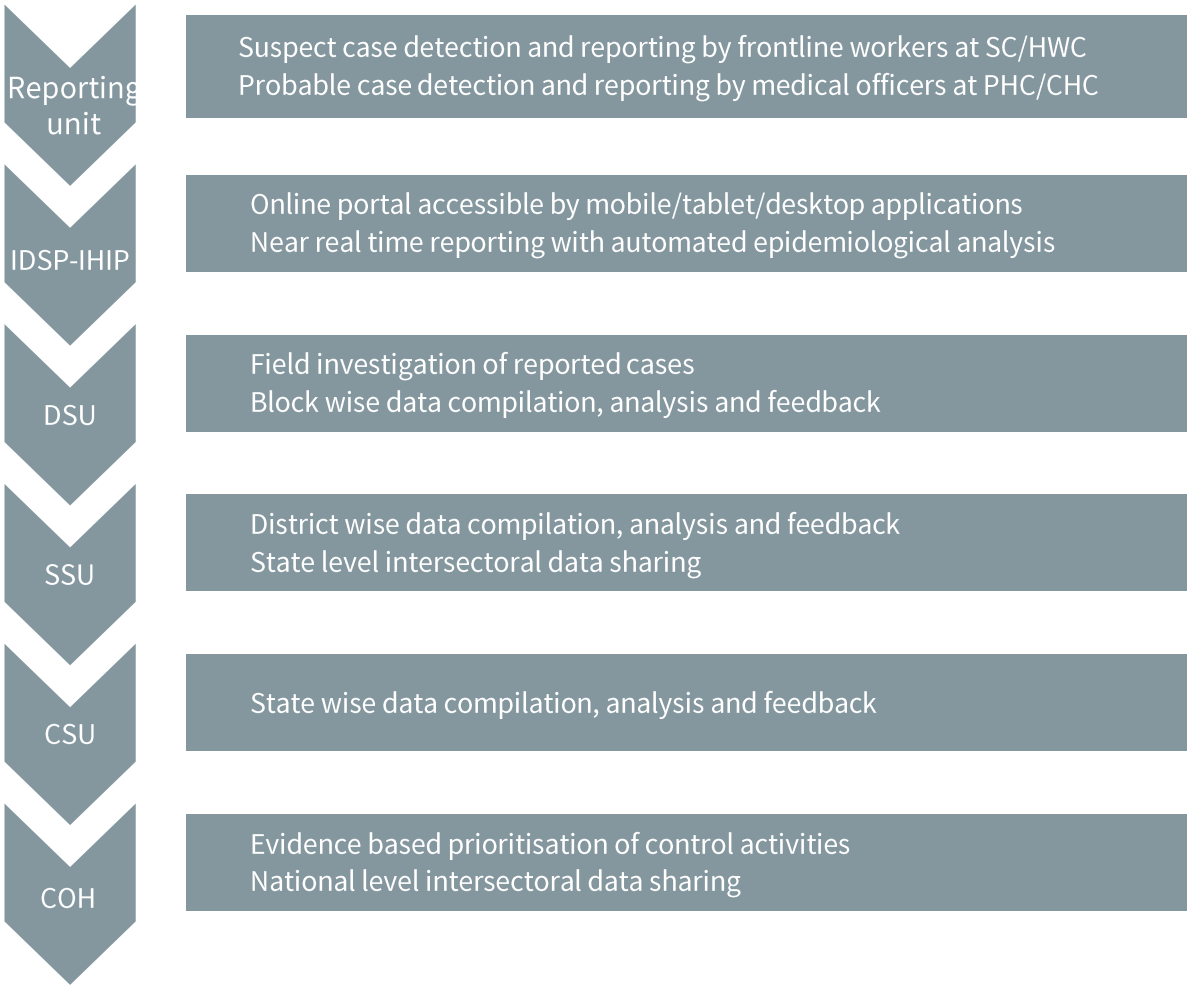


Figure 13- Mechanism of reporting for Snakebite

Components of Surveillance System:

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

S. No	Components of Surveillance System	Snakebite Envenoming
1.	Priority events/ Data Parameters	• Surveillance of Snakebites in Human • Surveillance of deaths due to Snakebite envenoming (Suspected and Confirmed) • Surveillance to estimated coverage of Anti Snake Venom • Surveillance on 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

S. No	Components of Surveillance System	Snakebite Envenoming
3.	Responsible officers	• Village level- ASHA/ ANM/AWW • PHC- PHC MO • Block- Block Level Medical Officer • District- Designated District Nodal Officers, Nodal officer of Tertiary care institutes • State – SNO, Snakebite Prevention and control • National- NPO, Snakebite Prevention and control
4.	Recording and Reporting Mechanism	All State Health Departments are advocated to use the standard recording and reporting formats at all health facilities providing Snakebite management • Snakebite management register • S and P form of IDSP/IHIP Portal • Monthly reporting format for Health Facility • Snakebite cases and deaths report • Line List format
5.	Monitoring and Evaluation	The surveillance system will be monitored in terms of Timeliness, Completeness, and usefulness of the data
6.	Support functions	Standard Guidelines and SOPs preparation, Organization of Trainings will be done by the National Program Management Unit of Snakebite prevention and Control of MoH&FW
7.	Data Sharing & Intersectoral coordination	Human health sector will periodically share the analysed report time, Place & person) of snakebite incidences and deaths with respective veterinary and wildlife departments to take appropriate action
8.	Infrastructure and logistics	• Ensuring the availability of ambulance services for snakebite cases • Ensuring the availability of laboratory test required for diagnosis of Snakebite such as – 20 minutes Whole blood clotting test, peak flow meter, urine analysis, Prothrombin time, platelet count, clot retraction time, Liver and kidney function test, serum amylase etc. • Ensuring the availability of beds with machine supported ventilation unit • Strengthening the capacity of admitting snakebite cases in ICU • Strengthening and ensuring the availability of dialysis Unit • Ensuring the availability of emergency medicines • Ensuring appropriate **management and referral** for Snakebite cases • Setting up a 24×7 snakebite helpline to answer queries with relation to snakes and snakebite

S. No	Components of Surveillance System	Snakebite Envenoming
9	Information, education and Communication	• Information Education and communication (IEC) for increasing awareness about Snakebite and the importance of seeking timely and appropriate treatment for Snakebite

The surveillance of prevention and control of snakebite include Clinical/Physical Surveillance as per the standard guidelines by MoHFW.

Recording & 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 existing IDSP/IHIP portal and to Programme division at National level. Various recording and reporting formats will be framed at each level of the health facility which would be implemented to strengthen the surveillance activities.

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

The reporting format (Annual, monthly reporting format (State and District), Snakebite Register and Line list format) are attached at Annexure 2,3,4,5, 7 and 8.

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. Suspect Case has to be reported by a health care worker in S Form, Probable Case has to be reported by medical officer in P form.

The definitions are as under: -

Suspected Snakebite case-
Definition: History of Snakebite reported by victim him/herself or by accompanied persons in reporting period

To be reported in S form by Health worker

Probable Snakebite case
Definition- History of snakebite* reported by victim him/herself or accompanied individual in reporting period with clinical features# suggestive of snakebite or systemic envenoming.

* Exposure is defined as-

- History of snakebite with one bite/fang mark on any body part
- Suspected snakebite without any fang mark or imagine that they have bitten by the snake

Clinical feature includes-

- Puncture marks at 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 (in extreme cases, breathing may stop altogether)
- Rapid heart rate, weak pulse, low blood pressure
- Disturbed vision
- Metallic, mint, or rubber taste in the mouth
- Increased salivation and sweating
- Numbness or tingling around face and/or limbs
- Muscle twitching

Monocled cobra, *Naja kaouthia* (venomous)

CHAPTER 11:

PRE-HOSPITAL CARE AND DIAGNOSTIC ASPECTS OF SNAKEBITE ENVENOMING: CHALLENGES AND RECOMMENDATIONS

Background

Snakebite injuries can range from simple puncture wounds to severe, life-threatening illnesses resulting in death or disabilities. Timely pre-hospital care (which includes appropriate first aid and rapid transport to the nearest possible health-centre); competent clinical assessment and diagnosis of envenoming, and prompt antivenom therapy combined with optimal supportive-care are vital to save lives of snakebite victims. Deficiencies in any one or more of these components significantly increases the risk of death or development of disabilities. This chapter discusses challenges faced in providing pre-hospital care and the diagnosis of snakebite envenoming and outlines key recommendations (see coloured boxes) to strengthen these components as part of the strategic response to the problem of snakebite envenoming in India.

Pre-hospital Care

A. First-aid

Rural communities can be unaware of correct first-aid techniques. With limited access to health facilities, they often visit faith-healers and resort to prayers, rituals or traditional therapies like incising the bite wound, sucking venom from the bite-site, tying tourniquets or applying herbs, animal excrement or appellation of snakestones. These measures can delay definitive treatment and may cause more harm such as disability or fatality. For instance, tourniquets can produce pain and swelling in the involved limb which can be mistaken for worsening local envenoming. If tourniquet tied on left on for long, they can cause severe local damage including ischemia, necrosis and gangrene. Incisions and local applications can result in skin tissue and soft-tissue infections, sepsis and tetanus.

Applying an elastic bandage over the immobilized bitten limb at a pressure that feels comfortably tight but allows a finger to be slipped under it (pressure-bandage immobilization) may slow down systemic venom absorption. A variant involves a localized cloth or rubber pad firmly pressed over the bite-site and held in place with a non-elastic band (pressure-pad immobilization). Though these techniques are generally recommended for neurotoxic elapid bites in some regions like Australia, their application in most other parts of the world is variable. Their clinical efficacy and potential to worsen soft-tissue injury in cases of local cytotoxic envenoming, have been inadequately assessed. They are discouraged in some guidelines because of the uncertainty of benefit and the possibility of worsening local tissue damage

(19). A recent systematic review identified the pressure-pad immobilization technique as the only first-aid measure effective in slowing down venom transit but the quality of evidence was graded as being very low (20). A study on 15 patients in Myanmar found that pressure pads were effective in reducing venom spread in Russell's viper bites and local effects after pad application were no more severe than those before treatment (21). Most other sources of data are either based on simulated snakebite scenarios in human volunteers and a few case reports on bites by species whose venoms do not cause local injury or in animal studies there is fatality instead of tissue injury as the primary end-point (22) (23) (24). The only exception is a single porcine study with dual end-points (fatality and compartment pressure) which demonstrated longer survival rates but at the cost of increased tissue pressures in a range that would in clinical contexts necessitate a fasciotomy(22).

Pharmacological interventions to retard venom-transit from the bite-site to vascular circulation by slowing lymphatic flow are a promising adjunct to snakebite first-aid. These agents which primarily act by inhibiting lymphatic pumping include nifedipine, lignocaine and glyceryl trinitrate. In murine studies where the agent was injected into the hind-foot pad of anaesthetised mice, a 300-500% increase in lymph-transit times and 50% increase in time to respiratory arrest was noted with simulated neurotoxic envenoming (25)

Universally approved elements of snakebite first-aid include reassurance and immobilization of the victim and especially the bitten limb to slow down venom spread.

Immobilize the bitten limb with a splint. Any rigid object like wooden or plastic boards or rolled-out newspapers can be used to splint the bitten limb.

Remove rings and other tight or potentially constricting objects around the bitten limb since they can act like a tourniquet once limb swelling occurs and progresses proximally.

B. Transportation of victim to the hospital

Pre-hospital mortality can be significantly reduced by rapidly transporting victims to healthcare facilities. However, up to 80% of all snakebite-related deaths in India occur before patients reach hospitals. It is essential that reliable, affordable transportation and healthcare access should be available at difficult geographic terrains.

Arrange for rapid transport to the nearest healthcare facility.

Use an emergency helpline number to hasten transport to healthcare centres, preferably those equipped with antivenom.

If the victim is being referred from one hospital to another it is advisable to inform the receiving hospital about the patient's condition over the phone, prepare a referral letter with details of assessment and treatment and enquire regarding the availability of snake antivenom and supportive care facilities.

Place the patient in recovery position as far as possible during transit.
Reduce any movement, particularly movement of the bitten limb to a minimum to avoid increasing the rate of systemic absorption of venom.

In situations where a conventional ambulance is unavailable consider alternate modes of transport which could include a stretcher, bicycle, motorbike, cart, train or a boat depending on the type of terrain or waterbody.

Diagnostic aspects

Diagnosis includes clinical and laboratory-based identification of the presence of features suggestive of local and/or systemic envenoming and inferring or confirming the likely species of biting snake.

A. Recognizing local and systemic envenoming: Clinical and laboratory diagnosis

The clinical presentation of a snakebite victim can vary with the age of the patient, the species of snake, the number and location of the bites and the quantity and potency of the injected venom. Routine medications, recreational substance-use and co-morbid illnesses can also influence diagnosis and outcomes. For instance, recent ethanol ingestion or recreational drug use may alter presenting symptoms; antiplatelets or anticoagulants may worsen bleeding or interfere with coagulation tests and shock in patients with pre-existing coronary artery disease or carotid artery stenosis may precipitate a myocardial infarction or cerebrovascular accident respectively.

Patients usually present with a history of a bite except those who experience painless nocturnal bites by kraits while asleep. In some instances of envenoming (venom injected into the victim during a snakebite), the onset of symptoms may be delayed but can worsen rapidly after their onset. With the exception of pain at the bite-site, such patients may have an entirely normal clinical and laboratory exam at presentation or have laboratory abnormalities without overt clinical symptoms. In India, delayed onset of systemic envenoming can classically be seen in krait bites where the onset of neuroparalysis may be delayed by up to 16 hours after the bite.

Early symptoms of envenoming can include pain, swelling and bleeding at the bite-site, visual blurring or double vision. These clinical manifestations can progress to bruising, blistering, dermo necrosis at the bite-site with lymphangitis, lymphadenitis or compartment syndrome involving the bitten limb and descending muscle weakness involving the bulbar, neck, limb, and respiratory muscles respectively. Patients with hemotoxic envenoming can present with

persistent bleeding from the bite-site, sub-conjunctival, nasal, gingivobuccal bleeds or more severe spontaneous internal (intracranial, pituitary, pericardial, pleural or retroperitoneal) haemorrhage. Other clinical manifestations include generalized rhabdomyolysis caused by venoms with myotoxic components and acute kidney injury.

Patients in snakebite endemic regions may present with shock, unconsciousness, bleeding, paralysis, respiratory failure or unexplained abdominal pain and may not provide a clear history of snakebite. It is important to consider snakebite envenoming as a differential diagnosis in these situations.

Even in instances where venom has not been injected into victims during snakebite incidents ("dry bites"), patients are often fearful and anxious. Anxiety-related manifestations may include palpitations, sweating, cold clammy extremities, tingling in the hands and feet, tachycardia, tachypnoea, elevated blood pressure and mydriasis. These clinical features can be mistaken for early systemic envenoming. However, anxiety-related symptoms usually have a more rapid onset (within minutes) while those due to systemic envenoming tend to occur at least thirty minutes following the event. Nausea, vomiting and headache are other non-specific symptoms that accompany a snakebite. These must be closely monitored at regular intervals since they can also be early indicators of serious consequences of envenoming such as uraemia, acute pituitary or intracranial haemorrhage and anaphylaxis.

The 20-minute whole blood clotting test (20WBCT) is a simple, rapid and inexpensive bedside test to screen for coagulopathy in patients without overt bleeding. The test also finds use in monitoring the resolution of coagulopathy in patients treated with antivenom. The 20WBCT is a gross measure of all intrinsic factors in the absence of tissue factor and is based on the fact that whole blood will generally form a clot when exposed to a glass surface. The use of new, clean, dry glass tube is an important prerequisite since the use of test-vessels made of plastic, polystyrene, polypropylene, or glass vessels cleaned with detergent or soap or coated with an anticoagulant can result in false-positive results.

The 20WBCT is usually associated with a sensitivity of 82-89% and specificity of 82-98% in most clinical validation studies with one study reporting that the test might potentially miss one of every five coagulopathic patients (26) (27). A recent systematic review and meta-analysis of the 20WBCT on its accuracy in detecting coagulopathy revealed an 84% sensitivity and 91% sensitivity using the international normalized ratio (INR) as the reference standard and 72% sensitivity and 94% specificity using plasma fibrinogen as the reference standard (28). The test has a lower sensitivity level in detecting milder coagulopathy (median INR for patients with false-negative 20WBCT was 1.9 (IQR 1.6 to 12, skewness of 1.06 and kurtosis of -0.83) and resolution of coagulopathy following antivenom administration (sensitivity 5% to 67%) (28).

The single breath count (number of digits counted in a single exhalation, normal >30), the breath-holding time (breath held at peak inspiration, normal >45 seconds) and assessing the ability to complete one sentence in one breath are important bed-side tests in neuroparalytic patients since they indicate respiratory muscle fatigue and impending respiratory failure. 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 normalized ratio Activated partial thromboplastin time (aPTT) Serum creatinine and blood urea nitrogen Serum electrolytes Serum creatinine phosphokinase 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

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

Accurate identification of the biting-species helps avoid unnecessary antivenom administration in cases of envenoming by snake species whose venoms are not neutralized by available Indian polyspecific antivenom. For instance, the hump-nosed pit-viper (*Hypnale hypnale*) and the Malabar pit-viper (*Trimeresurus malabaricus*) are well recognized as causes of medically-significant bites in south India (29) (30) (31) (32). Similarly, many green pit-vipers (*Trimeresurus* species), the Mountain-pit-viper (*Ovophis monticola*) and some non-front-fanged colubroids like the red-necked keelback (*Rhabdophis subminiatus*) are being now recognized as important causes of snakebite envenoming in north-east India. Venoms of these snakes are not effectively neutralized by Indian poly-specific antivenom.

Identifying the likely biting species also helps anticipate progression of clinical effects which can be specific to a particular snake species or family. However, withholding emergency treatment until the species is identified is unnecessary. Identifying snakes based on descriptions by victims or recognizing them from pictures can be unreliable since many instances of bites occur at night in the dark or in the undergrowth which obscures characteristic markings on the biting species. Though direct identification of the biting snake by an expert herpetologist is possible in instances where patients or their relatives bring captured or killed snakes to the hospital, evolutionary mimicry of venomous by non-venomous species can be an important challenge to accurate identification.

Since envenoming by some medically-important Indian snake species can result in distinctive and highly-specific syndromes, an alternate approach is based on identifying species-specific syndromes to infer the likely biting snake. Though the syndromic approach is widely used

across South Asia, it is limited by low sensitivity particularly in identifying and differentiating between envenoming's by some Indian viper species. The sensitivity and specificity of clinical syndromes in inferring likely biting-species was 78% and 96% for *Naja naja*, 66% and 100% for *Bungarus caeruleus*, 14% and 100% for *Daboia russelii* and 10% and 97% for *Hypnale hypnale* respectively, based on data from a prospective nation-wide hospital-based survey of patients envenomed by identified snakes conducted in Sri Lanka between 1993 and 1997 (33).

Notable laboratory techniques for snake-species identification include immunodiagnostic assays (ranging from initial immunoprecipitation tests to avidin-biotin enzyme immunoassays, EIAs) and nucleic acid amplification-based tools to detect venom antigens and snake nucleic acids in blood, wound swabs, wound aspirates and other biological tissues. Though EIAs for venom-antigen detection are a rapid and accurate species identification method they are currently unavailable for routine clinical use except in Australia. While some attempts have been made to develop EIAs for medically-important Indian snake species, none have been validated for clinical use. Nucleic acid-based assays care highly reliable, sensitive and species-specific. The sample used is stable and can be stored for long periods. However, these tests are expensive, have long turn-around times and have not yet been developed into a version that can be deployed in the field.

