National Snakebite Strategy & Costed Plan of Action

Non-Communicable Disease Control Programme

Directorate General of Health Services

July 2025

নূরজাহান বেগম
উপদেষ্টা
স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

Nurjahan Begum
Adviser
Ministry of Health & Family Welfare
Government of the People's Republic of Bangladesh

Message

I am happy to learn that National Snakebite Strategy of Coasted Plan of Action has been prepared by the initiative of Non-Communicable Disease Control of Director General of Health Services in collaboration with World Health Organization (WHO).

Our health system is not yet fully ready to deal the snakebite cases. Absence of community intervention, lack of adequate emergency care system, poor first aid knowledge, and delay in arriving health facility are few important reasons for high mortality following snakebite in Bangladesh. There is also lack of trained health care providers who can deal with antivenom with confidence in primary health care. The lack of organ support is another area which leads to a tendency to refer the patients to tertiary care institutes. In tertiary care hospitals, there is also lack of optimum logistics and uniform management protocol.

Considering the huge impact on public health mortality and morbidity there is a need for a separate program for managing the snakebite cases in Bangladesh. Among the neglected tropical diseases, snake bite remained the number one cause of death and physical disability and has a serious impact on socioeconomic status of Bangladesh. To mitigate the problem not only health system improvement is crucial but also collaboration and communication with GO, NGO, private and international agencies is also important.

National snake bite strategy with coasted action plan has been prepared with rigorous methodology and aligns with the sustainable development goal (SDG) with projected target for Bangladesh. This approved strategy will be a model for any country around the globe to mitigate the snakebite of a country. The success of having such time bound strategy and coasted action plan will be only reflected if all the activities and sub activities in this strategy can be followed with appropriate measures.

I wish the strategy would help Bangladesh to create a health system which can effectively manage snake bite patient from community to tertiary care effectively.

Nurjahan Begum

সচিব

স্বাস্থ্যসেবা বিভাগ
স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

Secretary

Ministry of Health & Family Welfare
Government of the People's Republic of Bangladesh

Message

Snakebite envenomation remains a serious yet preventable public health challenge, particularly in rural and agricultural communities. Each year, many lives are lost or permanently affected due to delayed treatment, limited awareness, and inadequate access to effective anti-venom. Ensuring the safety and well-being of our people is a priority for the Health Services Division, and I would like to reaffirm our commitment to strengthening snakebite prevention and treatment across the country.

Antivenom is the center of management of venomous snake bite. Access to a new antivenom developed specifically for Bangladesh would bring many benefits. Venom Research Centre (VRC) in Chittagong Medical College was built under NCDC program of Ministry of Health and Family Welfare with an aim of doing basic, molecular and clinical research with venom from our own venomous snakes, for doing neutralization and other proteinomics test and to evaluate environmental steps for initiation of making antivenom by the pharmaceuticals companies of our own.

The snake bite strategy with costed action plan of Bangladesh is prepared with the goal of the strategy is to prevent and control snakebite envenoming in order to halve the number of deaths and disability by 2030. This goal can be achieved by obtaining four objectives which includes empowering and engaging communities, providing treatment including antivenom, strengthen health systems and increasing partnership, coordination and resources.

Bangladesh Government is committed to attain the sustainable development goal (SDG) and universal health coverage by 2030. To mitigate the snake bite problem and ensuring prevention, treatment and rehabilitation, we need to pass through a litmus test to ensure appropriate scientific management of every snake bite case, in this soil and that can only be achieved by strictly following the action plan prepared in this national strategy of snake bite in Bangladesh.