C. Role of Poisons Information Centres in aiding with diagnostic aspects of snakebite envenoming

Poisons information centres are specialized units which provide advice on various toxicological aspects of chemicals (Including agrochemicals, industrial products, and pharmaceuticals), poisonous plants and venomous animals, including the diagnosis and management of clinical effects following human or animal exposures to these agents or their toxic derivatives. Poisons information centres can play an important role in assisting with the diagnosis and management of snakebite envenoming through the provision of remote expert opinion by telemedicine. Despite their immense potential in supporting the management of snakebite envenoming in India, the concept of poisons centre is yet to catch-on. The few well-established poisons centre that India possesses continue to be under-utilized. A South Indian observational study noted that only 40% of healthcare workers were aware of the availability of poison centres in India (34).

Admit all snakebite patients for a minimum of 24-hours.

Perform a rapid primary survey to identify critically-ill patients with a compromised airway, respiratory failure, shock or cardiac arrest.

Resuscitate and stabilize critically-ill patients, look for evidence of envenoming and urgently administer antivenom.

Reassure clinically-stable patients and collect history including details regarding the patient's symptoms and the site, circumstances and timing of the bite.

Perform a focused physical examination to look for signs of local and/or systemic envenoming.

Perform a baseline 20WBCT.

Infer the likely biting species by comparing the patient's clinical feature against well-established species-specific syndromes using the syndromic algorithm.

In patients without clinical and laboratory evidence of envenoming at presentation, examine for signs and symptoms of envenoming at 2,6,12 and 24 hours and perform the 20WBCT at 6, 12 and 24 hours after the bite or till evidence of envenoming is noted, whichever is earlier.

In patients with evidence of systemic envenoming or rapidly progressive local swelling or digital bites, administer Indian poly-specific antivenom except in circumstances where there is clear evidence that the venom of likely biting species cannot be neutralized by Indian poly-specific antivenom.

In snakebite cases with unusual clinical presentations or increasing complexity, obtain an early consult with a poison information centre, if feasible.

Summary of Issues, Challenges and Recommendations

A summary of current challenges and the recommendations for first-aid in snakebite envenoming is as follows:

First-aid practices	Associated Challenges	Recommendations
Tourniquets	Their use is associated with significant complications which can result in worsening morbidity and mortality. Tourniquets can impede venous blood flow and arterial blood flow, leading to limb ischemia, gangrene, and potentially, amputation. Moreover, psychologically, victims with ligatures tend to believe that venom flow has been inhibited. In such instances, there is an additional danger that the confidence in the power of the ligature will lead them to seek medical attention with less urgency.	Tourniquets should be avoided as their use may lead to complications If applied already, remove tourniquets slowly after ensuring that an intravenous line and resuscitation facilities are in place to avoid pronounced clinical deterioration. Do not remove the tourniquets at the field level.
Wound incision	Cutting of the wound and sucking blood may lead to wound infection, increased swelling and/or significant bleeding, in cases with hemotoxic envenoming	Wound incisions do not significantly improve outcomes in snakebite victims. They can cause harm and must be avoided.
Washing the bite-site	Washing the wound requires rubbing of the skin, which can potentially accentuate systemic venom absorption and exacerbate local tissue damage.	Not to touch/wash the wound/ bite mark area.
Electrical Therapy and Cryotherapy	These techniques may potentially result in deleterious effects like coma or incontinence, further complicating management	Electrical therapy has no role in snakebite first-aid and cryotherapy may do more harm
Traditional medicines	Sometimes prior ingestion and local application of traditional remedial materials may complicate the clinical picture of a bite case. Conclusive evidence that these interventions can improve outcomes or produce symptomatic relief is lacking at present.	Although traditional medicines can potentially reduce pain and prevent lethality, detailed studies are required to understand their wider application. Thus, it is not recommended to apply these therapies at the field level.

First-aid practices	Associated Challenges	Recommendations
Pressure immobilization	Their clinical efficacy and potential to worsen soft-tissue injury in cases of local cytotoxic envenoming, have been inadequately assessed. Inappropriate usage may affect victims' arterial and venous flow. These techniques require special equipment and intensive training which is poorly retained.	This method has been identified as an effective first-aid measure in some regions. Applying a pressure immobilization bandage with a pressure between 40- and 70-mm Hg in the upper extremity and between 55- and 70-mm Hg in the lower extremity around the entire length of the bitten extremity can be reasonable way to slow the spread of venom by slowing lymph flow Larger studies in snakebite victims are required to assess their application in patients with local cytotoxic envenoming In resource poor settings, immobilization of the victim and particularly immobilization of the bitten limb using a splint is recommended
Lymphatic-flow Inhibitors	Clinical evaluation is insufficient for field trials.	Although there is some evidence that these agents can slow venom transit from lymphatics to circulation, clinical studies are needed before recommendation for use in field conditions

A summary of current challenges and the recommendations on clinical aspects of snakebite envenoming is as follows:

Circumstances	Associated challenges	Recommendations
Reassurance	Snakebites are dramatic events and can be associated with significant anxiety.	Victims must be reassured that most snake bites (approximately 70%) in India are by non-venomous species. Even in instances where a victim is bitten by a venomous snake, venom may not have been injected during the bite (dry bite). Victims must also be reassured that snakebite envenoming is treatable.
Nonspecific symptoms	Snake Bites can be associated with symptoms due to anxiety which triggers sympathetic activity. These can be mistaken for early envenoming and include palpitations, sweating, tremulousness, tachycardia, tachypnoea, elevated blood pressure, cold extremities and paraesthesias. These patients may have dilated pupils which are also observed in snakebites with neurotoxic envenoming involving the autonomic nervous system.	These symptoms should be differentiated from the symptoms and signs of the envenoming.

Circumstances	Associated challenges	Recommendations
Identification of snake species by the victim	Identifying snakes based on descriptions by victims or recognizing them from pictures can be unreliable since many instances of bites occur at night in the dark or in the undergrowth which obscures characteristic markings on the biting species. Though direct identification of the biting snake by an expert herpetologist is possible in instances where patients or their relatives bring captured or killed snakes to the hospital, errors in the identification can still occur. Evolutionary mimicry of venomous by non-venomous species can be an important challenge to accurate identification by non-experts. Species-specific venom detection kits are not currently available for clinical use in India	Withholding emergency care till the likely species is identified is unnecessary and can cause harm. The decision to treat snakebite envenoming with antivenom should be based on the presence or absence of symptoms and signs of envenoming and not on whether the biting snake is identified as venomous species. In most parts of peninsular India, consider identifying the likely biting species once emergency care including antivenom has been administered based on standard guidelines and the patient is stable. This will help anticipate and specifically look for clinical effects which can be specific for some species. Identifying biting snake species is important in regions like north-eastern India where species other than the Big-Four are more prevalent – venoms of many of these species cannot be neutralized by Indian antivenom. The administration of Indian antivenom in such victims will be ineffective and will also expose them to potentially life-threatening adverse effects. If the snake has been brought along with the patient, contact a herpetologist or a poison information centre to assist with snake identification. Posters of venomous snakes of local area need to be displayed. Additionally, compare patients' clinical features with standard species-specific envenoming syndromes available in Indian standard guidelines to infer likely biting species

Circumstances	Associated challenges	Recommendations
Unwitnessed snakebites	Patients in snakebite endemic regions may present with shock, unconsciousness, bleeding, paralysis, respiratory failure or unexplained abdominal pain and may not provide a clear history of snakebite.	Consider snakebite envenoming as a differential diagnosis when patients present with unexplained neurological and/or cardiorespiratory abnormalities even in the absence of a witnessed snakebite event.

A summary of current challenges and the recommendations on laboratory aspects of snakebite envenoming is as follows:

Name of the test	Current challenges	Recommendations
20 Minute Whole Blood Clotting Test (20WBCT)	Various factors are found to affect the result of this test including the type of glassware used, presence of other agents on the glassware etc. This could lead to false negative results.	Always use a new, clean, dry glass tube to perform the 20WBCT In patients without clinical and laboratory evidence of envenoming at presentation including a negative baseline 20WBCT, perform 20WBCT at 6, 12 and 24 hours after the bite or till evidence of hemotoxic envenoming is noted, whichever is earlier.

Name of the test	Current challenges	Recommendations
Nucleic acid-based identification tools	Although highly reliable, sensitive, and species-specific, the method can be time-consuming method and expensive The sensitivity of this test may be impaired if the bite-site is washed prior sample collection Clinical validation studies are lacking	Well-designed clinical validation studies are required
Immunodiagnostic	Commercial point-of-care availability of venom-detection kits (VDKs) currently limited only to Australia for species occurring on that continent Commercial VDKs are currently not available in India Though considerable pre-clinical data is available, clinical data on the efficacy and safety / accuracy and reliability of these tests is severely lacking	Venom-detection kits can be valuable research tools particularly in studies on snakebite epidemiology and clinical trials on antivenoms. Their routine use in clinical practice is usually warranted in countries using monospecific antivenoms Clinical studies to validate Indian venom-detection kits are required

Detailed information on diagnosis and management of snakebite envenoming in India can be obtained by referring:

Standard Treatment Guidelines, Management of Snakebite, Ministry of Health & Family Welfare, Government of India
Available at: https://nhm.gov.in/images/pdf/guidelines/nrhm-guidelines/stg/Snakebite_QRG.pdf

More information on envenoming profiles of different snakes in the WHO South-East Asia Region and their management can be obtained from the following sites:

South-East Asian snakebites – Guidelines for the management of snakebites
World Health Organization Regional Office for South-East Asia, India, 2016.
Available at https://www.who.int/snakebites/resources/9789290225300/en/

Andaman cobra, *Naja sagittifera* (venomous)

CHAPTER 12:

STRENGTHENING OF HEALTH FACILITIES FOR SNAKEBITE MANAGEMENT

Snakebite can be managed at all levels of health facilities and Strengthening of primary health facilities is necessary as the majority of cases occur in peripheral and rural areas. For effective management of snakebite envenoming, it is necessary to ensure access to quality ASV, supportive treatment, counselling, referral diagnostic and case management services at State, District, Block and Village levels. For this, following areas needs to be addressed:

Delivery of effective, safe, quality health services at different levels of Health care Facilities

A. At Primary Health Care Centre

Primary Health Care system should be equipped to deliver the following:

1. IV Fluids: Normal Saline
2. Anti-snake Venom (in domestic fridge, if liquid)- 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.
3. Facility to give oxygen by mask or laryngeal mask airway (LMA) for respiratory support to patients presented with respiratory distress.
4. Availability of basic equipment like Clean, dry, glass test tubes, IV sets, syringes, Blood pressure monitor, AMBU Bag with mask.
5. Other desirable facilities: Laryngeal tube with laryngeal mask airway, Oxygen supply
6. Availability of Essential drugs like Paracetamol, Hydrocortisone, Antihistamine, Adrenaline, Neostigmine, Atropine, Tetanus Toxoid, Analgesics, etc.
7. Linkages for referral Snakebite management facilities.
8. Availability of ambulatory services for transfer of snakebite victims to higher referral centres (Secondary or tertiary health care centres).

B. At District Hospital Level

In addition to facilities given in section 1.1 the followings must be available:

1. All District Hospitals/Civil Hospitals should have a dedicated snakebite room with some dedicated bed in the indoor.
2. Equipment to carry out clinical and laboratory assessment including biochemical (20 mins WBCT) and haematological measurements, ECG, radiography etc.
3. Facility for transfusion of blood or fresh frozen plasma, surgical debridement of dead tissue, dialysis, insertion of endotracheal tube, anaesthetic bag or ventilator.
4. Availability of trained Healthcare professionals for managing snakebite (regular training of doctors, nurses, dispensers, ambulance staff etc.). training for identification of snakebite and early management of snakebite cases is essential at every facility.

5. All house surgeons in the internship assigned duty for 24 × 7, during the season of snake bite.
6. All newly appointed Medical Officers/Existing Medical Officers should have hands-on training in management of snake bite.

C. At tertiary hospital or Medical College

Facilities as in section 1.1 & 1.2 in addition to the followings must be available:

1. All tertiary hospitals or Medical Colleges should have a dedicated snakebite room with some dedicated bed in the indoor.
2. Facilities for advanced surgical management of local necrosis (e.g. split skin grafting), bacterial cultures and imaging (CT scans), physiotherapy and rehabilitation.
3. Intensive care unit.
4. A minimum number of beds with ventilator and dialysis unit dedicated for snakebite management in accordance with case burden of snakebite.
5. All house surgeons in the internship assigned duty for 24 × 7, during the season of snake bite.
6. All newly appointed Medical Officers/Existing Medical Officers should have hands-on training in management of snake bite.

Capacity Building program for health care workers

Snakebite management at health care facilities requires skilled physicians, frontline professionals and community health workers. Only about 52.2% and 20.2% of Indian medical practitioners are aware of the common presentations of Common Krait and Viper envenoming, respectively.

Capacity building exercises like Hand-on training programs and workshops on every aspect of snakebite envenoming (snakebite management, intubation, administration of Anti Snake venom, supportive therapy, identification of venomous snakes, and all other technical aspects) will be undertaken on a regular basis. These specialized centres are required to organize regular trainings of State Nodal Officers, healthcare and laboratory professionals and frontline workers involved in snakebite identification, diagnosis and management. Also, regional toxicology departments could take up this challenge with support from other partners and NGO's.

Knowledge regarding local venomous snakes of medical importance existing in the area and identification of the snake-induced clinical syndrome should be imparted to the primary health care workers.

The Healthcare professionals at every level of health care should have adequate knowledge of the recommended snakebite first-aid/pre-hospital care, ASV administration as well as the adverse reactions, knowledge of the nearest health care facility having capacity to manage snakebite cases, the standard treatment protocol for snakebite and rational use of anti-venom.

Detailed preparatory checklist for the same is attached at Annexure-6

Community Awareness Program

Community awareness on prevention, early identification and first-aid of snakebite cases can be provided to risk groups (farmers, rangers, wildlife officers, etc.) or general population by organizing awareness programmes on snakebite prevention and control. Counselling and education of snakebite survivors or their caregivers could also be offered in the health facility setting. This can be done at healthcare facilities of all levels by IEC creation and dissemination. While educating the community on snakebite management, creating IEC materials and following points should be emphasised:

1. Community should be taught that traditional healers and Blackstone application at the bite site and other traditional rituals is not the treatment for snakebite envenomation
2. Check the history of snake-bite and look for obvious evidence of a bite (fang puncture marks, swelling of the bitten part etc.) and signs of inflammation.
3. Immobilize the patient as far as possible by laying him/her down in a relaxed but safe position (e.g. the recovery position), immobilize the bitten limb or any body part and give reassurance.
4. Arrange transport of the patient to medical facility as quickly, safely and passively as possible by ambulance, vehicle, boat, bicycle, motorbike, stretcher etc. Ideally the patient should lie in the recovery position (prone, on the left side) with his/her airway protected to minimise the risk of shock and inhalation of vomit.
5. Victim must not run or drive himself to reach a Health facility, rather efforts should be made to reach the health facility preferably through Ambulance or any form of transport available.

Mountain pitviper, *Ovophis monticola* (venomous)

CHAPTER 13:

ANTI-SNAKE VENOM

Background

Anti-snake venom (ASVs) remains the only specific treatment that can potentially prevent or reverse most of the effects of snakebite envenoming when administered early in an adequate therapeutic dose. Early access to safe, affordable and effective ASVs is critical for minimising morbidity and mortality, and improving this access is a major component of an emerging WHO strategy to control snakebite envenoming. The current ASVs practiced in India is of polyvalent type, a sterile preparation of equine immunoglobulin fragments. This is effective against all four-common species; Russell's viper (*Daboia russelii*), Common Cobra (*Naja naja*), Common Krait (*Bungarus caeruleus*) and Saw Scaled viper (*Echis carinatus*). Each millilitre of reconstituted antivenom has the potency to neutralize the venom of the following snakes: 0.6 mg of dried Indian cobra venom, 0.6 mg of dried Russell's viper venom, 0.45 mg of dried saw-scaled viper venom and 0.45 mg of dried common krait venom. The present chapter discusses the recommended ASV doses, manufacturing capacity, demand forecasting, challenges and way forward.

ASV dosage administration in India

ASV is given though the intravenous route as the intramuscular route is found to be ineffective, painful and may increase intercompartmental pressure. ASV is available in the form of lyophilized powder or liquid as per the manufacturing company. There is NO evidence that clinically one form is better at neutralizing venom than the other. The following are the recommended ASV doses.

Case	Dose	Recommendations
Adult		
Neuroparalytic snake bite	First dose	10 vials of ASV as infusion for over 30 to 90 minutes followed by a 2nd dose of 10 vials after 1 hour (only if no improvement seen within the 1st hour).
	Repeated dose	Repeat ASV when there is worsening neurotoxic or cardiovascular signs even after 1–2 hr. Maximum dose of 20 ASV vials can be given for neurotoxically envenomed patients. If large doses have been administered and the coagulation abnormality persists, give fresh frozen plasma (FFP) or cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, if FFP not available or platelet concentrate.

Case	Dose	Recommendations
Vasculotoxic snake bite	First dose	10 vials of polyvalent ASV stat over 30 to 90 minutes as infusion, followed by 6 vials 6 hourly as bolus therapy till clotting time normalizes and/or local swelling subsides.
	Repeated dose	Repeat clotting test every 6 hours until coagulation is restored. Administer ASV every 6 h until coagulation is restored. If 30 vials of ASV have been administered reconsider whether continued administration of ASV is serving any purpose, particularly in the absence of proven systemic bleeding.
Pregnancy		Pregnant women are treated in exactly the same way as other victims. The same dosage of ASV should be given. However, the change in the physiology in pregnancy should be monitored. Refer the victim to a gynaecologist for assessment of any impact on the foetus.
Children		Children are also given exactly the same dose of ASV as adults, as snakes inject the same amount of venom into children and adults. *Infusion*: liquid or reconstituted ASV is diluted in 5-10 ml/kg body weight of normal saline. However, reduce the amount of fluid in the running bottle to 200 ml to avoid fluid overload.

ASV manufacturers in India

The WHO has recommended that venom producers, antivenom manufacturers and quality control laboratories that use animals adhere to the highest ethical standards. Antivenoms should be manufactured using validated fractionation procedures, and can thus contain whole IgG molecules, $F(ab')_2$ fragments or Fab monovalent fragments, which are further subjected to ultrafiltration and sterilization before being dispensed in final containers. Equines intended for antivenom production should follow the CCSEA guidelines. After that, primary immunisation is given by subcutaneous injections of small volumes at multiple sites, and subsequent booster injections are given till the antivenom titre reaches the pre-established minimum accepted titre. When the adequate antivenom titres are reached, the animal is bled from the external jugular vein, plasmapheresis is done manually or by automatic methods, and red blood cells are re-suspended in saline solution and given back to the animal in 20 to 30 hours. Each venom batch should be traceable, with the scientific names of snake species included and their respective geographical origin, along with the number of animals used, to detect any errors in the preparation process.

Quality control of snake venoms should be assured to ensure that the venoms represent venomous snakes inhabiting a region for which the antivenoms are manufactured. Moreover, the manufacturer should perform quality control of antivenom preparations, and the results are to be disclosed in the documentation.

In India, the Drug Controller General of India, MoHFW, Govt. of India, provides the licence to manufactures for ASV production.

Monitoring of ASV supply and demand

It is important to determine how much antivenom remains unused at the end of each year in different parts of the country, to allow the calculation of antivenom requirements, and the efficient deployment of adequate stocks of this scarce resource to areas where it is most needed. Adequate buffer stocks are mandatory in areas where natural disasters occur such as flood, cyclones etc., which may increase the number of snakebite cases. These provisions will reduce preventable deaths. Adequate training of medical personnel in the rational use of ASV is important to reduce mortality and morbidity and minimize wastage. List of manufacturers is annexed at Annexure 9.