Md. Saidur Rahman

Message

Prof. Dr. Md. Abu Jafor
Director General (Grade-1)
Directorate General of Health Services
Government of the People's Republic of Bangladesh

Snakebite envenoming remains a neglected yet deadly public health challenge in Bangladesh, disproportionately affecting rural and underserved communities. Each year, thousands of our citizens particularly farmers, children, and women suffer the consequences of snakebites, often with limited access to timely and effective treatment. Snakebite causes around 450000 envenomation and more than 7500 deaths per year in Bangladesh among rural poor, mostly farming and fishing community. Primary care team is not yet ready to provide treatment. First aid provided is inappropriate. Community concept of prevention of snakebite is not usual and arrival to hospital for treatment is delayed. Treatment seeking to 'Ozha' is common. The deleterious effect is imminent by these traditional intervention and ensure early fatality and serious morbidity in Bangladesh. The young earner of the family become victim on their activity of daily living and trapped into serious economic crisis. Recognizing the urgency of this issue, the Directorate General of Health Services (DGHS), under the Ministry of Health and Family Welfare, has taken a decisive step forward.

I am proud to present the National Snakebite Strategy and Costed Action Plan 2023-2028, a comprehensive roadmap aligned with the World Health Organization's global strategy to halve snakebite deaths and disabilities by 2030. This strategy is the result of extensive collaboration among public health experts, clinicians, researchers, and community stakeholders.

The strategy is built around four core objectives:

1. Empowering and engaging communities to prevent snakebites and seek timely care.
2. Ensuring effective and safe treatment through improved access to antivenom, trained personnel, and referral systems.
3. Strengthening health system with surveillance, research, and data systems to guide evidence-based interventions.
4. Collaboration and communication and thus building institutional capacity and governance to sustain and scale up snakebite mitigation efforts.

The accompanying Costed Action Plan outlines specific activities, timelines, and budgetary requirements to operationalize these objectives. It emphasizes investments in community education, health worker training, antivenom supply chains, and facility readiness particularly in high-burden districts.

This strategy is not merely a policy document; it is a call to action. We must work together across government, civil society, academia, and international partners to ensure that no life is lost to a preventable and treatable condition like snakebite.

I urge all stakeholders to embrace this plan with commitment and urgency. Together, we can build a safer, healthier Bangladesh where every citizen, regardless of geography or income, is protected from the threat of snakebite.

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Prof. Dr. Md. Abu Jafor

Message

Prof. Dr. Syed Zakir Hossain
Former Line Director
Non Communicable Disease Control,
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of the People's Republic of Bangladesh

Snakebite envenoming is one of the oldest and most significant public health problems, particularly in rural and hard-to-reach areas of Bangladesh, contributing to preventable deaths, disabilities, and socio-economic burdens. Deaths due to snakebite rank first among all poisoning-related deaths. In 2017, the World Health Organization (WHO) included snakebite envenoming in the list of "Neglected Tropical Diseases." According to WHO estimates, global annual deaths from snakebite range between 81,000 and 138,000.

A survey conducted by the NCDC, DGHS in 2022 estimated that approximately 450,000 snakebite incidents and more than 7,500 snakebite-related deaths occur each year in Bangladesh, predominantly among the rural poor. Recognizing this burden, the National Snakebite Strategy and Costed Plan of Action has been developed to provide a comprehensive framework for prevention, timely case management, and post-exposure care.

I am proud to present the National Snakebite Strategy and Costed Plan of Action of Bangladesh, which has been prepared with the goal of achieving the Sustainable Development Goal (SDG) commitment to halve snakebite-related deaths and disabilities by 2030. This goal will be pursued through four key objectives: empowering and engaging communities; ensuring access to effective treatment, including antivenom; strengthening health systems; and enhancing partnerships, coordination, and resource mobilization. This approved strategy will serve as a model for countries around the globe in mitigating the burden of snakebite.

I am confident that all stakeholders will embrace the National Snakebite Strategy and Costed Plan of Action with commitment and urgency to ensure that no life is lost to a preventable and treatable condition like snakebite. Together, we can build a safer and healthier Bangladesh, where every citizen regardless of geography or income is protected from the threat of snakebite-related death.

Prof. Dr. Syed zakir hossain

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PART B

ANNEX

ABBREVIATIONS AND ACRONYMS

ACSM	Advocacy, Communication, and Social Mobilization
ADR	Adverse Drug Reaction
AIDS	Acquired immunodeficiency syndrome
AKI	Acute kidney Injury
ALS	Advanced Life Support
APAMT	Asia Pacific Association of Medical Toxicology
AV	Antivenom
BBS	Bangladesh Bureau of Statistics
BCC	Behaviour Change Communication
BITID	Bangladesh Institute of Tropical and Infectious Diseases
BLS	Basic Life Support
BMDC	Bangladesh Medical and Dental Council
BNCC	Bangladesh National Cadet Corps
BRAC	Bangladesh Rural Advancement Committee
BSITD	Bangladesh Society of Infectious and Tropical Diseases
CBHC	Community Based Health Care
CC	Community Clinic
CDC	Communicable Disease Control
CG	Community Group
CHCP	Community Health Care Provider
CHWs	Community Health Workers
CMC	Chittagong Medical College
CMCH	Chittagong Medical College Hospital
CMSD	Central Medical Stores Depot
COVID-19	Coronavirus Disease 2019
CSR	Corporate Social Responsibility
CS	Civil Surgeon
DGHS	Directorate General of Health Services
CSG	Community Support Group
DGDA	Directorate General of Drug Administration
DGMS	Directorate General of Medical Services
DH	District Hospital
DIHS2	District Health Information Software 2
DMCH	Dhaka Medical College Hospital
DP	Development Partners
EPI	Expanded Programme on Immunization
EDCL	Essential Drugs Company Limited

FAO	Food & Agriculture Organization
FWA	Family Welfare Assistant
GDP	Gross Domestic Product
GIS	Geographical Information System
GOB	Government of Bangladesh
HFWC	Health and Family Welfare Centre
HRs	Human Resources
HSS	Health System Strengthening
HPLC	High Performance Liquid Chromatography
HPNSP	Health, Population, and Nutrition Sector Programme
HSM	Hospital Services Management
HWWs	Healthcare Workers
ICU	Intensive Care Unit
ICD-10	International Classification of Diseases 10th Revision
IEC	Information, Education and Communication
INGO	International non-governmental organization
IPC	Interpersonal communication
IPH	Institute of Public Health
ISBAD	International Snakebite awareness Day
IUCN	International Union for Conservation of Nature
KAP	Knowledge, Attitude, and Practice
LGED	Local Government Engineering Department
LLIN	Long Lasting Insecticidal Net
MHV	Multipurpose Health Volunteers
MIS	Management Information System
MoH&FW	Ministry of Health and Family Welfare
MO	Medical Officer
MOLGRD	Ministry of Local Government and Rural Development
NAP	National Action Plan
NCD	Non- Communicable Disease
NCDC	Non- Communicable Disease Control
NEC	National Eye Care
NGOs	Non-Governmental Organizations
NSP	National Strategic Plan
NSSP	National Snakebite Strategic Plan
NTC	National Technical Committee
NTD	Neglected Tropical Disease
OIE	World Organization for Animal Health
OP	Operational Plan
PIP	Project Implementation Plan
PKSF	Palli Karma-Sahayak Foundation
PME	Performance Framework with Indicators
PPP	Public Private Partnership

SAARC	South Asian Association of Regional Cooperation
SACMO	Sub-Assistant Community Medical Officer
SBCC	Social and Behavioral Change Communication
SDG	Sustainable Development Goal
SEA	South-East-Asia
SEARO	South-East-Asia Regional Office
SMART	Specific, Measurable, Achievable, Relevant, and Time Bound
SOP	Standard Operating Procedure
STH	Soil Transmitted Helminthiasis
SWAp	Sector-Wide Approach
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TB	Tuberculosis
TSB	Toxicology Society of Bangladesh
UHC	Universal Health Coverage
UH&FPO	Upazila Health and Family Planning Officer
UHS	Upazila Health System
UzHC	Upazila Health Complex
UZ	Upazila
VDP	Village Defence Party
VRC,B	Venom Research Centre, Bangladesh
WHA	World Health Assembly
WHO	The World Health Organization

EXECUTIVE SUMMARY

Snakebite envenoming is one of the important rural community emergencies predominantly among the poor farming community, causing more than 100,000 annual deaths globally (81,000 – 138,000 per year) and several times higher numbers of physical and psychological disability. Bangladesh data is limited by the absence of regular and separate snakebite surveillance data from the health system; early survey data estimated 589,919 cases and 6041 deaths annually. Data on snakebite related disability among survivors is sparse and incomplete.