Challenges and recommendations for ASV management in India

Category	Associated challenges	Recommendations
Venom extractions	Venom is the essential component for the ASV manufacturing, there should be a continuous supply. However, various factors affect this process; the Wildlife Protection Act limits the access to snakes, and only one organization extracts the venom of the entire country.	There should be relaxation in the current policy for the easy access to snakes for Venom extraction. High burden states to explore the possibility of a venom extracting centre. GMP facility and appropriate CoA along with the venom supply.
Polyvalent ASV	ASV is effective only against a bite from a few snake species. Some species of snakes are regional specific, bites from such species may not be effectively treated by the current polyvalent ASV. The ASV is being wasted, since it is polyvalent as only a few neutralizing antibodies will be effective against it. The inappropriate use of the ASV.	The healthcare worker to be trained for administering the current ASV. The possibilities of utilization of monovalent ASV to be investigated. Geographically specific ASV may be manufactured, which will reduce the wastage of the ASVs. A centralized web-based portal may be developed to monitor the availability of ASV in the health centres, through which the relocation of the ASVs may be possible in emergencies, the consumption of ASVs can be monitored and the demand forecasted.

Category	Associated challenges	Recommendations
Monovalent ASV	Species of biting snakes may not be known; species identification may be doubtful for envenomation. There are no diagnostic methods currently available to identify the responsible snake species. More ASVs may be needed, which may not be cost effective.	Before initiating the monovalent ASV, research is required, the strategy to identify the particular snake species should be developed and validated. The monovalent ASVs may be effective for regional use and not for pan India.
Cold storage	Although lyophilized ASVs do not require any cold storage (however, should be stored < 25°C), the liquid ASVs require it.	Apart from secondary and tertiary care health centres, the PHCs should be equipped with adequate quantities of ASV, at least in the hot spot areas to minimize the mortality and morbidity.
The quality of ASVs	Sometimes, the use of ASV beyond their expiry dates, quality standards of the ASV, improper storage may lead to ineffective ASV treatment.	The quality of ASV should be ensured (labels on the vials with expiry date) by the healthcare providers at each level before it is administered to the victims. The expired ASVs should be destroyed as per the instructions.
Paucity of epidemiological data	There is inadequate data on snake species & Snake population and their geographical distribution in India Similarly, the true number of snakebite cases, the snake species involved, number of ASV treated and number of deaths is not correctly known for effective snakebite management.	The effective surveillance system should be developed to understand the geographical distribution of snakebite cases for the effective ASV supply chain management. A Real-Time reporting system needs to be developed for the timely action points and implementations.
Facilitating next generation therapies	Most studies on next generation therapies are not clinically validated. The next generation therapies may be more expensive than the present ASVs, which may not be feasible to implement in India.	Required funding may be allocated to the research institutes for research.

Proposed strategies for ASV management in India

1. To encourage the initiation of the Regional venom extraction centres and Regional Guidelines.
2. To work on classification of Severity of Envenomation for the development of the National Guidelines.
3. To collect and set up a Biobank with venom of different geographical species under GLP compliance and cGMP compliance.
4. To correlate between geographical variation, seasonal variation and ASV effectiveness against Venom variants.
5. To create a central list India's specific venom database
6. To develop a guideline for regulating the snake venom production and determining the snake venom quality by the appropriate central agencies in India.
7. To develop a multi-sectoral coordination between the stakeholders for the snake catching, venom extraction, quality assurance of the venom, ASV production and marketing to meet out the country's demand.
8. To encourage the production of ASVs for the geographical specific snakes based on the evidence.
9. To develop the technical capacity of national authorities to evaluate quality, safety, and effectiveness of antivenom products.
10. To promote the research on envenomation in pregnant women from India.
11. To develop the ASV for the sea snakes.
12. To include adverse reactions of ASV in the National Pharmacovigilance Registry.
13. To engage with WHO for prequalification of antivenoms and collaborative registration of antivenoms.
14. To determine the effective clinical dose of antivenoms through robust independent pre-clinical testing and dose-finding clinical trials according to the snake menace in India
15. To train rural health workers in the diagnosis, treatment and care of snakebite emergencies, including rational antivenom use and appropriate early management of adverse drug events.
16. To ensure appropriate collection of data regarding the geographical distribution of snakes, snakebite cases, and mortality by strategic surveillance.
17. To develop the dedicated ASV portal for India for transparent management of ASVs in the country. Use GIS mapping tools to model populations at risk of snakebite and antivenom requirement and optimize antivenom procurement and distribution.
18. To encourage the development of molecular diagnostic tools for identification of snake venoms, thus, the demand for monovalent ASVs may be estimated.
19. To share good practices of antivenom procurement, using the number of effective treatments, not the number of vials consumed.
20. To engage with traditional healers for prompt referral of victims to a facility equipped for snakebite management. To provide accessible information about the availability of treatment in affected communities using a range of tools, media and community engagement.
21. To strengthen first responder health services such as village first-aid providers, emergency medical staff, primary health care centres and decentralized rural ambulance services.

Red-necked keelback, *Rhabdophis subminiatus* (venomous)

CHAPTER 14:

GUIDANCE FOR DEVELOPING STATE ACTION PLAN FOR SNAKEBITE ENVENOMING

State nodal officers of the health department, veterinary department and wildlife/forestry will prepare a joint state action plan for prevention and control Snakebite as per the needs of vulnerable population groups in the state. The steps in the development of state action plan are as follows:

1. Joint Gap Analysis (to be done by each stakeholder) - As each state has a different burden of snakebite and deaths, resources in the health, veterinary and wildlife sector, hence each state needs to develop the state action plan based on the needs for the respective state as under. Following are basic domains in which gap analysis of each state is to be undertaken:

- Estimation the burden of snakebite cases and deaths in the state and identify the population at risk /vulnerable population.
- Identification of high-risk areas at the districts and block level.
- Identification and mapping of health facilities in the areas wherein management of snakebite envenoming may be done
- Identification of veterinary infrastructure, veterinary clinics, local NGOs, and municipal/ civic bodies' active in the areas.
- Identification of laboratory facilities in the state in both sectors.

2. Identification of earmarked funds - Health, veterinary and wildlife sectors need to identify the funds that could be made available for the activities to be undertaken for Snakebite prevention and control. For the human health component, funds are to be explored under Snakebite prevention and control in NHM PIP for each year. The state may also allocate additional funds from the state budget based on the requirements.

3. Identify the stakeholders involved, and define roles and responsibilities- Each state has to identify the stakeholders from the Medical, veterinary, and Wildlife sector, education dept, NGOs and voluntary organisation, etc. Thereafter roles and responsibilities for each stakeholder to be demarcated after consultation with each stakeholder.

4. Preparation of action plan with activities to be undertaken at each level for the next 10 years. - Based on the mapping of stakeholders and resources available for the state, each state will prepare the action plan for the next 10 years to prevent and control snakebite from the state based on the guiding principles outlined in the National Action Plan for Prevention and Control of Snakebite.

5. Submission of the action plan – Each state is expected to prepare the action plan. State-level meeting of the state zoonosis committee may be undertaken to review the action plan at the state level.

6. Joint review of the action plan submitted by the state by NCDC and other stakeholders- Action plan thus submitted will be reviewed by respective sectors at National level and feedback will be provided to the individual state for any suggestion.

7. Implementation of the program by the state from the next financial year.

Plan for implementation

To implement the National Action Plan for Prevention and Control of Snakebite effectively all states need to propose developing a State Plan of Action in line with the National Action plan and as per the need of the State. To develop a State Action Plan that will encompass all aspects of snake-bite envenoming, it is proposed to hold a consultation of experts to formulate the draft as soon as possible. The process of formulation of the State Action Plan will include consultations with experts to discuss the contents of the document and timelines to complete it.

A. Short term plan- (Year 2024, 2025, 2026)

1. Advocacy for prioritising Snakebite in the State.
2. Estimate burden of Snakebite cases and deaths in the State for baseline assessment for target envisaged for year 2030.
3. Estimate snake types and population in the selected areas.
4. Identify or establish funding (e.g. schemes, programs, pensions, disability etc.), components under funding (such as vaccines, training, IEC etc.).
5. Exploring and piloting Regional Venom Centres
6. Mapping of health facilities for snakebite management and referral linkage of PHCs with this facility through digital solutions
7. Establish technical guidelines (Regionally tailored guidelines) on snakebite identification, prevention and control.
8. Strengthening of ambulance services for timely management and referral of snakebite victims
9. Develop training modules for medical officers, wildlife veterinarians, and support staffs
10. Development of SOP for snakebite identification, snakebite management as per STG guidelines etc.
11. Identify villages/talukas/districts/ based on snakebite cases and evidence as high-risk areas, medium risk areas, and low-risk areas.
12. Achieve Intersectoral collaboration by sharing information among stakeholders.
13. Initiate inter-departmental collaboration (Wildlife, Local self-governing bodies, NGOs) through MoU.
14. Initiate capacity building, Professional education and training of staff needed for activities planned.
15. Develop a joint State Specific Action Plan for Snakebite prevention and control with the micro plan for districts as per the risk areas or start a pilot project in the selected city, district or block for implementation of the program.
16. Monitoring of requirement of Anti Snake Venom at all levels

B. Medium-term plans- Phase 2 Activities (Year 2026, 2027, 2028)

1. Continue the advocacy and creating awareness on snakebite management. Do's and don'ts etc.
2. Scale-up implementation of the state actions plans throughout the country. The results of the pilot project in a selected city /block/district with improvements should now be implemented in another area.
3. Setting up the Regional Venom Centre at all region and expanding liaison of this centres with relevant stakeholders
4. Preparing database on Snakebite related disability cases
5. Strengthening the health facility at all levels as envisaged under NAP-SE for management of Snakebite cases.
6. Establish surveillance systems, including feedback mechanisms, and coordination between administrative levels (national, state, district, municipal, etc.).
7. Evaluate ASV coverage and address the issues through stakeholder engagement and digital platform-based solutions.
8. Continue Surveillance activity for human, animal and wildlife snakebite cases.
9. Continue snake species enumeration count
10. Ensuring the availability of laboratory test required for diagnosis of Snakebite such as – 20 minutes Whole blood clotting test, peak flow metre, urine analysis, Prothrombin time, platelet count, clot retraction time, Liver and kidney function test, serum amylase etc.
11. Ensuring the availability of beds with machine supported ventilation unit
12. Continue to ensure the availability of ambulance services for snakebite cases
13. Strengthening the capacity of admitting snakebite cases in ICU
14. Strengthening and ensuring the availability of dialysis Unit for snakebite victims in all areas as part of health system strengthening
15. Ensuring the availability of emergency medicines
16. Ensuring appropriate management and referral for Snakebite cases
17. Collaborate with major stakeholders for snakebite prevention and control activities
18. Monitoring of targets at all level envisaged under NAPSE snakebite related deaths

C. Long term plans- Phase 3 and Phase 4 activities (2029, 2030)

1. Continue the advocacy and creating awareness on snakebite management. Do's and don'ts etc.
2. Continue Surveillance activity for human, animal and wildlife snakebite cases
3. Assessment of the established Regional Venom Centre
4. Continue to establish facilities for biochemical, proteomic, genomic, taxonomic and toxicological studies of different snake species and venoms of India.
5. Continue to ensure the availability of ambulance services for snakebite cases with trained professionals
6. Continue the activities for prevention and control to prevent and control snakebite envenoming in order to halve the numbers of deaths and cases of disability that it causes by 2030.

Short sea snake, *Hydrophis curtus* (venomous)

CHAPTER 15:

ADDRESSING COMMUNICATION BARRIERS IN SNAKEBITE PREVENTION

Every organism plays a significant role in an ecosystem, including snakes. Snakes control the rodent population and other small animals in the agricultural areas and wild. They are found in almost every ecosystem except for extremely cold regions like the north and south poles. Due to the change in landscape patterns, some animals, like rodents, have successfully colonized urban and suburban areas. Rodents are easy prey for snakes, which is an essential part of snake's food web, so snakes (including venomous species) have also adapted to live near rural-urban human habitation, using them for shelter and foraging. The most common big four venomous species Russell's Viper (Daboia russelli), Saw-scaled viper (Echis carinata), Common krait (Bungarus caeruleus), and Spectacled cobra (Naja naja), are found in human settlements, which cause death, disability, and disfigurement. Most snakebite cases occur around human habitation and agriculture areas, which makes a human-snake conflict zone. In ideal conditions, snakes are secretive. Human-snake encounters mostly occur when the snakes' micro-habitat gets disturbed by human activities like farming, construction, earth moving, and removing fuel woods/cow dung or bricks from piles.

According to the Central Bureau of Health Intelligence (CBHI) data, the total number of snakebite cases in India from 2016 to 2020 is 79,7013 and the total number of death cases during this period is 5,343. This clearly shows that snakebite is a health burden on the country and we need to take measures to tackle this problem. Like any other public health challenges this also has certain barriers when it comes to communication.

Issues and Challenges

Human-snake conflict often arises from misunderstandings and the menace of snakes, and humans needs to be carefully clarified snakebite envenoming. At the same time, some snakes can pose a threat to human safety, especially those that are venomous. To manage human-snake conflicts effectively, it is important to educate the rural-urban communities, raise awareness, and implement measures to reduce the risk of snake envenoming and protect snake habitat from destruction.

In a country like India where two-third of the population living in villages, lack of education is the primary concern and mainly affects agriculture and unorganised sectors. Snakebite envenoming is a potentially life-threatening disease caused by toxins in the bite of a venomous snake. Snakebite envenoming mainly affects the low socioeconomic communities of rural areas, including hunters, agricultural workers, working children, families living in poorly constructed houses, and people with limited access to education and healthcare. It is a practically quite challenging to reduce snakebite envenoming in affected areas & strong engagement with communities and health workers is necessary. Empowering communities with knowledge on snakebite prevention, first-aid and well-functioning health systems

with effective medicines is necessary to prevent and control snakebite envenoming. Once a community understand the importance of prevention, avoidance of risk, and early medical care for snakebite envenoming, the outcome will improve.

Major issues and challenges in prevention and control of snakebite envenoming in India-

a) **Financial burden:** Research studies have shown that snakebite is more prevalent among rural and tribal areas who cannot afford the cost of treatment and have limited access of healthcare facilities.
b) **Faulty first-aid practices and medical treatment:** Snakebite victims do not receive adequate treatment due to a lack of trained medical personnel or facilities, including poor ambulance and pre-hospital care.
c) **Far away health facilities:** Antivenom is the most effective treatment for snakebite envenoming, but it is often unavailable in rural or sub-rural areas.
d) **Poor awareness:** There is often vital misinformation about snakebite and first-aid treatment, leading to dangerous and ineffective remedies being used instead of proper medical care. Communities are also less aware about venomous species commonly found in human habitation zone.

There are communication barriers pertaining to snakebites and some of them are as follows:

a. Poor Awareness- Most of the snake species are found in interior and rural areas of the country. These places have lack of facilities and low literacy rates. All these factors together lead to poor awareness of the problem. Firstly, the population living in these areas does not know how to avoid snakebites and secondly, if they get bitten, they do not know how to provide first-aid and transport to the nearest health facility. They use traditional methods to treat the patient which are not safe and may lead to loss of life. If they were aware of prevention and control methods it would have save many lives. There should be good coverage on awareness campaigns designed to meet the requirements. Toolkits for prevention and control of snakebites should be provided to the targeted audiences.

b. Language differences- In any public health strategy, communication plays a vital role so as does language. India being a diverse country has many languages and dialects. At times, it acts as a barrier when one has to communicate a message to the masses. If a communication message has been designed in a certain language it may not be understandable by a community that speaks some other language. This may lead to misinterpretation of the message and cause miscommunication.

Other than language, usage of technical jargons in health campaigns is another issue that creates barriers. If the campaign is designed for the people, it must be in their language. If the communication material is too technical then people do not pay much attention to it.

The material generated for public awareness should be jargon-free and in their language. The communication material (pamphlets, posters, booklets, brochures, video and audio messages) should be available in regional language too.

c. Prevailing myths in the society- In the rural areas when there is any case of snakebite people generally go to traditional healers as they are the reference point. But their practices and knowledge level are sub-optimal and risky while providing first-aid management. People follow wrong practices like putting incisions at the site of snakebites as they think through the incision the poisoned blood would flow out and putting tight tourniquets around the

bite which causes gangrene. Various local narratives and sequels in movies related to snakes have also being considered. These kinds of myths sometimes become the cause of death of a snakebite patient and rescuers.

Research studies says that there are many myths prevalent in Indian society about snakes. The most prominent one is snakes are fond of milk, bite by certain snakes makes one immune to subsequent bites and likewise there are many. This clearly shows a lack of awareness and prevailing myths about snake and snakebite management in society.

To address this nukkad nataks, puppet shows, pictorial messages should be designed and shown to the target audiences. As the target audience is majorly rural and looking at the literacy rate these kinds of programs would be impactful.

d. Incorrect first-aid practices- Applying tourniquet, ice, or water on the site of snakebite, sucking out venom, give the person alcohol or caffeinated drinks or any other medications are a few commonly followed practices for snakebite patients. But due to lack of awareness, these may lead to disabilities & death as they are not the right practices. Lack of awareness happens because a large population have been following wrong practices for generations and the scientific methods are not known.

Regarding this, all the sub-centres, public health centres, ASHA workers should be provided with IEC material for distribution & display and the same may be demonstrated by the health staff during community programmes. These centres may hold frequent meetings with the local people to make them aware about the right practices.

Focus states for snake envenoming

In India, snakebite is a serious problem; numerous states record high annual rates of snake envenomation. The Indian states of Andhra Pradesh, West Bengal, Tamil Nadu, Maharashtra, Odisha, and Karnataka are among those where snakebites most frequently occur. Therefore, it is imperative to increase public awareness about the prevention and treatment of snakebite as well as to make effective antivenom therapies accessible if one hopes to lower the number of snakebite deaths in India. A good communication strategy will be quite helpful in creating awareness about how to avoid snakebite and educating people about how to handle the patient after the snakebite and transport the victim to the nearest health facility. Even in general, right message at right time to the concerned people saves life. Reaching out to people with relevant information and training them with the know-how is of paramount importance on how to handle a snakebite incidence. None the less, awareness sessions and spreading the words through any mode of communication encourages people for better health seeking behaviour. Any morbidity or mortality caused by snakebite causes financial constrain for the victim's family, so it is important to provide the correct information to prevent such situations. This can only be done with a well-thought-out communication strategy. It can be achieved through training of front-line health workers, ASHA workers, AWW, MLHP and staffs of Sub-centres, PHCs and CHCs.

Communication strategy is a combination of methods, message and approach by which the planner seeks to achieve the communication objectives (Assifi French DTCP-1985)

Methods of Communication Strategy for the prevention of snakebite includes following steps:

Community needs assessment:
Geographical areas have defined communities with interests or characteristics such as culture, religion, race, age, and occupation. People within a community come from different backgrounds and have unique cultures, customs, and values. Community need assessment assists in identifying and prioritizing the needs and issues in community in terms of snakebite morbidity and mortality. It gives community leaders an overview of current local policy and environmental change efforts and assists in identifying areas for improvement. Community need assessment requires following essential steps to achieve communication strategy goals.

Identify and assemble a diverse community team: All community team members play a vital role in the assessment process. They can assist in collecting data through surveys, interviews, focused group discussions groups and develop questions to identify data collection methods to use. This process also ensures that the community team has equitable access to and informed knowledge of the process, thereby solidifying their support. The community needs assessment concept refers to need assessment and planning with the involvement of stakeholders to ensure that everyone is informed and engaged in the process. e.g., Hospital administrator, community health worker, ASHA worker, Paravet, forest guards, school principal and headmaster, civic leaders, sarpanch, local community representatives, Community health volunteers, and representative of panchayat raj institutions.