The World Health Organization (WHO) has had a long history of interest in snakebite that dates back as early as the 1950s. The South-East Asia Regional Office of WHO also had a consultation meeting on snakebite in the 1980s. In the last few years there were successive initiatives to address snakebite mitigation: the WHO Resolution (2018) (World Health Assembly, WHA71.5) reinstating snakebite envenoming as a neglected tropical disease followed by the development of a document, 'Snakebite Envenoming - A Strategy for Prevention and Control', and a South-East Asia Region (SEAR) document drafted under the title 'The Regional Snake-bite Prevention and Control Plan of Action'. The WHO global roadmap aims to reduce the deaths and disability following snakebite by 50% by 2030.

Bangladesh was one of the few countries that developed an early National Guideline for Management of Snakebite (2000) and a training module for doctors and health workers through own initiative by the Directorate General of Health Services (DGHS) and the Ministry of Science & Technology, Government of Bangladesh (GOB). An 8-member committee drafted and finalized the guidelines in the course of a workshop. Despite limited resources, a good number of scientific publications of international quality reporting on the local evidence have been generated since the 1990s. Information, Education and Communication (IEC) materials on snakebite were developed, and human resources were appraised on the topic in a continued manner.

There was, however, no significant visible public health programme on snakebite in any country of the SEA region including Bangladesh despite the adoption of a South-East-Asia (SEA) regional resolution in 1982 considering snakebite as an important public health problem.

Bangladesh also played an important role in various steps of the scientific and strategy development on snakebite at the global and regional levels. With renewed interest of WHO, the GOB decided fortunately to develop a strategy for the prevention and control of snakebite conforming with the WHO initiative. For the last four years, the International Snakebite Awareness Day (ISBAD) was observed in Bangladesh with high-level attendance and commitment from the government to address snakebite with due importance, and the programme of ISBAD

had wide-scale enthusiastic participation by many healthcare and allied professionals down to the community level.

A 14-member technical committee on snakebite was formed with Professor Md. Robed Amin, Line Director, Non-Communicable Disease Control (NCDC), DGHS, as the Chair. Review of the background documents on snakebite mitigation was made covering the national, regional, and global documents including key literature. A three-day long brainstorming workshop was held to draft a strategy conforming with WHO documents on snakebite envenoming and related aspects of the WHO neglected tropical disease (NTD) roadmap.

An analysis of strengths, weaknesses, opportunities, and threats (SWOT) was done, Theory of Change was made, and the methodology was formulated to work on the development of the strategy.

Consultations with different stakeholders including professionals, researchers, non-health ministry involvement, participation/perception of the traditional healers, community, and healthcare professionals were held to better understand different needs and perspectives. Several online discussion meetings were held with the concerned officials and departments at WHO Geneva and the WHO South-East-Asia Regional Office (SEARO). An extensive literature review was made, and a good number of webinars on snakes and snakebite were attended by members of the committee.

A three-day-long multi-stakeholder workshop, a one-day stakeholder consultation with the Technical Committee and a two-day-long finalization workshop were arranged. We worked with minimum presentation, had at least four sets of workshops, and 12 plenary sessions on the various areas of the drafted strategy to have valuable input and a continued expert opinion thereafter. Input from public consultations and reviewers' comments were incorporated throughout the three months' time.

National Snakebite Strategy & Costed Plan of Action (NSSP) at a glance

Objectives: The four objectives identified as per the WHO strategy:

1. Empowering and engaging communities
2. Providing safe and effective treatment including antivenom
3. Strengthening the health system
4. Increasing partnerships, coordination, and resource mobilization

For each objective, strategies were identified and so also activities planned to be performed under each strategy.

Key strategic elements

- Identify high risk communities
- Active community engagement and participation
- Improve the prevention, reduce risk and increase avoidance of snakebite envenoming
- Effective first aid and bike/ambulance/motor transport to hospital (effective first aid practices)
- Participate in accelerated development of pre-hospital treatment by participating in clinical trials
- Improve healthcare-seeking behaviours
- Build a strong understanding of (research) socio-cultural, epidemiological (anthropological, qualitative), economic factors, and 'one-health' affecting outcomes
- Provision of incentives for snakebite victims' families, follow-up costs
- Conservation of snakes
- To integrate training and education for healthcare professionals
- To improve clinical decision-making, treatment, recovery and rehabilitation
- Antivenom (AV) development, production, and monitoring
- Ensure safe and effective treatments (AV) are available, accessible and affordable to all
- Improved control and regulation of venoms and antivenoms
- Encourage participation in preclinical and clinical trials on new therapeutics
- Strengthen community health services (develop a community emergency transport system: a cross-cutting issue)
- Facilitate research and policy development to reduce treatment costs
- Improve infrastructure, services, and health facilities
- Include snakebite envenoming in national and sub-national health plans
- Enhance monitoring and surveillance of the disease burden
- Foster research on ecology, epidemiology, clinical outcomes, and therapeutics of snakebite envenoming

- Support governance and leadership
- Promote advocacy, effective communication, and productive engagement
- Enhance integration, coordination, and cooperation
- Strengthen partnerships, cooperation, and alliances
- Coordinate data management and analysis
- Establish a strong, sustainable investment case

Important areas for critical actions considered were: Establishing snake and snakebite surveillance system, gathering snake atlas and snakebite data; community engagement, involving communities in creating community awareness for prevention, seeking early scientific treatment, and avoiding traditional treatment; first aid, quick arrival to hospital, engaging 'Ozha'; multi-stakeholder health and non-health sector coordination at all levels with a high-level steering committee; providing a platform for advocacy, communication and social mobilization (ACSM)- various types and channel mix, etc.; arranging travel from the scene of the bite to hospital, travel cost, prevention of snakebite; involving non-government sector including philanthropy; skilled healthcare professionals (HCPs), initiating antivenom (AV) treatment at Upazila Health Complex (UzHC), taking organ care while referring the patient, developing a 'hub-&-spoke model'; AV & relevant logistics available at hospitals, pharmacovigilance of AV; steps for having Bangladesh-specific AV with venom source, sustaining and strengthening Venom Research Centre, Bangladesh (VRC, B); Medical College Hospitals and District Hospitals (MCH & DH): to be part of 'hub-and-spoke', 24/7 'snakebite clinic' model; follow up to detect disability; coordination within the health system: between Non-Communicable Diseases Control (NCDC) and Neglected Tropical Diseases of Communicable Diseases Control, CDC (NTDs/CDC), Community Based Health Care (CBHC), Upazila Healthcare System (UzHS), Hospital Services Management (HSM) and Management Information System (MIS);adequate domestic and Development Partners (DP) funding, involving non-government sector including philanthropy.

The planning, monitoring and evaluation of the proposed programme was prepared, draft core indicators were identified (30% reduction of deaths and disability by 2028), a framework for tier specific essential logistics drafted (for example, antivenom, drugs for combating adverse reactions to AV, respiratory support), and a coordination-collaboration mechanism including governance (dedicated staff for snakebite programme, committees at different tiers with TOR) was incorporated.

Working together with an economist, officials of NCDC, and experts, the costing of the action plan as per strategy was developed. The action plan was designed for short term (2 years), medium term (3 years) and long term (beyond 5 years) periods. The strategy will be implemented

(proposed) under the NCDC OP of DGHS, MOH&FW, GOB 2023-2028. The resource requirement for this period is estimated to be costed BDT (Bangladeshi Taka) one hundred and fifty-six (156.98) crore (18.69 million USD; considering one USD to be equal to 85 BDT). The resource need is expected to be covered from the upcoming Operational Plan (OP) of the next period, and support from the developing partners will be important as well, including technical assistance from WHO. The NCDC, DGHS/GOB will continue to explore resources from all sectors to fulfil the resource needs for the National Snakebite Strategy Plan (NSSP) 2023-2028.