Develop a team strategy: After assembling teams following points will be included

1. Defining goals and objectives of the assessment.
2. Selecting a method or tool for conducting the needs assessment (e.g., customized Excel spreadsheets, MS Word worksheets, google sheets, app based data collection etc.
3. Defining how the data collected will be used
4. Determining the timeline for the assessment
5. Determining roles and responsibilities of team members
6. Assigning tasks based on skills and available resources
7. Identifying how decisions will be made

Identify scope of statement

Define community of assessment: Community team member will decide what community to assess like starting with a smaller geographical area or segment of the population.

Identify community sector for assessment: Within the community identified, community team member will determine which distinct parts or sectors of the community assess examples of community sectors are, childcare centres, health and wellness organisations, college and universities, primary health centres, districts hospitals, community clinics, panchayat raj institutions, government offices, agriculture sectors, manufacturing sectors, private offices and schools.

Identify community component to assess: With each sector, team members will decide which component of community to assess. Select those components that the team member believes are most important and relevant to evaluate and that will lead to the most useful recommendation for improvement e.g., demographics, age, income, education level, type of

work/health/facility/school.

Develop questionnaires for: Community team members will develop a list of questions to ask to learn about the strengths and weakness of specific community component of each sector.

Select sites: Sites are locations within each sector community team members will visit to conduct the need assessment. At each site, the information gathered will provide answer to the questions team members have identified.

Determine data collection methods or use existing data: community team members can use several data collection methods for each site. Varying data collection methods provide more detailed assessments of the community.

Community team members can gather data in two forms

a. **Primary data:** Primary data is the first-hand data because no previous record of the data exist to be accessed in public domain. Community team members can use methods like surveys, interviews, focus groups
b. **Secondary data:** the secondary data already have been collected and compiled by institutions or originations, which available in public domain and can be access through government reports, census data, institutions heath data, organizations and departmental records, etc.
c. **Data collection methods:** On the basis of use methods, it can be classified in two categories.
d. **Quantitative data:** The quantitative data can be quantified and expressed in number e.g., age of the gender, heights of the students of class
e. **Qualitative data:** The qualitative data cannot be expressed in number and can be expressed through the nominal scale like religion, gender, etc.

Data collections techniques: Community team members can collect data by using various techniques. Some methods of collection techniques are:

1. Focused group discussions
2. Questionnaires
3. Interviews
4. Field observations
5. Case study
6. Ethnography
7. Oral history taking
8. Projective techniques
9. Postal survey
10. Telephone survey
11. Face-to-face survey
12. Web-based survey

Identify key informants: For each sector and site, community team members have to be identified for the assessment and contact people (or key informants) who will provide the appropriate insight, knowledge, or documentation. Community team members can contact people from the community, e.g., school principals, business leaders, sarpanch, city planners, police chief, chief medical officer, veterinary officer, and district wildlife officer.

Social map:
A social map can provide valuable insights into the social dynamics of a community and help to identify key influencers and relationships that can be leveraged to achieve a particular goal. Social mapping is an authentic way to find out what the social reality looks like for locals through social stratification, settlement patterns, demographics, and social infrastructure. It is helpful for network analysis and helps identify key individuals or groups and the relationships between them.

Social mapping helps to gather community information on:
1. Ethnic distribution
2. Social institution and economy
3. Family structure, Pattern and relationships
4. Government institution available and health challenges
5. Education background in the communities
6. Social groups
7. Leadership patterns
8. Value system of the villages
9. Social interactions, social structure
10. Media/ communication practices
11. Spatial distribution of the structures and institutions and their relevance to health and disease
12. Social norms, attitudes, and beliefs influencing health and illness

The following steps can be included in the process of social mapping:
Consultation with the local community helps to identify an appropriate time and place for carrying out the exercise.

Explain the purpose of the exercise, ask community members to begin by drawing the main physical features of their locality. Let them use whatever materials they choose (local or other materials)

Identify and number the household details, according to the goal of the exercise e.g., community compositions, schools and health centres.

Media engagement

Media engagement strategy is to involve and engage the media in an order to achieve specific goals. It aims to raise awareness about snakebite envenoming, promote preventive measures and provide information of locations where treatment is available.
In media engagement following stakeholders need to work together:
1. Media personnel including journalists and Community Radio Reporters (CRRs).
2. Civil Society Organizations, Community Based Organizations, Women Collectives.
3. Panchayat members
4. Academic and Research Institutes
5. Media institutes
6. Government through their Ministries and officials
7. International agencies e.g., WHO, CDC, UN

Modes of media engagement: Media engagement can be compiling in five types of engagement. These are

i. **Training and capacity building workshop:**
Training and capacity building workshop: It is necessary to conduct training and capacity building workshops for a different set of stakeholders, e.g., panchayat raj members, health sector workers, wildlife and animal husbandry workers, journalists, and community radio reporters. The design of the workshops is target specific, including people living in areas with high snakebite incidence, as well as health workers, first responders, paravet, ASHA workers, and forest guards. This activity's motive is to create awareness among different stakeholders about snakebite envenoming.

ii. **Exposures visit:**
Exposure visits are specifically for journalists. These visits help journalists develop a deeper understanding of subject matters and grassroots realities. During the exposure visits, journalists organize workshops, interviews, and meetups with the community and their members. It can focus on a broad range of issues related to environmental, public health, agricultural, local employment, and snakebite. Through this process, many compelling media stories can be increased, and the coverage of qualitative aspects of the grass root level news will be enhanced.

iii. **Awards recognition and fellowships:**
Awards and recognitions should be given to the participants' journalists, including community Radio Reporters (CRRs), on the coverage of issues/themes. This visit should be planned near the district's head centers, where most village-level stakeholders can meet.

Under the fellowships, the grantee can assign stories on snakebite envenoming and get them to publish in regional, national, and international print media. Those journalists selected as fellows can be asked to submit all the published stories to the fellowship organizer, which should be motivated by awards and recognition who have done good reporting (after their exposure visits) on snakebite issues.

iv. **Dialogue platforms (Meetings):**
These types of forums provide good opportunity to participants to learn from each other and help to develop linkage and networks.

The platforms can be for the journalists, CRRs, media students, law students, young legislators, block level and districts level panchayat raj institutions, primary health worker, ASHA workers, paravets, forest officials and forest guards.

v. **Media partnerships:**
In the media partnership, the media personnel engage the partner agency and brings the pertinent issues to the fore as and when needed. During this activity, a partnership-building exercise should be designed to bring synergies based on the complementary roles each stakeholder can play. The motive of this activity is to get substantial and substantive coverage in the media.

Spectacled Cobra, *Naja naja* (venomous)

CHAPTER 16:

MONITORING AND EVALUATION

Routine monitoring, periodic assessment and evaluation will be done under the program at all levels (National/State/District/Village etc.) to ensure implementation as per plan. The independent external evaluation of implementation of the state action plan will also be undertaken periodically. The key objective of monitoring and evaluation will be to assess the progress made at each level to achieve the target of prevention and control of snakebite envenoming, to identify challenges and to provide the solutions to the extent possible by advocacy and facilitation.

Institutional mechanism for monitoring and evaluation

The institutional mechanism for monitoring and evaluation at the National, regional, state and district level will be as under:

A. National Level			
Joint Monitoring	Standing Committee on Zoonoses under DGHS (Exists) National Technical Advisory group on Snakebite (Proposed)		
Component wise	The human health component would be monitored through existing NHM monitoring mechanisms (Common Review Missions and Joint Review Missions), as per the guidelines and NCDC.	Wildlife Department, MoEF&CC, The Snakebite incidence and snake population would be monitored as per the guidelines.	DAHD (Animal Health Component) The animal health component would be monitored as per the guidelines.
B. Regional Level			
Joint Monitoring	Regional Coordinators under the National One Health Programme for Prevention and Control of Zoonoses		
Component wise	Regional Directors of Health Sector	Regional Director of the veterinary sector and Wildlife sector/Disease Diagnostic Lab.	
C. State Level			
Component wise	As per the operational guidelines of Prevention and Control of Snakebite	As per the operational guidelines of the State Animal Husbandry Department/ State Wildlife/ State Agriculture Department.	
D. District Level and below			
Component wise	As per the operational guidelines of Prevention and Control of Snakebite	As per the operational guidelines of the State Wildlife Department.	As per the perational guidelines of State Animal Husbandry Department

Monitoring Indicators to assess the progress at State level

The State progress will be monitored by national nodal agencies in the health sector. The set of input and process indicators are identified to measure the outcome and achievement of vision of prevention and control of snakebite envenoming in order to halve the number of deaths and cases of disability that it causes by 2030.

Input Indicators

The input indicators are those indicators that will assess the progress made by the states with respect to their preparedness for formulation and operationalization of State Action Plans. These input indicators are also a measure of successful implementation of the National Action Plan for Prevention and Control of Snakebite Envenoming through continued advocacy among stakeholders at national and state level.

The input indicators for monitoring and responsible stakeholders will be as under-

Table 5- Monitoring Indicators at National level

S No	Indicators	Responsible stakeholders
1	Advocacy for Snakebite management and control has been done at all levels	Ministry of Health & Family Welfare; Ministry of Environment, Forest and Climate Change; Ministry of Fisheries, Animal Husbandry and Dairying; Ministry of Agriculture and Farmers Welfare; Ministry of Labour and Employment; Ministry of Home Affairs; Ministry of Housing and Urban Affairs; Ministry of Panchayati Raj and Rural Development.
2	Formulate action plan for Prevention & Control of Snakebite envenoming and submitted to national nodal agencies	
3	Develop relevant Technical Guidelines and Standard Operating Procedure for strategies of human/animal/wildlife component of SAP-SE	
4	Organize training programs for Medical, Veterinary and allied human resources for different components of SAP-SE	Ministry of Health & Family welfare; Ministry of Environment, Forest and Climate Change; Ministry of Fisheries, Animal Husbandry and Dairying; Ministry of Agriculture and Farmers Welfare.
5	Inclusion of prevention and management of snakebite in school curricula	Ministry of Human Resource and Development, Ministry of Education
6	Number of National level labs to be strengthened to carry out lab diagnosis for Snakebite envenoming	Ministry of Health & Family Welfare; Ministry of Environment, Forest and Climate Change; Ministry of Fisheries, Animal Husbandry and Dairying; Ministry of Agriculture and Farmers Welfare.
7	Snakebite to be made a notifiable event.	Ministry of Health and Family Welfare, National Disaster Management Authority, Road Traffic Accidents

Table 6- Monitoring Indicators at National/State level

S No	Indicators	Responsible stakeholders
1	Number of States/districts where advocacy for Snakebite management and control has been done at all levels	State Health Department, State Wildlife Department, State Agriculture and Farmers Welfare Department
2	Number of States/districts that have formulated State action plan for Snakebite envenoming and submitted to national nodal agencies	State Health Department, State wildlife department, State agriculture and farmers welfare department.
3	Number of States/districts that have developed relevant Technical Guidelines and Standard Operating Procedure for strategies if human/animal/wildlife component of SAP-SE	
4	Number of States/districts who has organized training programs for Medical, Veterinary and allied human resource for different components of SAP-SE	
5	Number of States/districts included chapter on snakes under school education curriculum	Department of Human Resources, department of education
6	Number of State level labs strengthened to carry out lab diagnosis for Snakebite envenoming	State Health Department, State wildlife department, State agriculture and farmers welfare department, Medical Education, ICMR etc.
7	Number of States that have made Snakebite a notifiable event.	State Health Department

Process Indicators

The process indicators are those indicators which are defined to measure the progress made in implementation of strategies under the National Action Plan on Snake Envenoming. The process indicators to assess the progress of target achievements and their means of verification is described as under-

Table 7- 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 adequate supply Anti Snake Venom (ASV) at all health facilities.	ASV procurements and Utilization Proportion of ASV vials procured against annual requirement. % of facilities (PHC & above) expected to maintain stock of ASV stocks register % 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 Snakebite DVDMS portal/ Media Supervision reports
Capacity building	% of staff trained in Snakebite management (from PHC & above)	Number of staff trained in facilities for management of Snakebite	Number of training certificates issued Trained Participants List (facility wise)	Prevention and Control of Snakebite Envenoming Attendance sheet & Training Reports
		% of facilities with trained staff for the administration of Anti Snake venom	Supervision. reports	
Diagnostic Support	Strengthening laboratory diagnostic capacity for diagnosis of Snakebite envenoming	% of laboratories equipped with diagnostic facilities	Laboratory assessment reports	Prevention and control of Snakebite envenoming reports SRL & RRL reports Report of Disease Surveillance unit

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
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	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 equipments etc.)

Table 8- Other Process Indicators

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
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 level of partnership and multi-sectoral collaboration among ministries, other government agencies, NGOs and private sector for 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	Snakebite burden of Snakebite Cases and Deaths and estimate of the disability due to Snakebite	% of applicable studies done	Study reports	Dissemination of results manuscript

Table 9-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 adequate supply Anti Snake Venom (ASV) at all veterinary polyclinics, Veterinary Hospitals, Veterinary Dispensary & Dispensaries in various Wildlife Sanctuaries, National Parks, Zoos etc.	ASV procurements and Utilization % 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 Snake population of different species	Species wise population of snakes		Wildlife Department

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
Capacity building	Trained staff on snakebite management (Para Vets, Maitri, Gopal Mitra, Pashu Sakhi etc.)	Number of staffs trained in facilities on appropriate management of Snakebite	Number of training certificates issued Trained Participants List	Programme for Prevention and control of Snakebite Training Reports
		% Of facilities with trained staff on the administration of Anti Snake venom	Regular supervision reports	
Diagnostic Support	Strengthening laboratory diagnostic capacity for 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 animal.	% Facilities reporting Snakebite cases and deaths in animals.	Programme for Prevention and control of Snakebite Reports and NADRS Reports	Programme for Prevention and control of Snakebite, INAPH Alert Report Surveillance unit (web portal)

Table 10- Other Process Indicators

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
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

Activities	Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
Inter-Sectoral Coordination	Assess level of partnerships and multi-sectoral collaboration among ministries, other government agencies, NGOs and private sectors 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
Operational Research	Baseline survey to estimate Snakebite burden and incidences of Snakebite cases and Deaths in Animals.	Number of applicable studies done	Study reports	Dissemination of results manuscript

Output /Outcome indicators

These indicators are to assess the overall impact of the activities undertaken under NAP-SE and to see the progress towards the goal of achieving halving the numbers of Snakebite deaths and cases of disability that it causes by 2030".

The outcome target and indicators thereof are described as under-

Table 11- Outcome Target Indicators

Technical Indicator	Objectively Verifiable Indicator(s)	Means of Verification	Source of Information
To prevent and control snakebite envenoming in order to halve the numbers of deaths and cases of disability that it causes by 2030	No of states who has 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

Salazar pitviper, *Trimeresurus salazar* (venomous)

CHAPTER 17:

ROLE OF NON-GOVERNMENT ORGANISATION & CIVIL SOCIETIES

In rural landscapes heavily dependent on agriculture, venomous snakebites pose a significant and immediate threat, particularly during routine activities such as sleeping, farming, or walking barefoot. These incidents predominantly impact economically vulnerable communities living in fragile dwellings exposed to snake movement. The consequences extend beyond mortality, affecting livelihoods due to prolonged recovery periods and, often, disabilities resulting from unscientific first-aid practices.

NGOs are instrumental in addressing these challenges. They actively engage in community awareness initiatives, educating individuals on snake ecology and preventive measures. Interventions include radio telemetry projects and offering insights into snake behaviour. NGOs also distribute essential resources like rechargeable torchlights and gum boots, acknowledging the heightened risk during night time activities in poorly lit rural areas.

Education is a focal point, targeting communities with limited access to formal education. NGOs bridge gaps by dispelling myths, encouraging safer practices, and promoting healthcare-seeking behaviours. Collaboration with government entities enhances the impact, as NGOs contribute to capacity building, influence policy implementation, and advocate for resource allocation in high-risk districts.

Recognizing the crucial role of NGOs, governments can strengthen partnerships by allocating grants to address local gaps. This collaborative approach aims to empower communities, ensuring proactive participation in health-related activities and, ultimately, mitigating the challenges posed by snakebite incidents in rural areas. The multifaceted strategy involves education, technology, and resource provision, contributing to a holistic and sustainable solution for snakebite management. There are multiple NGOs presently working at different levels to address the problem of snakebite. Some of the activities are mentioned below.

1. **Community Education and Awareness:**
    a. **Sustainable Education Programs**:
        i. Engage communities through diverse awareness programs at schools, community halls, and health centres targeted for community members like farmers, forest gatherers, snake handlers and traditional healers.
        ii. Utilize interactive formats, including presentations, films, street plays, and workshops for effective communication.
    b. **Material Distribution & Installation:**
        i. Distribute engaging educational materials such as posters and booklets.
        ii. Install large informative posters strategically at key locations like schools, community centres, and health facilities.

c. Hands-on Training Workshops:

i. Organize practical training sessions for professionals working for healthcare, forest, fire, and police departments for snakebite sensitization and emergency response.

ii. Conduct specialized training for ASHA workers, Anganwadi workers, and other first responders for field-based emergency interventions and evacuation.

2. Equipment and Resource Distribution:

a. Strategic Equipment Distribution:

i. Prioritize the distribution of culturally acceptable and effective snakebite prevention materials.

b. Community Engagement Initiatives:

i. Facilitate village meetings with interactive sessions to enhance community participation.

ii. Collaborate with local leaders to educate traditional faith healers snake charmers on alternative livelihoods.

3. Collaborative Efforts and Regulation:

a. NGO Identification and Collaboration:

Type of NGOs	Activities to be conducted
Snakebite Mitigation	Prevention and First-aid Initiatives
Forest and Fire Department	Support and collaboration for snake conflict-related incidents
Research Institutions	Research on venom, antivenom, epidemiology, social sciences and other related sciences
Educational Material Development	Creation and distribution of IEC materials
Agricultural Development	Initiatives related to rural farming safety
Media Campaigns	Awareness campaigns through various media channels
Women and Child Welfare	Programs addressing the well-being of women and children
Tribal Welfare	Initiatives focusing on tribal communities
Medical Aid	Provision of healthcare support and resources
Sustainable Development Goals	Programs aligned with SDGs for holistic development
Others	NGOs showing interest in snakebite mitigation

b. Effective Monitoring of NGO Activity:

Implement robust monitoring mechanisms to enforce standardized practices and elevate the quality of snakebite prevention initiatives across NGOs. By ensuring adherence to uniform standards, the monitoring process will contribute to a more impactful and cohesive approach.

i. Reporting and Assessment:

1. NGOs submit routine reports to state authorities on progress, challenges, and outcomes, including data on awareness programs and material distribution.
2. Conduct periodic on-ground visits and audits to ensure the accuracy and

completeness of reported information both Internal and external evaluation

ii. Performance Metrics and Stakeholder Engagement:

1. Establish clear Key Performance Indicators (KPIs) for NGOs, including metrics on the number of people reached and program effectiveness.
2. Gather feedback from community members, healthcare professionals, and local authorities to help prioritize actions.

iii. Financial Transparency:

1. Develop a detailed budget that breakdown estimated cost for relevant activities
2. Ensure transparent and responsible use of funds by conducting regular financial audits.
3. Verify the proper allocation of financial resources to programme activities

c. Enhanced Intersectoral Communication:

i. Participate in local and regional stakeholder forums of the government to discuss strategies, share updates, and strengthen coordination efforts.

ii. Establish regular communication forums between governmental and non-governmental agencies involved in snakebite management. These forums will provide a structured space for stakeholders to discuss strategies, share updates, and strengthen coordination efforts.

iii. Foster a collaborative environment by actively encouraging mutual information sharing among NGOs. This collaborative ethos will create an ecosystem where organizations can learn from each other's experiences, share best practices, and collectively enhance their effectiveness in snakebite prevention.