Part A

1. INTRODUCTION

Snakebite is a new neglected tropical disease (NTD) endorsed by the World Health Organization (WHO) in 2018[1]. In Bangladesh all NTDs are under the Communicable Disease control (CDC) programme except snakebite which is under the Non-communicable Disease Control (NCDC). The 4th Health, Population, and Nutrition Sector Programme (4th HPNSP) January 2017 – June 2022 has limited activities for prevention and treatment of snakebite including animal injury under NCDC Component C: Injury including poisoning and snakebite[2]. While formulating the 4th HPNSP 'Development of Bangladesh Snakebite Policy/Strategy based on WHO SEARO Guidelines 2016 and updating the National Guideline for Management of Snakebite' was envisioned. Meanwhile the WHO prepared 'Snakebite Envenoming, A Strategy for Prevention and Control' in 2019[3]. Soon the NCDC programme of Directorate General of Health Services prepared the 'National Guideline for Management of Snakebite 2019' where development of national strategies for management of snakebite was suggested with six key directions provided[4].

Considering the enormous global burden it causes in tropical resource limited countries, snakebite envenoming has been identified as a priority neglected tropical disease by the WHO in the resolution adopted in WHA 71.5 in 2018[1]. In Bangladesh, snakebite has been a persistent public health emergency especially in rural areas where poor subsistence agricultural farming and fishing communities are predominantly affected.

The WHO has had an interest in snakebite envenoming since immediately after its inception as an organization, and prepared a number of documents related to standardization of antivenom and clinical management guidelines. In its latest and most far-reaching document, the 'WHO Strategy for Prevention and Control of Snakebite Envenoming' published in 2019, the WHO calls on member states to achieve the target of reducing snakebite deaths and disabilities by 50% by 2030[3]. The four strategic objectives of the strategy leading to this reduction are to (1) empower and engage communities; (2) ensure safe and effective treatment; (3) strengthen health systems; (4) increase partnership coordination and resources.

"A central objective is to strengthen national health systems to provide solutions at community level. Access to treatment will be improved, renewing communities' confidence in early treatment with safe, effective, affordable medicine. Innovative research will address clinicians' needs for better diagnosis and treatment. Better case management - from first aid, through hospital care, to post-discharge rehabilitation- will help victims to resume healthy, productive lives".

The Regional Committee of WHO, SEARO discussed in Seventy-second Session in 2-6 September 2019 to develop a Regional Snakebite Prevention and Control Plan of Action covering all four objectives. The activity has already been initiated and is expected to develop the Regional Plan of Action soon.

1.1 Policy and Programme Environment

Snakebite was recognized as an important emergency public health and socio-economic problem for long period in Bangladesh and the first 'National Guideline for Management of Snakebite' was developed in 2000[5]. Despite the earlier absence of WHO strategy the SEA region of WHO developed and updated snakebite management guidelines. Bangladesh proactively formulated commendable limited public health activities for addressing snakebite consistent with commitment to achieve 'Sustainable Development Goals (SDGs) including SDG3- Good Health and Well-being with specific target 3.3 'By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases. Also 'The goal of achieving 'access to safe, effective, quality and affordable essential medicines and vaccines for all' is embedded into UN Sustainable Development Goal (SDG) 3.8, and a central component of Universal Health Coverage (UHC)[6] no one will be left behind'.

Bangladesh is now developing a strategy for prevention and control of snakebite in alignment with the WHO strategy to reduce death and disability by 50% by 2030[3,7]. Bangladesh is one of the few countries who advocated and contributed for endorsing WHO resolution for adopting snakebite as a neglected tropical disease and developing the global strategy for snakebite mitigation[1].

1.2 Process of Developing the First Strategic Plan

There was no separate strategic plan on snakebite. In view of developed WHO strategy 2019 and the recommendations to develop a 'National Strategy for Snakebite Mitigation' NCDC, DGHS formed a committee for preparation of the National Guideline, and an initiative was taken to develop the first strategic plan 'National Snakebite Strategy and Costed Action Plan'. This was developed under the leadership of the Director, NCDC, DGHS with the support of WHO and a 14-member committee was formed (Methodology provided in page 30). The National Snakebite Strategic Plan (NSSP) is aligned with the 'WHO Snakebite Envenoming Strategy for Prevention and Control', the SEARO Regional Document on snakebite prevention and control (draft) and relevant part of new neglected tropical diseases (NTD) roadmap (2021-2030)[1,8,9].

1.3 Alignment of NSSP with National Planning and Budgeting

The National Snakebite Strategic Plan is the health sector investment framework of Bangladesh, developed inclusively by country-led process supported by the country office of WHO. It has policy, strategy, budget, and proposed operational plan. The scope of the strategy has a broad area of involvement of stakeholders covering government (health and non-health sector), development partners including WHO, non-government and philanthropy as well.

The NSSP will be implemented by Operational Plan (OP) and Project Implementation Plan (PIP) and in line with the budgeting cycle of the People's Republic of Bangladesh. The NSSP will be aligned with national planning and budgeting cycle and implementation tools like 5th HPNSP, OP-PIP.

2. COUNTRY PROFILE: BANGLADESH

The People's Republic of Bangladesh is a democratic country in South Asia bordering with India on the west, east and north, Myanmar on the South-East and the Bay of Bengal on the south. It is close to Bhutan and Nepal separated by a narrow strip of India. Around 63.4% population live in the rural areas.

2.1 Demographic Profile

The estimated size of the population of Bangladesh is 164 million. It is the world's eighth most populous country and the fifth most populous in Asia. (Table- 1)

Table 1: Population Statistics in Bangladesh[10]

Population Variables	
Total population in 2019 (in millions)	163
Population, female (% of total population) [2019]	49
Population, rural (% of total population) [2019]	63
Population density per square kilometre (2019)	1,253
Population growth rate per annum (2019)	1.03
Male/Female sex ratio	102/100
The population household size per family unit	5.01

Source: https://datacatalog.worldbank.org/dataset/world-development-indicators; https://knoema.com/atlas/Bangladesh/topics/Demographics/Population/ Population-density; Population growth rate; Male-to-female-ratio

2.2 Geography and Climate

The country is divided into three regions: most part of the country is dominated by fertile Ganges-Brahmaputra delta, central and north-western part formed by the Madhupur and the Barind plateu, the southeast and part of the northeast have evergreen hill tracts. Most part of the delta region are less than 12m above the sea level so most vulnerable to climate change. Only

15.6% of the country is covered by forests and 12% is covered by the hill systems (with highest peak of 1064 of Saka Haphong in Banderban district near the Myanmar border).

The climate is tropical with mild winter from October to February and a hot, humid summer from March to June, warm and humid monsoon from June to October. Bangladesh is highly prone to floods, cyclones, and tornados.

2.3 Administrative and Governance Structure

Bangladesh has a unitary form of government having eight administrative divisions, sixty-four districts and four ninety-five upazilas (sub-district). Each upazila has several unions (4554 altogether), each union consists of three wards further subdivided into nine (Table- 2). Village is the smallest social structure in rural areas.

Table 2: Administrative Structure in Bangladesh[10]

S. No.	Administrative Statistics	Number	Administrative Head
1.	Division	8	Divisional Commissioner
2.	District	64	Deputy Commissioner
3.	Upazila	492	Upazila Nirbahi Officer
4.	Union	4,554	Union Chairman
5.	Ward (in rural area)	40,977	Ward Member
6.	Village (approx.)	87,320	Village Headman
7.	Household/Village (Average)	250-500	Household Head
8.	City Corporation	12	Mayor
9.	Metropolitan City	4	Mayor
10.	Municipality	328	Mayor

Source: Health Bulletin, MoHFW, GoB, 2019; Bangladesh Bureau of Statistics, 2021

2.4 Health System in Bangladesh

The Ministry of Health and Family Welfare (MOHFW) is responsible for planning and management of promotive, preventive, and curative services to the population of the country through different (eight) directorates except in the urban areas primary health care services are provided by the Ministry of Local Government and Rural Development (MoLGRD).