4. Government and NGO Collaboration:

Central and State-Level Collaboration

a. Centralized Knowledge Hub

i. Establish a central repository accessible to all states and NGOs, housing comprehensive snakebite control programme resources, insights, and best practices.

b. Collaborative Action Teams

i. Form dynamic central and state-level working groups, bringing together diverse stakeholders.

ii. Collaborate on strategic planning, training initiatives, and continuous monitoring efforts.

c. District level Coordination for Partners

S.No.	Component	Detailed activities	Time line
1.	Advisory	State nodal officer should plan an annual meeting with the support of State Wildlife Officer, District SSO, District Wildlife Officer & NGOs Meeting should discuss technical support, disease burden, Information Education and Communication IEC/Behaviour Change Communication BCC up to grass root level.	Every Six Month
2.	Technical Support	State Nodal Officer to organize meetings for dissemination of technical guidelines to state, district, block and grass root level with support of partners Plan and conduct epidemiological surveys as required	Throughout the year
3.	Social mobilization (IEC/BCC)	Partner support good quality material for IEC at state and district level. Various forms of delivering health education to the community with the help of nuked natak, puppet and other forms of folk media. The IEC such as banner, poster, handbills, flash cards, miking, audio-visual spot and social media kit through tweeter, Facebook and WhatsApp	Every Six months
4.	Training	Training Components organize at state level with State Wildlife officers and other stakeholder and partners as a TOT. TOT officials are responsible for cascade training from district, block and grass root level	Every Six months
5.	Rapid Response Team	SNO, representatives of Forest department, Emergency services (Police & Fire), NGOs Dedicated helpline number to be established through heath department	Annually (ongoing)

5. Challenges and Mitigation Strategies:

a. Identification and Regulation of NGOs

Challenge	Mitigation Strategy
Identifying relevant NGOs	Establish a centralized effort with mentorship for identification and support.
Monitoring NGO activities	Institute proactive monitoring mechanisms for adherence to best practices.

b. Intersectoral Communication and Standardization

Challenge	Mitigation Strategy
Communication gaps between sectors	Introduce regular cross-sectoral meetings and a unified communication platform.
Standardization of IECs for uniform messaging	Develop and disseminate standardized materials for consistent communication.

c. Funding and Collaboration

Challenge	Mitigation Strategy
Limited funding for NGOs	Utilize the regional funding opportunities from governmental and private sources
Collaborating at regional levels	Foster collaborations with regional stakeholders for sustained support.

d. Manpower and Cultural Considerations

Challenge	Mitigation Strategy
Limited availability of qualified personnel	Support dedicated personnel recruitment, training, and continuous professional development of Volunteers
Addressing cultural and social factors in interventions	Tailor interventions to consider cultural nuances for enhanced effectiveness.

Nodal officer involvement at state /district/block level

S.NO	Level	Activities
1.	State Level	i) The state Committee or Nodal officer select the NGOs to work at the state and district level, including for such as training, capacity buildings and awareness programs. ii) State Nodal officer establish a state NGO cell with in the state programme unit. It monitors and evaluate the NGO programmes. iii) State Nodal Officer establish the state NGO coordinator which lead the NGO cell. Communicate government policies and national guidelines to NGOs. Enable periodic field visits, developing terms of reference and participating in the evaluations, ensuring timely submission of reports by the NGOs.
2.	District/Block level	i) State Nodal Officer select the NGOs in district. ii) District level NGOs selection for activities to conduct at the district or block level. This include training of panchayat raj institutions, ASHA worker, PHC workers, paravets and forest guards. conduct the review meetings to assess the work of NGOs and evaluate impact. iv) A district NGO coordinator (A district level Medical Officer or the District Programme Manager (DPM) may be designated as the District NGO Coordinator) select for the implementation of NGO programmes at the district/block level. District NGO coordinator Facilitation of the advertisement for the selection of NGOs. Monitoring of NGOs performance to enable needs based technical support. v) Acknowledge/evaluate best practices replicable ones included in national programmes

Large scaled pitviper, *Craspedocephalus marcolepis* (venomous)

CHAPTER 18:

OPERATIONAL RESEARCH & GAP AREAS

Snakebite related issues are complex i.e. involves and involve marginalised population, populations including people living in vulnerable areas with varied social economic socioeconomic issues intermingled along with limited health systems infrastructure & logistic, and skilled manpower related issues.

Therefore, addressing these issues would require constant effort and collective efforts to assess the areas region-specific issues and suggesting real and propose realistic/practical solutions to health or any other responsible agencies authorities to address them. Hence, it. Thus, it requires constant vigil by responsible stakeholders and is essential to be vigilant on the ongoing operational research by institutions/organisations involved in these efforts.

This chapter briefly describes the major domain areas in which institutional/organisation can focus for research related toon snakebite research and to be guided at the central level from by agencies involved in this e.g. the ICMR.

Snake Venom

Snake venom is a complex mixture of hundreds of different components ranging from low molecular mass peptides and non-proteinous compounds to large proteins. Due to varying venom compositions, snakebite envenoming results in a wide range of clinical profiles including local tissue damage (cytotoxicity), systemic effects, neurotoxic manifestations, haemotoxicity, acute kidney injury, rhabdomyolysis, cardiotoxicity, autonomic hyperactivity and thrombosis (35). The variations in pathological effects due to snakebite envenoming may be attributed to the extensive variations in the composition of venoms that may occur in both inter and intraspecific allies (36) (37).
Previous research shows that although venom proteins are diverse, the most important pathologic events following envenoming arise from a small group of enzymatic and non-enzymatic components. Out of around 26 toxin families found in snake venoms, the following are the most prevalent and medically important toxins:

(1) Phospholipase A_2 (PLA2);
(2) Metalloproteases (MPs);
(3) Serine proteases (SPs); and
(4) Three-finger toxins (3-FTX)

Pharmacological Actions of Various Venom components

1. **Neurotoxic venom:** this type of venom mainly found in elapid snakes (e.g., Black mamba, cobra, krait and coral snakes) causes muscle paralysis, breathing difficulties, ptosis, impaired neurotransmission, loss of consciousness and death.
2. **Haemotoxic venom:** this type of venom is mainly found in viper snakes such as the Russell's viper, rattlesnakes, and puff adder. This type of venom is likely to affect the blood coagulation cascades, circulating platelets, and lyse red blood cells in victims. This

will result in unnecessary blood clotting within the vasculature or uncontrolled bleeding leading to cardiovascular collapse. Moreover, this venom can damage the blood vessels by destroying basement membrane components such as collagen. As the effects of haemotoxic venoms are relatively slow, the victims can survive with timely treatments including antivenom.

3. **Cytotoxic venom:** It is found in cobras and other elapids as well as some vipers. This venom is not as deadly as haemotoxic or neurotoxic venom, but loss of limbs and other disabilities often result from cytotoxic venoms due to their extensive detrimental effects on local tissues.

Although these are broad classes of venoms, it is critical to understand the impact of individual venoms and their components to relate to their clinical symptoms in victims. This will improve the clinical management procedures to save lives or limbs promptly. Therefore, further research on to the nature, composition, and clinical effects of individual venoms of the medically important species in India using appropriate, in vitro, pre-clinical and clinical approaches.

Consequences of Venom Variation

The compositional and functional variations in snake venoms pose challenges in designing appropriate antivenoms and other alternative therapies for snakebite envenoming. The currently used antivenoms consist of polyclonal antibodies (IgG) or antibody fragments (Fab2) derived from the plasma of hyper-immunised large animals with venoms from several medically important snake species (polyvalent) found in a particular region (38). Hence, the efficacy and specificity of the antivenom used against a particular snakebite depends on the nature of the venom used for immunization (39)mostly rural populations around the world. That snakebite still exists today, as a widely untreated illness that maims, kills and terrifies men, women and children in vulnerable communities, is a cruel anachronism. Antivenom can be an effective, safe and affordable treatment for snakebites, but apathy, inaction and the politicisation of public health have marginalised both the problem (making snakebite arguably the most neglected of all neglected tropical diseases. Moreover, the antibodies produced against the venoms of other snakes are often not helpful in neutralising the venom of the offending snake. If all venoms used are equally immunogenic, there will be a small portion of antibodies specific to the venom of the offending snake. Therefore, research to produce monovalent antivenoms should be initiated along with developing strong clinical guidelines and a diagnostic kit for the identification of the offending snake. In addition, it has been reported that the immunogenicity of toxins used to produce antivenoms often depends on the molecular mass of the toxins. For example, the lower molecular weight toxins are often less immunogenic leading to sub-optimal antibody response in animals and hence a reduced potency against those toxins in victims (40)the low immunogenicity of many small but potent snake venom toxins represents a challenge for obtaining a balanced immune response against the medically relevant components of the venom. Here, we employ high-throughput sequencing of the immunoglobulin (Ig (41)technological innovations have been introduced in the manufacturing process. These medicines must comply with identity, purity, safety and efficacy profiles, as requested by the current Good Manufacturing Practices (GMPs. Some studies have reported that in some cases the antivenom has exhibited cross-neutralization against bites from different snake species. The possible reasons for such cross-neutralization could be due to similar venom or toxin composition as a result of the same family of snakes, shared ancestry or convergent evolution. Further research is required to determine the level of venom variations among medically important species and whether such variations affect

the neutralisation efficacy of currently used antivenoms. If the efficacy of antivenoms is affected by venom variations, the impact of increased doses and refined antivenoms should be evaluated to tackle this issue in snakebite victims (42)bites are uncommon. Consequently, this venom is not used in the mixture of snake venoms used to immunise horses for the manufacture of regional SAIMR (South African Institute for Medical Research (43).

Diagnostics of Snakebite Envenoming

The identification of the offending snake is an important factor during the clinical management of snakebites. Although the polyvalent antivenom is being currently used, such identification is critical in providing associated treatments for snakebite victims. Currently, the identification of the offending species is challenging, but it can be predicted based on various factors such as the circumstances of the bite, clinical manifestations, knowledge of species commonly found in that particular geographical area, and information gathered from the victim or their relatives. In some cases, the victims or their relatives bring dead or live specimens of the offending species, although in some cases they catch the wrong snakes. While this is a dangerous practice, this is helpful in some cases although this is not possible in all cases, e.g. when the bite occurs in the dark. Due to the lack of laboratory-based diagnostics for snakebite envenoming, the only way to investigate and diagnose snakebite is through clinical features and some traditional coagulation test methods. (42) (44).

For example, a 20-minute Whole Blood Clotting test (20WBCT) may be used to assess the clinical severity of viper envenomation and the efficacy of antivenom treatment by identifying the level of coagulopathy Some of the other bedside tests that are being currently used to assess the coagulopathy in snakebite victims include prothrombin time (PT), the International Normalized Ratio of clotting (INR), and activated partial thromboplastin time (aPTT) along with bleeding and clotting times. Similarly, measurement of fibrinogen, fibrin degradation products (FDP), D-dimer, thromboelastography (TEG) and thromboelastometry (TEM, ROTEG, and ROTEM) are being used in some victims (45) (46).

Therefore, the unavailability of affordable, reliable, and quicker diagnostic tests emphasises the urgent need to develop such diagnostic tools for snakebite envenoming.

Limitation of Existing Therapies

As discussed in the previous section, the currently available antivenoms are produced by hyper-immunization of animals like horses, sheep, camels or donkeys. While they help saving lives, they raise numerous questions on their effectiveness, safety, and availability. In addition, there is a scarcity in the evidence demonstrating the efficacy of the antivenoms that are being mainly tested using *in vitro* or *in vivo* experimental approaches as there is a lack of randomised clinical trials. Since the antivenoms that are being used currently are heterologous and, in some cases, nearly 70% of the IgG content is not directed against the venom components of the offending species, early adverse effects like urticaria, itching, tachycardia, nausea, vomiting, abdominal colic, bronchospasm, hypotension, and angioedema have been reported (47) (48) (49) (50).

Therefore, further research to refine and improve the antivenom production is necessary. Some countries have reported the use of monovalent antivenoms against specific snake species.

However, the major hindrance in using monovalent antivenoms is the lack of information about the offending snake species or unique clinical symptoms to ascertain the offending species. However, the accuracy of the syndromic approach is again a question, since there can be an overlap in clinical manifestations in envenoming by different species (51) Therefore, monovalent antivenoms supported by a diagnostic kit will significantly improve the clinical management of snakebites in India.

Recent Advances in Snakebite Envenoming Research

Researchers have long been trying to design new snakebite therapeutics that can circumvent the limitations associated with venom variations using recent advanced technologies of "omic" which can provide a better understanding of the composition and variability of snake venoms (52) (53). Correct identification of the venom components can potentially bring multiple benefits in treating snakebite envenomation. By combining transcriptomics and established proteomics methods, venom composition of 132 species of snakes has been identified (21). Further research is required to analyse such venom variations and how this can be addressed in producing refined antivenoms (54).

The next-generation antivenoms that are currently under development encapsulate a range of different methods including toxin-specific recombinant monoclonal antibodies and antibody fragments, nanobodies, small molecule inhibitors such as repurposed drugs, aptamers, synthetic peptides, metal ion chelators, and antivenoms manufactured using synthetic immunogens that will not be dependent on venoms for its formulation. However, the extensive knowledge of venom composition and clinical toxicity for the individual snake species along with thorough pre-clinical and clinical studies will be required for the successful formulation of such next generation antivenoms.

In an attempt to circumvent venom variation by providing generic inhibition of specific toxin classes, some researchers have explored the use of small molecule inhibitors for specific toxins, with some notable successes against SVMP and PLA2 (55). Researchers have described that the use of the Phase II-approved peptidomimetic small molecule inhibitors for matrix metalloproteases such as batimastat and marimastat, can broadly neutralize multiple viperid SVMPs under in vitro and in vivo settings (56) (57) (58). In similar studies, it has been demonstrated that a Phase II-approved PLA2 inhibitor, varespladib, can broadly neutralize PLA2-mediated pathologies caused by different elapid and viperid venoms (59). Moreover, therapeutic combination of marimastat and varespladib has been reported to provide broad preclinical efficacy against lethality caused by a range of geographically diverse viper venoms (58). Currently, clinical trials are underway to test the efficacy of some of these molecules for snakebite envenoming.

Ultimately, next-generation snakebite therapeutics may not necessarily be based on only one antitoxin format (e.g., antibodies or small molecule inhibitors), but instead seem likely to be composite products comprising of mixtures of different modalities to ensure a broad-spectrum toxin neutralization across numerous distinct snake venoms(60). The recent gains described earlier demonstrate that this is likely achievable in the future as long as sufficient knowledge about venom composition and variation is at hand. However, further research and significant funding support are critical to progress with such advancements on snakebite research.

Saw scaled Viper, *Echis carinatus* (venomous)

CHAPTER 19:

TRIBAL SUB-ACTION PLAN FOR SNAKEBITE ENVENOMING PREVENTION AND CONTROL

Over 104 million tribal people, or one-third of the world's tribal and indigenous population, are estimated to reside in India, according to the Census of India 2011. They make up 705 different tribes and 8.6% of the total population of the nation. Madhya Pradesh has the largest tribal population (15 million), followed by Maharashtra (10 million), Odisha (9 million), and Rajasthan (9 million). In fact, more than two-thirds of India's tribal population live in the 7 states of Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Maharashtra, Gujarat, and Rajasthan. The majority of the nation's tribal population, nearly 90%, resides in rural areas. In 169 districts, the tribal population makes up more than 20% of the total population, and in 809 blocks, the tribal population makes up more than 50% of the total population.

Every tribal community is unique, and the snakebite action plan should be tailored to their specific cultural, environmental, and healthcare needs. Regular evaluation and adjustments are crucial to the success of the plan over time. For laying down a special action plan for tribal population for snakebite envenoming prevention and control requires collaboration between tribal communities, healthcare professionals, and relevant authorities.

A) A general outline of the action plan is:

1. **Assessment and Baseline Data Collection:**
   Collaborate with local health centres, tribal leaders, and researchers to collect following information:
   a) Mapping the snakebite incidents, prevalence, and local snake species for the tribal population
   b) Mapping beliefs and practices of tribal people with respect to snake bite
   c) Mapping the unequipped primary health centres devoid of trained workers in tribal districts
   d) Mapping availability of the standard treatment, anti-snake venom (ASV) in health facilities
   e) Mapping the Traditional healers in the community
   f) Mapping the functional Public Health institutes in tribal districts
   g) Mapping the availability of patient transport system in the tribal districts
2. **Information, Education and Communication for increasing awareness about prevention and control of snakebite envenoming and appropriate treatment for snakebite:**
   - Conduct workshops to educate representatives from tribal population about snakebite risks, prevention, and early treatment. Use local languages, cultural references, and interactive methods to ensure effective communication.
   - Conduct awareness camps in educational institutes/ community gatherings emphasising that alternate forms of treatment practised in villages wherein the victim is first taken to a faith healer (quack) should be strictly avoided as Anti

snake venom is the only treatment for snakebite envenomation.

- Develop regional or local specific IEC on identification of Local Venomous and Non-Venomous snakes.
- Ensure that treatment is available to all snakebite victims irrespective of snake species involved as prompt first aid and immediate transfer to health facility holds key to the survival of victim.
- Train community members in basic snakebite first-aid, such as immobilizing the affected limb and keeping the victim calm while seeking medical help.
- Educate the tribal population about easy ways to prevent snakebite incidents by appropriate clothing and footwear, such as using torches, rubber boots, and "snake safe" harvesting techniques that reduce the risk of snakebites, considering the local climate and customs

  Snake-Human interactions: Collaborate with tribal leaders and environmental experts to develop strategies that reduce snake-human interactions, such as clearing snake habitats away from residential areas.
- Encourage building practices that minimize snake entry into homes, such as sealing gaps and using pest-repellent materials, use of mosquito nets.
- Install signage in strategic locations (Specifically in weekly markets) to warn people about snakebite prone areas and provide information of contacts in cases of emergency
- Conduct intensive pre-monsoon awareness campaigns on snakebite awareness strategies, snakebite management and information of local snake handlers.

Capacity Building:

- Provide training to local healthcare workers to improve their knowledge of snakebite management and first-aid.
- Provide definitive IEC material/guidelines on snakebite management for health professionals and field workers (ASHA/ANMs and paravets/ Media)
- Training the healthcare professional on identifying the local species of snakes in the area
- Local Snake handlers to be trained on rescue and safe release of the snakes.
- PRIs also to be trained along with field workers (ANM, ASHA etc.)

3. **Response and Treatment:**
   - **Emergency Transport:** Establish an efficient system for transporting snakebite victims to the nearest healthcare facility equipped to handle snake envenoming cases.
   - **Anti-Venom Distribution:** Work with healthcare agencies to ensure the availability of anti-venom in nearby health centres.
   - **Traditional Knowledge Integration:** Collaborate with traditional healers and tribal medicine practitioners to integrate their knowledge with modern medical practices for snakebite treatment.
   - **Healthcare Facility Upgrades:** Improvements in local healthcare facilities, ensuring they are equipped with the necessary resources and trained staff to manage snakebite cases. Timely referral to higher centres when required
   - **Telemedicine:** Explore the use of telemedicine to connect remote tribal communities with medical experts who can guide snakebite treatment in real-time.
   - **Traditional healers to refer for treatment at government hospitals**
   - **Emergency Transport-** All ambulances operational in the tribal area to be

equipped with ACLS.

- **Healthcare Facility Upgrades-** Local healthcare facilities to be equipped with necessary resources (such as emergency resuscitation, stabilisation procedures and timely referral).
- **All tribal villages to be equipped with emergency wireless communication facilities**

4. **Long-term Sustainability:**
    - **Community Engagement:** Maintain an ongoing dialogue with tribal communities, involving them in decision-making and ensuring that the action plan remains culturally sensitive and relevant.
    - **Capacity Building:** Establish training programs that empower tribal members to take ownership of snakebite prevention and response efforts.
    - **Advocacy:** Collaborate with regional health authorities to advocate for policies and resources dedicated to snakebite prevention and management in tribal areas.

B) Key Stakeholders and their roles in Snakebite Management:

A concerted effort on the part of all concerned namely policymakers, health authorities, public servants, ASV manufacturers, forest departments and health caregivers including treating doctors, non-governmental organizations, basic scientists, herpetologists and the lay public would lead to a fall in mortality and morbidity related to this eminently preventable cause of death and disability. The working model for engagement of key stakeholders at different Level may be as follows:

National Level:

- Ministry of Health and Family Welfare
- Ministry of Tribal Affairs
- Ministry of **Environment, Forest and Climate Change**
- Ministry of Human Resource Development
- Ministry of **Panchayati Raj**
- National Disaster Management Authority
- National Human Rights Commission

State Level:

- State Health Department
- State Forest Department
- State Tribal Department
- State Disaster Management Authority

District Level:

- District Health Office
- Zila Parishad CEO Office
- District Forest Officer
- Project Officer (Tribal Department)
- Gram Panchayat office
- Rural Development Department
- Local Civil Society/NGO
- Capacity building of frontline healthcare workers on first-aid and early referral

Village Level:

- Civil Society
- Private Sector
- ASHA Worker
- Sarpanch
- Gram Sewak
- Rojgar Sewak
- Krishi Sewak
- Anganwadi Supervisors
- Self Help Groups
- Teachers
- Wildlife Rescuers
- Community Educators

Table: Role and responsibilities of stakeholders in snakebite prevention and control among tribal population

Level of Execution	Stakeholders	Roles and Responsibilities
Nodal agency for planning and execution at the centre	NCDC, MOHFW Centre of One Health Nodal officer of Tribal Department	• Mapping of high-risk areas and actions for prevention and control measures accordingly • To provide training to healthcare Professionals, Paravets and other allied personnel on program management and implementation. ·Liaise with different stakeholders/agencies/international organizations (e.g. FAO, WOAH, WHO, SAARC, UNDP) for technical support • Monitor and evaluate the control programs implemented by field units
Nodal agency for planning and execution at State level	State Nodal Officer	Develop and Implement the State action plan for tribal areas as per activities envisaged under National Action Plan

Level of Execution	Stakeholders	Roles and Responsibilities
District Level	District health officer Identified District Nodal Officer (SNO) for Snakebite Nodal officer of Tribal Department	• To develop region specific module for the training and capacity building of traditional healer in that area. • Training the clinical staff for preventing and managing ASV reactions • Training and Capacity building of local healers about the basics of envenoming and referral • Ensure that adequate stock of anti-snake venom is always maintained at the Health care facilities (PHC/CHC) • Ensure 24X7 Availability of Anti snake venom in designated health care facilities • Ensure that drugs for treating ASV reactions are available at facilities designated for ASV therapy at PHC/CHC • Give feedback to ASV manufacturers and service providers
Block LEVEL	Block Medical Officers Ministry of Tribal Affairs NGOs	• Implementation of the program at ground level • Reporting to district nodal officer (DNO), feedback to DNO for refinement/betterment of the program as per field scenario • Enhancing medical knowledge and skilling of tribal youth about Snakebite prevention and Management • Get traditional Healers mapped down with the local Medical Officer and with help of him capacity building can be done there at local level • Impart training and capacity building to local healers and educating people for Snakebite Management • Provision of patient transport to nearest health care facilities such as bike ambulances in tribal dominated areas. The bike ambulance services can work in collaboration with nearest sub-centres / PHCs.

Level of Execution	Stakeholders	Roles and Responsibilities
Community Level	Identified community Leaders, Tribal Youth and community mobilizers, influencers for health and other programmes Identified faith healers NGOs ASHA ANM	Raise Awareness through • One on one visits with community leaders and members; • Visit existing and established small groups to inform them of the issue of snakebite; • Make one on one phone calls to friends and potential supporters. • Discuss descriptive local incidents related to the issue; • Approach and engage local educational/ health outreach programs to assist in the effort with flyers, posters, or brochures; • Begin to point out media articles that describe local critical incidents; Prepare and submit articles for church bulletins, local newsletters, club newsletters, etc.; and • Present information to local related community groups.

C) Roadmap for implementing a tribal action plan for snakebite envenoming prevention and control:

Phase	Phase 1 (2 Years)	Phase 2 (4 years)	Phase 3 (2 Years)
Action Plan	Appointment of Nodal officers Identify key stakeholders: Tribal leaders, healthcare professionals, local NGOs, researchers, and government representatives. Conduct a baseline assessment: Gather data on snakebite incidence, local snake species, healthcare infrastructure, and traditional practices related to snakebites. Form a multidisciplinary task force: Bring together experts from medical, ecological, cultural, and communication backgrounds. Development of Micro Plan for snakebite prevention and management at tribal level Assess healthcare facilities: Identify gaps in equipment, resources, transport facilities and staff training for managing snakebite cases. Advocate for upgradation: Collaborate with regional health authorities and NGOs to secure funding and resources for healthcare facility improvements. Liaise with different stakeholders/agencies/international organizations (e.g. FAO, WOAH, WHO, UNDP, SAARC) for technical support	Organize community meetings: Introduce the plan, emphasize the importance of community involvement, and listen to local concerns and suggestions. Develop culturally relevant educational materials: Create brochures, videos, and posters that explain snakebite risks, prevention measures, and first-aid in the local language. Train local educators and volunteers: Equip them to deliver informative and engaging workshops within the tribal communities. Train local healthcare providers: Offer workshops on snakebite management, first-aid, and proper administration of anti-venom. Monitoring and Surveillance of snakebite cases, snakebite death, symptoms of toxicity. Establish emergency transport networks: Coordinate with local transportation providers to ensure swift and safe transfer of snakebite victims to healthcare centres. Explore telemedicine options: Establish partnerships with telemedicine providers to offer remote guidance in critical cases.	Maintain ongoing communication: Keep the community engaged, informed, and motivated to sustain prevention efforts. Recognize achievements and milestones to maintain enthusiasm and commitment. Advocacy and creating awareness Share lessons learned and best practices to contribute to a broader understanding of effective snakebite prevention and control in tribal settings.

LIST OF CONTRIBUTORS

Core Committee for NAPSE (Members)

- Chairperson Prof.(Dr.) Atul Goel, Director NCDC and Director General of Health Services, Ministry of Health & Family Welfare, Government of India
- Dr. Jitendra Prasad, Additional Director General, Ministry of Health & Family Welfare, Government of India
- Dr. S. Venkatesh, Principal Advisor, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India
- Dr. Aya Yajima, Regional Adviser, Neglected Tropical Disease Control, WHO Regional Office for South-East Asia (SEARO)
- Dr. Polin Chan, Team Lead, Communicable Diseases, World Health Organization-India
- Dr. J. N. Srivastava, Advisor, Quality & Patient Safety, National Health System Resource Centre, Government of India
- Dr. Vinita Srivastava, Advisor, Ministry of Tribal Affairs, Government of India, New Delhi
- Dr. Sunil Gupta, Principal Consultant, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India
- Dr. Rubina Bose, Deputy Drug Controller, Central Drugs Standard Control Organization, Drug Controller General of India, Government of India
- Dr. Joy Krushna Jena, Director General-Animal Science, Ministry of Agriculture & Farmer Welfare, Government of India
- Dr. Dimple Kasana, Director, Central Research Institute, Kasauli
- Dr. Bhabani Das, State Nodal Officer-Snakebite Prevention & Control, West Bengal Health Department, Government of West Bengal
- Dr. Joy Kumar Chakma, Scientist F, Indian Council of Medical Research- Headquarter, New Delhi
- Dr. Rashmi Shukla, National Professional Officer, World Health Organization, India
- Dr. Ravikar Ralph, Professor, Clinical Toxicology Unit & Poisons Information Centre, Department of Medicine, Christian Medical College, Vellore, Tamil Nadu
- Dr. Manu Ayyan, Assistant Professor, Department of Emergency Medicine & Trauma, Jawaharlal Institute of Postgraduate Medical Education & Research, Puducherry
- Dr. S. A. Laskar, State Nodal Officer-Snakebite Prevention & Control, Assam Health Department, Government of Assam
- Dr. Usha Padmanabhan, Senior Scientific Officer, Haffkine Institute for Training and Research, Mumbai
- Dr. Vijay Kumar Teotia, Joint Commissioner, Department of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi
- Gnaneshwar Ch, Project Lead (Snakebite Mitigation Project), Madras Crocodile Bank and Centre for Herpetology
- Hafsa Ahmed, Consultant, NITI Aayog, Government of India
- Dr. Simmi Tiwari, Joint Director and Head, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Ajit Dadaji Shewale, Deputy Director, Centre for One Health, National Centre for Disease

Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Tushar Nanasaheb Nale, Deputy Director, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi

Centre for One Health Team

- Dr. Aastha Singh, Research Officer, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Arvind Prakash Srivastava, Senior Pubic Health Specialist, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Dipti Mishra, Consultant, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Gajendra Singh, Wildlife Officer, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Hanul Thukral, Epidemiologist, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Mahesh Chandra, Entomologist, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Nidhi Khandelwal, Technical Officer (Ecology), Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. Raghavendra A.H., Assistant Director, Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi
- Dr. S. Balaji, Consultant (Microbiologist), Centre for One Health, National Centre for Disease Control, Ministry of Health & Family Welfare, Government of India, New Delhi

State Nodal Officers- Snakebite Prevention and Control

- Dr. Antara Banik, State Nodal Officer-Snakebite Prevention & Control, National Health Mission, Tripura
- Dr. B. Malleshwary, Joint Director, IDSP, Department of Public Health & Family Welfare, Andhra Pradesh
- Dr. B.R. Jemini, Joint Director (PHCs), State Nodal Officer- Snakebite Prevention & Control, Department of Public Health and Preventive Medicine, Chennai, Tamil Nadu
- Dr. Bucka Oraon, Deputy Director, Health Services cum SNO- Snakebite Prevention & Control, Jharkhand health department, Jharkhand
- Dr. Cecil Ahongshangbam, State Nodal Officer-Snakebite Prevention & Control, Manipur Health Department, Manipur
- Dr. Dharmendra Gahwai, State Nodal officer- Snakebite Prevention & Control, Directorate of Health Services, Chhattisgarh
- Dr. Harshad Prajapati, State Nodal Officer-Snakebite Prevention & Control, Epidemic Branch, Health Department, Gujarat
- Dr. Hiten Banyal, State Nodal Officer- Snakebite Prevention & Control, National Health Mission, Himachal Pradesh
- Dr. Manav Singh, State Nodal Officer- Snakebite Prevention & Control, Head Office Punjab, Chandigarh, Punjab
- Dr. Mary Zohmingliani, State Nodal Officer-Snakebite Prevention & Control, National Health Mission, Mizoram
- Dr. Nishikant, Deputy Director Public Health, State Nodal Officer, DGHS Office, Haryana

- Dr. Pankaj Saxena, State Nodal Officer-Snakebite Prevention & Control, Joint Director, Directorate of Medical & Health Services, Uttar Pradesh
- Dr. Prashant Suryawanshi, State Surveillance Officer, State Nodal Officer-Snakebite Prevention & Control, Integrated Disease Surveillance Programme, DHS Panaji-Goa
- Dr. Praveen Aswal, State Nodal Officer, IDSP, SBPC, Directorate Medical and Health Services, Jaipur, Rajasthan
- Dr. Rita Pohrmen, Jointt Director of Health Services, State Nodal Office- Snakebite Prevention & Control, Integrated Diseases Surveillance Programme, Directorate of Health Services (MCH & FW), Meghalaya
- Dr. S. Ragunanthanan, State Nodal Officer-Snakebite Prevention & Control, Madras Medical College, Chennai, Tamil Nadu
- Dr. Subhash Chandra Mandal, State Nodal Officer- Snakebite Prevention & Control, Swasthya bhawan, ADGS-MPHWS, West Bengal
- Dr. Surajit Garabadu, State Nodal Officer-Snakebite Prevention & Control, Odisha health department, Odisha
- Dr. Triveni M G, State Nodal Officer-Snakebite Prevention & Control, Office of JD-CMD, Arogya Soudha, Bangalore, Karnataka
- Dr. Vikram Khan, State Nodal Officer-Snakebite Prevention & Control, Daman & Diu & Dadar & Nagar Haveli

Field experts and other Stakeholders

- Avinash C. Visvanathan, General Secretary, Friends of Snakes Society, Telangana
- Dr. Amit Pritam Swain, Epidemic Intelligence Officer, National Centre for Disease Control,
- Ministry of Health & Family Welfare
- Dr. A. Durairaj, Senior Medical Officer, Indira Gandhi Govt General Hospital & Post Graduate Institute, Puducherry
- Dr. Ajay Kumar Tahlan, Consultant, Central Research Institute, Kasauli
- Dr. Anil Yadav, Associate Vice President, Antisera Production & Antisera R&D
- Dr. Arunabha Dasgupta, Professor & Head of Department, Department of Medicine, Agartala Government Medical College, Tripura
- Dr. Ashok Kumar, ESIC, Ministry of Labour and Employment, Government of India
- Dr. B.P. Kurhe, Manager, Haffkine Bio Pharmaceutical corporation limited
- Dr. Ch. Arunkumar Singh, Associate Professor, Department of Medicine, Jawaharlal Nehru Institute of Medical Sciences, Manipur
- Dr. Chiranjeev Bhattacharjya, National Programme Manager-HSS, Health Systems Strengthening Unit, United Nations Development Programme
- Dr. Dileep P. Punde, MBBC & MD, Punde Hospital Mukhed, Dist. Nanded, Maharashtra
- Dr. Dhirubhai C Patel, Vice-Chairman, Snake Research Institute, Gujarat Forestry Research Foundation, Government of Gujarat
- Dr. Dhruva Chaudhary, Senior Professor and Head of Department, Department of PCCM, Pandit. B D Sharma, Post Graduate Institute of Medical Sciences, Rohtak, Haryana
- Dr. Diwakar, Assistant Professor, Rajendra Institute of Medical Sciences, Ranchi., Jharkhand
- Dr. Himadri Kumar Pal, M.O. ICU, Deben Mahato Government Medical College & Hospital, Purulia, West Bengal
- Dr. Himmat Bawaskar, Expert, Bawaskar Hospital & Research Centre, Raigad, Maharashtra
- Dr. Jaideep Menon, Professor of Cardiology, Amrita Institute of Medical Sciences, Amrita University, Kochi, Kerala, India
- Dr. Joseph Dena, Anesthesiologist/MO I/C Casualty, District Hospital, Siaha, Mizoram

- Dr. Kathrina Marbaniang, Senior Medical Specialist, Civil Hospital Shillong, Meghalaya
- Dr. Lallianpuii Kawlni, Scientist D, Wildlife Institute of India, Government of India
- Dr. Mohabatpal Singh, Medical Specialist, Civil Hospital, Gurdaspur, Punjab
- Dr. Mrunal Ghag Sawant, Head of the Department, Haffkine Institute for Training, Research & Testing, Maharashtra
- Dr. Munesh Meena, Associate Professor Medicine, JLN Medical College, Ajmer, Rajasthan
- Dr. Nilay Mozarka, Pediatrician incharge, District Hospital, Raipur, Chhattisgarh
- Dr. Nimesh Jitubhai Chaudhari, MD Physician, General Hospital Vyara, Health & Family Welfare , Gujarat
- Dr. Omesh Bharti, State Epidemiologist, SIHFW Parimahal, Kasumpati Shimla, Himachal Pradesh
- Dr. Parmod Kumar Rawat, Superintendent, Community Health Centre, Noghasanm, Lakhimpur, Kheeri, Uttar Pradesh
- Dr. Parul Bhatnagar Ridani, Wildlife/Technical expert, Gujarat Forest Department, PCCF Office, Gandhinagar, Gujarat
- Dr. Prabhjot Kaur, Epidemiologist, Civil Surgeon Office, Gurdaspur District, Punjab
- Dr. Pragya Yadav, Scientist 'F' and Group Leader, NIV Pune
- Dr. Prasad, Director (Zoo), IFS, Telangana Forest Department, Telangana
- Dr. Rahul Gajbhiye, Scientist E, ICMR- National Institute For Research In Reproductive and Child Health, Maharashtra
- Dr. Rajneesh Rana, Principal Scientist (AH), Animal Science Division, Indian Council of Agricultural Research (ICAR), Ministry of Agriculture and Farmers Welfare, Governmnet of India, New Delhi
- Dr. Ranjan Kumar Pal, Senior Medicine Specialist, Capial Hospital, Bhubaneswar, Odisha
- Dr. Sadanand Raut, Shivneri Bhushan, MD(Gen.Med.), Consultant Physician, Cardiologist, Diebetologist, Toxinologist, Maharashtra
- Dr. Sanjay Shukla, Member Secretary, Central Zoo Authority, Ministry of Environment, Forest and Climate Change, Government of India
- Dr. Santosh Kumar Sinha, Deputy Director, Ministry of Panchayati Raj, Government of India
- Dr. Surajit Giri, Consultant- Anesthesiologist, Assam Demow Model Hospital, Sivasagar, Assam
- Dr. V. Prakash, Senior Medical Officer, Indira Gandhi Govt General Hospital & Post Graduate Institute, Puducherry
- Dr. Vrinda Lath, Lead, Human-Wildlife Conflict Mitigation, Education, Manipal Birding and Conservation Trust
- Dr. Yaduraj D K, Medical Officer, Government General Hospital, Puttur, Dakshina Kannada, Karnataka
- Dr. Freston Marc Sirur, Associate Professor, Manipal Academy of Higher Education, Manipal
- Dr. Milind Khadilkar, Technical Director, Premium Serums & Vaccines Pvt.Ltd.
- Dr. S. Sridhar, Senior Assistant Professor of General Medicine, Madras Medical College, Chennai, Tamil Nadu
- James Reid, Executive Director, Global Snakebite Initiative USA Foundation
- Kartik Sunagar, PhD, Assistant Professor, Wellcome Trust/DBT India Alliance Fellow, Evolutionary Venomics Lab, Centre for Ecological Sciences, Indian Institute of Science, Bangalore
- Kedar Bhide, Director, Nature Works, Maharashtra
- Leena Menghaney, Regional Head (South Asia) and Global IP Advisor, Medecins Sans Frontieres – Access Campaign

- Mr. Darshan Patel, Plants head, Vins Bioproducts Limited, Telangana
- Mr. Nikhil Sharma, Sales head, Vins Bioproducts Limited, Telangana
- Ms. Jyoti Kumar, State Entomologist, IDSP, Directorate Medical and Health Services, Jaipur, Rajasthan
- Ms. Nisha Raj, Snake Research Institute & Deputy Conservator of Forests, Valsad, Government of Gujarat
- Dr. Priyanka Kadam, President and Founder, Snakebite Healing and Education Society, Maharashtra
- Prof. M.Bhaskar, Coordinator, M.Sc.,Animal Biotechnology (UGC Innovative Programme), Deptartment of Zoology, Sri Venkatshewara University, Tirupati
- Prof. Sakthivel Vaiyapuri MSc., PhD., FRSB, Professor in Cardiovascular & Venom Pharmacology, Royal Society Leverhulme Trust Senior Research Fellow
- Shri Madan Lal Soni, Director (AR), Nodal Officer of Department of Higher Education, Ministry of Education, Government of India
- Shri Sunil Sharma, Joint Director (Wildlfie), Ministry of Environment, Forest and Climate Change, Government of India
- Shubhra Sotie, Research and Policy Specialist, The Liana Trust and HSI/India
- Sumanth Bindumadhav, Director- Wildlife protection, The Liana Trust and HSI/India
- Vishal Santra, Herpetologist/Researcher, Society for Nature Conservation Research and Community Engagement (CONCERN), West Bengal
- Dr. Kripa Murzello, Senior General Manager, Head- Research & Development (R&D) Biologicals, Bharat Serums and Vaccines Limited
- Dr. Saswata Banerjee, Senior General Manager, Medical Affairs, Bharat Serums and Vaccines Limited
- Dr. Divyesh Mundra, Manager, Health Policy and Market Access, Bharat Serums and Vaccines Limited

REFERENCES

1. Snakebite envenoming [Internet]. [cited 2023 Dec 22]. Available from: https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming
2. Suraweera W, Warrell D, Whitaker R, Menon G, Rodrigues R, Fu SH, et al. Trends in snakebite deaths in India from 2000 to 2019 in a nationally representative mortality study. eLife. 9:e54076.
3. Thakur V. Sociodemographic profile of patients with snakebite in Jharkhand. Int J Adv Med. 2022 Sep 23;9(10):1001.
4. Chakma JK, Menon JC, Dhaliwal RS. White paper on venomous snakebite in India. Indian J Med Res. 2020 Dec;152(6):568–74.
5. Kumar S. Worship of Snakes in the Shivalik Hills; A histroical Perspective. [cited 2023 Dec 22]; Available from: https://www.academia.edu/42617664/Worship_of_Snakes_in_the_Shivalik_Hills_A_histroical_Perspective
6. Jayawardana S, Arambepola C, Chang T, Gnanathasan A. Long-term health complications following snake envenoming. J Multidiscip Healthc. 2018 Jun 26;11:279–85.
7. Snakebite envenoming India [Internet]. [cited 2023 Dec 27]. Available from: https://www.who.int/india/health-topics/snakebite
8. Novel approaches to empower Indian communities in their fight against snakebite envenoming [Internet]. [cited 2024 Feb 14]. Available from: https://www.who.int/news/item/18-09-2022-novel-approaches-to-empower-indian-communities-in-their-fight-against-snakebite-envenoming
9. Rodríguez Pérez D. The Meaning of the Snake in the Ancient Greek World. Arts. 2021 Mar;10(1):2.
10. Wallach V, Williams K, Boundy J. Snakes of the World. A Catalogue of Living and Extinct Species. Snakes of the World: A Catalogue of Living and Extinct Species. 2014.
11. Whitaker R, Martin G. Clinical Toxinology in Asia Pacific and Africa. In 2015. p. 115–36.
12. Sharma RC. The fauna of India and the adjacent countries. Reptilia. Calcutta: The Survey; 1998. 1 p.
13. Ahmed SM, Ahmed M, Nadeem A, Mahajan J, Choudhary A, Pal J. Emergency treatment of a snake bite: Pearls from literature. J Emerg Trauma Shock. 2008;1(2):97–105.
14. Mehta S, Sashindran V. Clinical Features And Management Of Snake Bite. Med J Armed Forces India. 2002 Jul;58(3):247–9.
15. Das J. Poison apparatus and the biting mechanism of snakes.
16. Gutiérrez JM, Calvete JJ, Habib AG, Harrison RA, Williams DJ, Warrell DA. Snakebite envenoming. Nat Rev Dis Primer. 2017 Sep 14;3(1):17063.
17. World Health Organization. Snakebite envenoming: a strategy for prevention and control [Internet]. Geneva: World Health Organization; 2019 [cited 2024 Feb 15]. 50 p. Available from: https://iris.who.int/handle/10665/324838
18. World Health Organization - Regional Office for the Eastern Mediterranean [Internet]. [cited 2023 Dec 22]. WHO EMRO | Public health surveillance | Health topics. Available from: http://www.emro.who.int/health-topics/public-health-surveillance/index.html
19. Seifert SA, White J, Currie BJ. Commentary: Pressure Bandaging for North American

Snake Bite? No! J Med Toxicol. 2011 Dec;7(4):324–6.
20. Avau B, Borra V, Vandekerckhove P, De Buck E. The Treatment of Snake Bites in a First Aid Setting: A Systematic Review. PLoS Negl Trop Dis. 2016 Oct;10(10):e0005079.
21. Tun-Pe null, Aye-Aye-Myint null, Khin-Ei-Han null, Thi-Ha null, Tin-Nu-Swe null. Local compression pads as a first-aid measure for victims of bites by Russell's viper (Daboia russelii siamensis) in Myanmar. Trans R Soc Trop Med Hyg. 1995;89(3):293–5.
22. Bush SP, Green SM, Laack TA, Hayes WK, Cardwell MD, Tanen DA. Pressure immobilization delays mortality and increases intracompartmental pressure after artificial intramuscular rattlesnake envenomation in a porcine model. Ann Emerg Med. 2004 Dec;44(6):599–604.
23. Murrell G. The effectiveness of the pressure/immobilization first aid technique in the case of a tiger snake bite. Med J Aust. 1981 Sep 19;2(6):295.
24. Pearn J, Morrison J, Charles N, Muir V. First-aid for snake-bite: efficacy of a constrictive bandage with limb immobilization in the management of human envenomation. Med J Aust. 1981 Sep 19;2(6):293–5.
25. van Helden DF, Thomas PA, Dosen PJ, Imtiaz MS, Laver DR, Isbister GK. Pharmacological Approaches That Slow Lymphatic Flow As a Snakebite First Aid. PLoS Negl Trop Dis. 2014 Feb 27;8(2):e2722.
26. Diagnostic 20-min whole blood clotting test in Russell's viper envenoming delays antivenom administration - PubMed [Internet]. [cited 2023 Dec 22]. Available from: https://pubmed.ncbi.nlm.nih.gov/23674721/
27. Wedasingha S, Isbister G, Silva A. Bedside Coagulation Tests in Diagnosing Venom-Induced Consumption Coagulopathy in Snakebite. Toxins. 2020 Sep 10;12(9):583.
28. Lamb T, Abouyannis M, de Oliveira SS, Shenoy K R, Geevar T, Zachariah A, et al. The 20-minute whole blood clotting test (20WBCT) for snakebite coagulopathy-A systematic review and meta-analysis of diagnostic test accuracy. PLoS Negl Trop Dis. 2021 Aug;15(8):e0009657.
29. Harikrishnan M, Rohan K V, Ayyan M. Trimeresurus Malabaricus Bites: Need of Species-specific Management for Snakebites. J Emerg Trauma Shock. 2020 Apr 1;13:167.
30. A Tropical Kiss by a Malabar Pit Viper - PubMed [Internet]. [cited 2023 Dec 22]. Available from: https://pubmed.ncbi.nlm.nih.gov/34865965/
31. T HP, R AKC, John BM. A study on clinical and laboratory features of pit viper envenomation from Central Kerala, India. Int J Adv Med. 2018 May 22;5(3):644–51.
32. Jk J, Id S, Nc M, Mp J, Kj K, Gb R, et al. First authenticated cases of life-threatening envenoming by the hump-nosed pit viper (Hypnale hypnale) in India. Trans R Soc Trop Med Hyg [Internet]. 2007 Jan [cited 2023 Dec 22];101(1). Available from: https://pubmed.ncbi.nlm.nih.gov/16839578/
33. Ca A, Mh S, C A, Rd T, Da W. Syndromic approach to treatment of snake bite in Sri Lanka based on results of a prospective national hospital-based survey of patients envenomed by identified snakes. Am J Trop Med Hyg [Internet]. 2009 Oct [cited 2023 Dec 22];81(4). Available from: https://pubmed.ncbi.nlm.nih.gov/19815895/
34. Seifert S, White J, Currie B. Commentary: Pressure Bandaging for North American Snake Bite? No! J Med Toxicol Off J Am Coll Med Toxicol. 2011 Nov 8;7:324–6.
35. Snakebite envenoming | Nature Reviews Disease Primers [Internet]. [cited 2024 Jan 17]. Available from: https://www.nature.com/articles/nrdp201763
36. Laxme RRS, Attarde S, Khochare S, Suranse V, Martin G, Casewell NR, et al. Biogeographical venom variation in the Indian spectacled cobra (Naja naja) underscores the pressing need for pan-India efficacious snakebite therapy. PLoS Negl Trop Dis. 2021 Feb 18;15(2):e0009150.
37. Rashmi U, Khochare S, Attarde S, Laxme RRS, Suranse V, Martin G, et al. Remarkable

intrapopulation venom variability in the monocellate cobra (Naja kaouthia) unveils neglected aspects of India's snakebite problem. J Proteomics. 2021 Jun 30;242:104256.
38. Evolution Bites — Timeworn Inefficacious Snakebite Therapy in the Era of Recombinant Vaccines | Indian Pediatrics [Internet]. [cited 2024 Jan 17]. Available from: https://link.springer.com/article/10.1007/s13312-021-2158-x
39. Williams DJ, Gutiérrez JM, Calvete JJ, Wüster W, Ratanabanangkoon K, Paiva O, et al. Ending the drought: new strategies for improving the flow of affordable, effective antivenoms in Asia and Africa. J Proteomics. 2011 Aug 24;74(9):1735–67.
40. Laustsen AH, Engmark M, Clouser C, Timberlake S, Vigneault F, Gutiérrez JM, et al. Exploration of immunoglobulin transcriptomes from mice immunized with three-finger toxins and phospholipases A2 from the Central American coral snake, Micrurus nigrocinctus. PeerJ. 2017;5:e2924.
41. León G, Vargas M, Segura Á, Herrera M, Villalta M, Sánchez A, et al. Current technology for the industrial manufacture of snake antivenoms. Toxicon Off J Int Soc Toxinology. 2018 Sep 1;151:63–73.
42. Whiteley G, Casewell NR, Pla D, Quesada-Bernat S, Logan RAE, Bolton FMS, et al. Defining the pathogenic threat of envenoming by South African shield-nosed and coral snakes (genus Aspidelaps), and revealing the likely efficacy of available antivenom. J Proteomics. 2019 Apr 30;198:186–98.
43. The paraspecific neutralisation of snake venom induced coagulopathy by antivenoms | Communications Biology [Internet]. [cited 2024 Jan 17]. Available from: https://www.nature.com/articles/s42003-018-0039-1
44. Frequent and potentially fatal envenoming by hump-nosed pit vipers (Hypnale hypnale and H. nepa) in Sri Lanka: lack of effective antivenom - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/18455743/
45. Delayed double reading of whole blood clotting test (WBCT) results at 20 and 30 minutes enhances diagnosis and treatment of viper envenomation - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/29796013/
46. Hadley GP, McGarr P, Mars M. The role of thromboelastography in the management of children with snake-bite in southern Africa. Trans R Soc Trop Med Hyg. 1999;93(2):177–9.
47. Laustsen AH. Guiding recombinant antivenom development by omics technologies. New Biotechnol. 2018 Oct 25;45:19–27.
48. Laustsen AH. Toxin-centric development approach for next-generation antivenoms. Toxicon Off J Int Soc Toxinology. 2018 Aug;150:195–7.
49. Efficacy and safety of two whole IgG polyvalent antivenoms, refined by caprylic acid fractionation with or without beta-propiolactone, in the treatment of Bothrops asper bites in Colombia - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/16698053/
50. Safety and efficacy of a freeze-dried trivalent antivenom for snakebites in the Brazilian Amazon: An open randomized controlled phase IIb clinical trial | PLOS Neglected Tropical Diseases [Internet]. [cited 2024 Jan 17]. Available from: https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0006068
51. Providing Antivenom Treatment Access to All Brazilian Amazon Indigenous Areas: "Every Life Has Equal Value" - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/33291444/
52. Toxins | Free Full-Text | A Wolf in Another Wolf's Clothing: Post-Genomic Regulation Dictates Venom Profiles of Medically-Important Cryptic Kraits in India [Internet]. [cited 2024 Jan 17]. Available from: https://www.mdpi.com/2072-6651/13/1/69
53. Senji Laxme RR, Khochare S, Attarde S, Kaur N, Jaikumar P, Shaikh NY, et al. The Middle

Eastern Cousin: Comparative Venomics of Daboia palaestinae and Daboia russelii. Toxins. 2022 Nov;14(11):725.
54. A Review and Database of Snake Venom Proteomes - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/28927001/
55. Albulescu LO, Hale MS, Ainsworth S, Alsolaiss J, Crittenden E, Calvete JJ, et al. Preclinical validation of a repurposed metal chelator as an early-intervention therapeutic for hemotoxic snakebite. Sci Transl Med. 2020 May 6;12(542):eaay8314.
56. Layfield HJ, Williams HF, Ravishankar D, Mehmi A, Sonavane M, Salim A, et al. Repurposing Cancer Drugs Batimastat and Marimastat to Inhibit the Activity of a Group I Metalloprotease from the Venom of the Western Diamondback Rattlesnake, Crotalus atrox. Toxins. 2020 May 9;12(5):309.
57. Effectiveness of batimastat, a synthetic inhibitor of matrix metalloproteinases, in neutralizing local tissue damage induced by BaP1, a hemorrhagic metalloproteinase from the venom of the snake bothrops asper - PubMed [Internet]. [cited 2024 Jan 17]. Available from: https://pubmed.ncbi.nlm.nih.gov/10825472/
58. Albulescu LO, Xie C, Ainsworth S, Alsolaiss J, Crittenden E, Dawson CA, et al. A therapeutic combination of two small molecule toxin inhibitors provides broad preclinical efficacy against viper snakebite. Nat Commun. 2020 Dec 15;11(1):6094.
59. Gutiérrez JM, Lewin MR, Williams DJ, Lomonte B. Varespladib (LY315920) and Methyl Varespladib (LY333013) Abrogate or Delay Lethality Induced by Presynaptically Acting Neurotoxic Snake Venoms. Toxins. 2020 Feb 20;12(2):131.
60. Casewell NR, Jackson TNW, Laustsen AH, Sunaga K. Causes and Consequences of Snake Venom Variation. Trends Pharmacol Sci. 2020 Aug 8;41(8):570.

ANNEXURES

Annexure 1

विशाल चौहान, भा.प्र.से.
संयुक्त सचिव
VISHAL CHAUHAN, IAS
Joint Secretary

आज़ादी का अमृत महोत्सव

भारत सरकार
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
निर्माण भवन, नई दिल्ली - 110011
GOVERNMENT OF INDIA
MINISTRY OF HEALTH & FAMILY WELFARE
NIRMAN BHAVAN, NEW DELHI - 110011
Tele: 011-23063585 / 23061740
e-mail: js.policy-mohfw@gov.in

DO No. M-11016/42/2021-NHM-II
Dated the 05th January 2023

Dear Colleagues

As you are aware, that Mission Steering Group (MSG) of National Health Mission (NHM) has approved the inclusion of activities for Prevention & Control of Snake Bites at District and State Level under existing components of National Health Mission. Please refer to the Minutes of the MSG meeting dated 07.09.2022 available at GoI NHM website at link: https://nhm.gov.in/New_Updates_2018/Monitoring/MSG/7th-MSG-of-NHM-Minutes.pdf).

In continuation of above, a D.O. letter no. ISCP/57155/06/2022/DZDP/NCDC dated 20.10.2022 (copy attached) from Additional Secretary, Govt. of India has been issued wherein it was requested to submit the proposals on activities for prevention and control of Snake Bite envenoming in PIP matrix for FY 2023-24.

In this regard, this is to inform that an additional row (budget line) on 'Prevention, control and management of snakebites' has been added at Sl. No. 200 of the PIP Budgeting format 2023-24 in which States/UTs may propose the concerned budget requirement.

It is therefore requested to submit the supplementary proposal on activities for prevention and control of Snake bite envenoming in attached 'Annexure-1 Revised PIP matrix' to E-mail id: pipprocess2023.24@gmail.com latest by 15th January 2023.

With best wishes

Encl. As above

Yours sincerely,

(Vishal Chauhan)

To,
- ACS/PS/Secretary(HFW) – All States/UTs
- Mission Director (NHM) – All States/UTs

Copy to:
- PPS to Secretary(HFW), MoHFW
- PPS to AS&MD(NHM), MoHFW
- PS to Director – NHM (I/II/III/IV), MoHFW
- PS to ED, NHSRC

Annexure 2

Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Annual Reporting Format (State)

State Name	
Year	
Name of the Nodal Officer – Snakebite Prevention	

Number of Snakebite Cases and Deaths reported in the State (Month wise)

Months	Snakebite Cases in the State				Snakebite Deaths in the State		
	No. of Snake-bite case reported	Top five Priority districts report-ing snake-bite cases	Top five Blocks report-ing snake-bite cases	Total No. of Snakebite Envenom-ing report-ed	No. of snake-bite deaths reported	Top five priority districts report-ing snake-bite deaths	Top five priority blocks report-ing snake-bite deaths
January							
Febru-ary							
March							
April							
May							
June							
July							
August							
Septem-ber							
October							
Novem-ber							
Decem-ber							

*Any clustering of the cases observed – Yes/No (If Yes, provide details)

Status of availability of Anti-Snake Venom

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)	

Health facility having Anti-Snake Venom

Type of Health facilities	Total Health Facilities in State	No. of Health Facilities having ASV	Compliance (%)
Medical Colleges			
DHs			
SDH			
CHCs			
PHCs			

Annexure 3

Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Monthly Reporting Format (State)

NATIONAL SNAKEBITE ENVENOMING REPORTING FORMAT **National Centre for Disease Control** **Ministry of Health and Family Welfare, Government of India**						
State Monthly Report						
State Name:						
Name and contact information of State Nodal Officer:						
Month and Year of Reporting:						
Number of Facilities submitted report / Total no. of health facilities providing facility for snakebite management in state:						
Number of snakebite cases and deaths reported in state (District-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 shared with State Forest/Wildlife department						
Any stakeholders meeting conducted on Snakebite						
Number of trainings conducted at State and District level in current year						
Number of field visit 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 locality						
Any other remarks						
Date:						

Annexure 4

Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Monthly Reporting Format (District)

NATIONAL SNAKEBITE ENVENOMING REPORTING FORMAT National Centre for Disease Control Ministry of Health and Family Welfare, Government of India				
District Monthly Report				
State 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 state:				
Number of snakebite cases and deaths reported in state (block-wise)				
Block	Type of geo-graphical area (Urban/Rural)	Total No. of Snake-bite case reported	Total No. of Snakebite Envenoming reported	Total No. of Snake-bite deaths report-ed.

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 shared with State Forest/Wildlife department	
Any stakeholders meeting conducted on snakebite	
Number of trainings conducted at District and block level in current year	
Number of field visit conducted by District officials to monitor the progress of Snakebite activities	
Any Unusual increase in Snakebite Bite Cases observed? If yes write the details including locality	
Any other remarks	

Annexure 5

Snakebite Prevention and Control

Preparatory Checklist for Management, Prevention and Control of Snakebite at State/ District/Block/Health Facility Level (whichever is applicable)

Name of State/District/Block/Health Facility:
Address of Health Facility:
Contact details of Nodal Officer:
Health Facility Code:

Type of Health Facility (Medical College/DH/SDH/CHC/PHC):

S. no.	Monitoring Parameter	Level	Availability (Yes/No)	Remarks
1	Line list of Snakebite suspected/probable cases maintained, and analysis of data based on high risk population, high risk group etc. completed (If yes, please attach copy of analysis of data)	State/District level		
2	Monthly reports and line list of snakebite cases and deaths maintained	State level		
		District level		
		Block level		
		Health facility level (mention type of health facility)		
2	Training on Prevention and control of Snakebite held at state level/district/ block level. (If Yes, Date of training held, list of participants to be attached with checklist)	State level		
		District level		
		Block level		
3	Adequate Availability of Emergency Medicines in all Health care units (State/District/Blocks) for Snakebite management like Paracetamol, Hydrocortisone, Antihistamine, Adrenaline, Neostigmine, Atropine, Tetanus Toxoid, etc. (*Based on suspected cases occurred in previous year + 10% of buffer stock)	State level		
		District level		
		Block level		
		Health facility level (mention type of health facility)		
4	Availability of beds with machine-supported ventilation unit (as per previous year case data)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		

S. no.	Monitoring Parameter	Level	Availability (Yes/No)	Remarks
5	Availability of dialysis unit (as per previous year case data)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		
6	Availability of ASV (as per previous year case data)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		
7	Status of availability of laboratory test required for the diagnosis of Snakebite (Whole blood clotting test, peak flow meter, urine analysis, Prothrombin time, platelet count, clot retraction time, LFT, RFT etc)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		
8	Total Capacity of admitting snakebite cases in ICU (as per previous year case data)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		
9	Referral linkage from PHCs/CHC's to Snakebite management centres established	PHC/CHC level		
10	Availability of Trained manpower at Snakebite management facility (Yes/No)	State level Hospitals/Medical Colleges		
		District level Hospitals		
		SDH/CHC/PHC		
11	Availability of Reporting Formats for Day to day surveillance Reporting of snakebite at all level	State level		
		District level		
		Block level		
12	Media plan prepared for generating community awareness regarding prevention of snakebite in community	State and District level		
13	IEC prototypes (pamphlets', posters, Audio/video spots) available in Hindi /English /local language for dissemination.	State and District level		
14	Community and high-risk occupations awareness meetings	State level		
		District level		
		Block level		

S. no.	Monitoring Parameter	Level	Availability (Yes/No)	Remarks
15	Preparation of Ambulatory services for referral transport of the suspected and probable cases	State level		
		District level		
		Block level		
16	List of review meetings held at state level where Snakebite surveillance issues were discussed with details (dates, agenda) 2016 to 2018	State level		
17	Feedback given to districts related to Snakebite surveillance in the current year	State level		
18	Press releases/statements issued on snakebite cases reported in media; etc.	State level		
		District level		
		Block level		
19	Inter-sectoral Coordination: - Meetings with Representative from Forest/Wildlife Department (if yes please provide the minutes of the meeting and proposed action plan.)	State level		

Annexure 7

Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India
SNAKE BITE EXPOSURE REGISTER

Name of Health Facility:
Type of Health Facility (Medical College/District hospital/Sub-divisional hospital/CHC):
Address of Health Facility:
Contact details of Health Facility:
Reporting Month and Year:
Health Facility Code:
Any clustering of cases observed (If yes, write details):

Registration		**Patient details**				**Exposure Details**		**Anti-Snake Venom (ASV) treatment**		**Clinical details of the patients**	
Registration No.	Date	Name	Age	Sex	Residential Address	Date of Bite	Address where snake-bite incident took place	ASV given (Yes/No)	Symptoms of Envenoming present (Yes/No)	Clinical picture of the patient (Asymptomatic/ Symptomatic/ critical)	Outcome of Patient (Discharged/ Death)

Annexure 8

Centre for One Health
National Centre for Disease Control
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of India

Line List of Suspected/Probable deaths due to Snakebite

Name of the Health Facility/Block/District/State:
Month and Year of reporting:
Address of the Hospital:
Type of Health Facility/Block/District/State:
Name and Designation of Nodal Person:
Contact Information:

Patient Details								Exposure Details				Case Details		
S. No.	Name	Date of death	Age	Sex	Contact No. of patient's kin	Patient's Address with District/Taluk/ Block	Type of geographical area (Urban/ Rural)	Time taken by patient to reach health facility	Suspected/ Probable snakebite death (to be confirmed by medical officer)	Biting snake, if identified	Address of place where bite incident took place	Status of ASV given (Yes/ No)	Name & type information of health facility that reported snakebite death with contact information	Weather patient brought dead at the time of admission (Yes/No)

To be reported by health facilities to District Nodal Officer, State Nodal Officer & National Programme Division (Delhi) at snakebitencdc@gmail.com by 5th of every month.

Annexure 9

The list of manufacturers and their capacity are given below;

S. No.	Name of Manufacturer	Installed Capacity (vials per annum)
1.	M/s Virchow Biotech Pvt. Ltd.	4,32,000
2.	M/s Haffkine Biopharmaceuticals Corporation Limited	4,50,000
3.	M/s Biological E. Limited	8,40,000
4.	M/s Premium Serums and Vaccines Pvt. Ltd.	14,40,000
5.	M/s Bharat Serums and Vaccines Limited	21,00,000
6.	M/s VINS Bioproducts Limited	13,60,000
7.	M/s Central Research Institute	10,000
8.	M/s Serum Institute of India Pvt. Ltd., Pune	1,20,000
Total		**67,52,000**

***Note: This is as per information provided by DCGI in FY 2022-23. The above information is subject to change**

Annexure 10

Financial Provision under Snakebite Management

Under the Ministry of Health and Family welfare, National Health Mission is providing the financial support to all the states/UTs every year for strengthening the National Health Programs through PIP mechanism of National Health Mission

To strengthen activities for prevention and control of snakebite envenoming, Mission Steering Group (MSG) of National Health Mission has also approved the financial support to all the states/UTs through NHM PIP for the following activities for snakebite prevention and control: -

1- Training & capacity building of Medical officers/Health Workers at state & district level
2- Meetings to review the activities under snakebite prevention at state & district level.
3- Surveillance and Monitoring at state & district level.
4- Procurement of Anti Snake Venom (ASV) drug for health facilities.

The budget amount is approved for the FY 2022-24 is given in table below. Budget amount may differ for the next FY under the snakebite activities. Budget may be proposed by the State NHM for the above activities through NHM-PIP under S. No. 200 of the PIP budgeting sheets. The details of the budget for the snakebite activities are given below: -

S. No	Respective head of A/C	Activity	Approved budget norm under NHM-PIP
1	Training & Capacity Building	State level training	-Rs 5,45,150/- per annum / state (Maximum) -Rs 272575/- per annum /UT (maximum)
		District level training	-Rs 19560/- per annum / district (Maximum)
2	Meeting	Meeting and office/ administrative expenses at State level	-Rs 3,00,000/- per annum / state (Maximum)
		Meeting and office/ administrative expenses at District level	-Rs 50,000/- per annum/district (Maximum)
3	Surveillance and Monitoring	State level Surveillance and Monitoring	-Rs 7,00,000/- per annum / state (Maximum)
		District Level Surveillance and Monitoring	-Rs 50,000/- per annum/district (Maximum)
4	Drugs	Procurement of Anti Snake Venom (ASVs)	Calculation made on the basis of Snakebite cases in State/UT

The above budget is as per the MSG approval in FY 2023-24 and subject to change as per programme requirements and approval of competent authority of MoH&FW.

Annexure 11

Snakebite: Key Messages for Prevention and Control

Following are the key messages for Snakebite Prevention and Control.
Target population – High risk group (Farmers/Agricultural workers, Fishermen, Tribal and forest workers general population residing in affected areas, school children etc.)

Prevention of snakebites

1. General precautions

- If you see a snake, do not try to pick it up or kill it; give it a clear path to leave the area**, maintain a safe distance and gently move away**. Snakes do not confront humans and do not attack from a distance.
- **People should be aware of their local snakes, toxicity status** (venomous and non – venomous), activities, activity cycles, and habitats, dwelling spots and hideouts.
- **Always maintain a safe distance from snakes**, including from those that enter human habitation.
- **Wear sturdy closed-toe footwear and exercise vigilant caution while navigating through the bush.**
- **Be vigilant** of snakes, especially **during the rainy season. Hatchlings** of several species, including **cobras, emerge out during the monsoon.** Additionally, **snakes in flood-inundated areas may be forced out of their burrows**, which may then wander in search of warmer, drier terrain, including houses**,** roads, fields, etc.
- Snakes do not attack unless they are **handled, threatened, trapped, cornered,** or **stepped on**.
- When walking through a forest, wearing a hat or cap offers protection from bites of tree-dwelling snakes.
- **Do not pick up a snake that is either dead** or appears dead. Even accidental scratching from the fangs of a snake's severed head can deliver venom.
- Even a juvenile venomous snake has fangs and venom, so do not ignore bites by a small snake.
- **Chemical or natural repellents are ineffective in repelling snakes**. While bleaching powder or gammaxene application may not deter snakes, they may repel small creatures like rats and frogs, thereby, avoiding snakes that may come in search of prey.
- In case of snake bite, get to the nearest health facility that stocks and administers anti-snake venom.

2. Home/environment

- **Use a torch light or lamp while walking outside at night**. Do not step or walk in areas where the ground is not visible.
- **Always check shoes**/footwear before wearing them.
- **Do NOT put hands, fingers, or feet into holes,** nests, or hidden places, where snakes may live.
- Carefully prod and examine any material for hidden snakes that have been on the ground before picking it up.
- **Try to avoid sleeping on the ground**. If unavoidable, **use a mosquito net that is well**

tucked in under the mattress or sleeping mat.

- Avoid open-air defecation, especially in the dark. If unavoidable, carry a torch or lamp**. Constructing indoor toilets** while constructing a new house would be an ideal practice.
- **Clear heaps of rubbish, building materials, and termite mounds in and around human habitation.**
- **Regularly trim ornamental plants, grass, and undergrowth, especially around the buildings. This practice would remove any hideouts for snakes or their prey.**
- Where ever possible, apply smooth plastering on the outer side of the boundary wall to discourage snakes from climbing over and entering human dwellings.
- **Cut tree branches** that enter your boundary. Snakes may scale vegetation to enter human spaces.
- **Discard garbage responsibly. Rodent control should be top priority to keep snakes away.**
- **Store firewood at a distance from the house,** to prevent snakes from hiding in it and coming into the house**.**
- **Avoid housing livestock and poultry indoors, as this may attract** snakes seeking to prey on them. Additionally, store animal feed away from the house or inside a close space, as it can attract rodents, and in turn attract snakes.
- **Seal the holes in the house/around the premises** to prevent snakes from entering.
- **Keep plants away from doors and windows** as snakes like cover and climb on them into the windows. Trim branches of creepers and trees so that they are not too near your window.
- The mouth of rain-water overflow may be covered with a mesh to avoid entry of snakes.
- **Inspect mud-made chulhas** first before cleaning them.
- Examine beddings for snakes before using it in areas where snakebites are common.

3. Farmers/Agricultural workers

- Wear protective gloves and shoes (gumboots) while working in fields.
- Complete farm work early and **avoid walking in late evenings** to minimize the risk of snake bites, as most incidents occur during this time.
- **Use a stick while cutting/collecting grass** or picking fruits or vegetables or clearing the base of trees. With the stick move the grass or leaves first, which gives a chance for the snake to move away
- While **harvesting crops like millets** which are cut at head height, **keep checking the ground ahead**

4. Trekkers/Adventurers

- **During trekking** through forests or mountains it is advised to **stay on clearly marked tracks. Step on to rocks or logs rather that straight over them** so that snakes if present on either side can slither away
- Rock climbers and trekkers often seek support in rocky crevices as they climb. While doing this ensure that no creature is lurking within

5. Fishermen

- **Fishermen should not touch sea snakes** caught in their nets
- Sea snakes are often seen lying immobile in marshy and sandy areas. Avoid the

temptation to touch and prod them.

6. Snake catchers and charmers

- Only trained personals should be involved in catching and handing the snake
- Appropriate handling of snake to prevent inadvertent bites and injury to the snake
- Always wear protective equipment's which handling the snake.
- Avoid exhibition and shows after catching the snake in public.
- After snakebite – Do's The symptoms of snakebite include progressive painful swelling of limb (viper bite), neuroparalytic symptoms like ptosis (drooping of eyelids), double vision, difficulty in speaking, hoarseness of voice, difficulty in respiration and difficulty in swallowing (cobra, krait bite), vasculotoxic symptoms like bleeding, tissue necrosis, kidney injury (Russel's viper/Saw-scaled viper), myotoxic symptoms like muscle pains (sea snake) or severe abdominal pain and vomiting (krait bite). **Inform the doctor about any of these symptoms or any new symptom which has occurred**
- Seek medical help immediately. If necessary walk with support (try not to run) to get help
- Take a picture of the snake on mobile phone from a distance or try to remember what it looked like to describe to the doctors. It is advised not to waste time on this if it is difficult to do.
- Arrange for transport of patient to an equipped medical care facility as quickly, safely, and passively as possible by ambulance (toll free no. 102/108, etc.), or any other suitable means of transport (bicycle, stretcher, boat or motorbike).
- **Keep the patient calm.** Reassure the victim that the bites can be effectively treated in an emergency room with ASVS.
- **Do not apply any pressure or force, including heat and electricity at the bite site.**
- **Restrict the movement** of the affected part by immobilizing the limb with a sling (as in a fracture), with a **loose splint** which should not restrict blood supply. Keep the affected area below the heart level to reduce the flow of venom.
- **Rinse the venom in the eyes** with running water in case of spitting snakes
- **The victim should not exert themselves after a snakebite. Running or self-driving to a health facility could speed up blood flow in the body.**
- **Remove the shoes, belt, rings, watches, jewellery, or tight clothes** from the affected area as these can act like a tourniquet when swelling occurs
- **Make the patient lie in** prone, on the left side, with the right leg bent and hand supporting the face so that the patient will breathe better and the chances of aspiration of vomitus are minimized
- Inform the doctor about any observable envenomation symptoms, including swelling, drooping of eyelids, slurring of speech etc.
- **If the bitten area begins to swell and change colour,** the snake was probably **venomous**
- **Blisters,** if any should be **left undisturbed**

If possible, **monitor the person's vital signs** like temperature, pulse, rate of breathing, and blood pressure. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket

After snakebite - Don’ts

- Do not waste time with traditional remedies (black stones, sacrifice) and alternative medicine/herbal therapy as they are ineffective and do harm by delaying the treatment.
- Do not allow the victim to become over-exerted or panic.
- Do not run as this will increase the speed at which the snake venom spreads through the body
- Do not wash the wound or interfere with the wound (by rubbing, vigorous cleaning, massage, cutting, suturing, suction, tattooing, application of herbs or chemicals) as this may increase the absorption of venom and increase local bleeding or infection
- Do not apply or inject anti-snake venom locally in the wound
- **Do not apply a tourniquet** or cold compress to the snakebite site. Application of tourniquets cannot occlude the arteries, and release of tourniquets will cause sudden release of toxins into blood circulation which can result in sudden symptoms like fall in blood pressure. Victims with ligatures tend to believe that venom flow has been stopped, thus delay in seeking medical attention and less urgency. It carries the danger of necrosis (tissue death) and loss of limb in cobra and viper bites, and inadequate blood supply if left in place more than 40 minutes. If applied, it should be removed only in presence of a doctor in a health facility
- **Electrical therapy has no role in snakebite first-aid and cryotherapy may do more harm**
- Do not try to suck out the venom or cut into the wound by a razor or knife; these can cause infection and venom spread
- Do not rub the eye if the snake has spit venom into the eye. Rubbing causes irritation to the eye and spreads the venom
- Do not give the person stimulants or pain medications unless prescribed by doctor
- Do not give the person anything by mouth after a snakebite
- Do not raise the site of snakebite above the level of the person’s heart
- Do not attempt to kill or catch the snake as it is dangerous and time might be wasted hunting for the snake and there is risk of another snakebite. Even a dead snake or a severed head can bite for several hours due to reflex activity. Take a picture of snake for identification by an expert

Annexure 12

IEC prototype: Key messages for developing print IEC (e.g., pamphlets/poster/billboards etc.)

How to prevent snakebites – set 1

1. If you see a snake, do not try to pick it up or kill it. Maintain a safe distance or move away**.**
2. **Wear closed-toe footwear and watch your step in the bush. Use a torch in the dark.**
3. **Be vigilant** about snakebites **during rainy seasons, especially, after flooding when snakes come out of their holes.**
4. **Do not pick up a snake that is dead as it can still inject venom**
5. **Use torch light while walking outside at night**
6. **Use a stick to move the grass while walking cutting/collecting grass** or picking fruits, which gives a chance for the snake to move away

How to prevent snakebites – set 2

1. Keep distance from snakes.
2. **Use torch light while walking outside at night and walk with shoes on and heavy steps** to make sound
3. **Do not put hands or fingers or feet into holes or crevices**
4. **Try to avoid sleeping on the ground**. If unavoidable, **use mosquito net that is well tucked** in
5. **Clear heaps of rubbish, building materials and termite mounds near house premises; close rat holes**
6. **Do not keep livestock or poultry indoors** as snakes may be attracted to hunt them
7. **Inspect mud made chulhas** first before cleaning them
8. **Trim the branches of creepers and trees** so that they are not too near your windows.
9. Put up protective netting on windows that will keep out snakes and also lizards and similar pests.
10. There should not be a large gap beneath the door in areas where snake seek inside houses for shelter.

Snakebite: First-aid – set 1

1. Keep calm, move away from the snake and do not panic; do not attempt to kill or catch the snake
2. Seek medical help immediately
3. **Restrict the movement** of the bitten part
4. **Remove shoes, belt, rings, watches, jewellery or tight clothes** from the affected area
5. **Do not apply a tourniquet or cold compress**
6. **Do not waste time in traditional treatments**
7. **Go to a hospital as fast as you can as injecting anti-venom is the only cure**

Snakebite: First-aid – set 2

1. Seek medical help immediately. If necessary walk with support (try not to run) to get help
2. Do not attempt to kill or catch the snake. If possible, take the picture of the snake on mobile phone.
3. Do not waste time in traditional first-aid methods (black stones, scarification) and alternative medicine/herbal therapy
4. Keep the victim calm and take him to the hospital immediately
5. **Restrict the movement** of the affected part by immobilizing the limb as in a fracture, by creating a **loose splint**
6. Remove any tight encircling object in the bitten area or limb as it will be difficult to remove when the parts become swollen
7. Antivenom administration is the only treatment for snakebite

Ministry of Health & Family Welfare
Government of India

DO'S & DON'TS DURING SNAKEBITE

DO'S

Stay calm and reassure the bitten person.

Move slowly away from the snake.

Leave the wound area (or bite mark) alone.

Remove the shoes, belt, rings, watches, jewellery or tight clothes from the affected area.

Make the patient lie in prone, on the left side, with the right leg bent and hand supporting the face.

Rush to the nearest health facility for medical treatment.

DON'TS

DON'T allow the victim to become over-exerted or panic.

DON'T attack or kill the snake. If you are close enough to hurt it, it can defend itself by biting you.

DO not cut and apply or inject any anti-snake vemon locally on the wound.

Don't tie the affected area to stop blood circulation. It can lead to loss of limbs.

DON'T lay the patient on his/her back. Lying on the back can block the airways.

Don't use traditional methods or any unsafe treatments.

SNAKEBITE PREVENTION AND CONTROL

www.mohfw.nic.in
www.mygov.in
www.pmindia.gov.in

mohfwindia
@MoHFW_INDIA

CALL AT 15400

http://ncdc.gov.in/
@director_NCDC

SNAKEBITE

Let’s put an end to snakebite deaths

Developed By
Centre for One Health
National Centre for Disease Control
Director General of Health Services
Ministry of Health and Family Welfare
Government of India