MOH&FW has an organizational structure and health infrastructure at the different administrative levels of the country for policy making, organizing, managing, coordinating, implementing, and regulating health, family planning & nutrition related activities and programmes through a sector-wide approach (SWAp). (Figure 1)

Figure 1: Healthcare service delivery system in Bangladesh[10]

Public Healthcare Services Delivery System Responsible Ministry: Ministry of Health &Family Welfare (MOHFW)				
Health Facilities	DGHS		DGFP	
Medical Colleges: Public (36) & Private (70); Specialized hospitals with post-graduate medical teaching institutes (39)	Principal, Hospital Director & Institute Director		Director	
Division (8) Specialized Hospitals (30)	Divisional Director-Health		Divisional Director-FP	
District (64) District Hospitals (62); MCWC (97)	District Civil Surgeon		District Deputy Director-FP	
Upazila (492) UzHC (490); Hospital (34)	Upazila UH&FPO		Upazila FP Officer	
Unions (4,554) UH&FWC (3,863); USC (1,382)	HI/AHI	MT-Lab & MA	FPI/AFPI	FWV/ SACMO
Wards (40,977) Community Clinic (CC) (13,932)	HA	CC - CHCP	FWA	

Source: Health Bulletin (2019), MoH&FW, GoB

Central level: The NCDC, DGHS has direct responsibility for planning and implementing NCD activities including injury and animal & snakebite; other than snakebite all other NTD activities are under director CDC, DGHS. NCDC is relatively new directorate at DGHS with limited human resources to manage the limited snakebite activities/programme. The existing set up and human resources at different tiers of health care delivery (central, district, upazila) provide NCD services including those of snakebite. Self-motivated health professionals including societies are working on snakebite proactively since 1990s- providing training, creating community awareness and conducting research and providing support to the DGHS. A collaboration with different stakeholders, partners, academia and non-government sectors has been established for NCD control. Bangladesh has a pluralistic system of health care where multiple types of providers are engaged in health care delivery which is particularly true for management of snakebite at the community level (Table 3). Having no structured health insurance system, the poor rural community used to seek care from different low-cost systems of care for the management of snakebite, in fact they have great trust in this system as well.

Table 3: Definition of terms of health care system and providers in Bangladesh[11]

Allopathic (treatment): in Bangladesh, this term means treatment by a doctor who is trained in the Western system of medicine (also called modern medicine)- e.g., with an MBBS or MD qualification- including its variants such as paramedics and medical assistants. Allopaths use synthetic drugs for treatment as opposed to herbal treatments, Ayurvedic, Unani, and other forms of remedies including homoeopathic drugs, and other physical and surgical procedures.
Ayurvedic: Traditional system of medicine originating from the Indian subcontinent.
Faith healers: Healers who use religious belief in the form of incantation, sanctified water, oil, or written verses from holy books to treat patients.
Homoeopathy/homoeopathic: A system of therapy founded by Samuel Hahnemann that is based on the concept that disease can be treated with drugs (in minute doses) thought capable of producing the same symptoms in healthy people as the disease itself.
Kabiraj: Practitioners of traditional medicine- e.g., Ayurvedic or Unani medicine.
Some of them also treat snakebite patients and other patients.
Totka: Combination of traditional and modern medicine often used by the Kabiraj.
Traditional healers: Practitioners of traditional medicine such as Ayurvedic and Unani.
Ozha: Treats patients with snakebite only. Some may catch snakes and act as snake charmer.
Unani: Traditional Muslim medicine originating from Greece.
Gunin: They use different types of 'mantra', 'tabij', 'taga' and black magic to treat patients of snakebite and other patients

Source: Ahmed SM el al. (2013). Lancet UHC, Vol. 382 (9906): 1746-1755

Community Systems in Health Services Delivery

The community clinic (CC) for a population of ~6000 is the 'Flag ship' programme of Bangladesh for providing one stop primary health care close to the rural community particularly for the women, children and marginalized populations. Staffed by a Community Health Care Provider (CHCP) and supported by health assistant (HA) & family welfare assistant (FWA) managed by community clinic management group (community group and community support group) which include local public leaders and representatives is an example of taking responsibilities of the health of the community in the hands of the people themselves through a Community Clinic Trust project. Additional multipurpose health volunteers (MHV) are introduced to supplement the home-based predominant health awareness and improved treatment seeking programme[12]. A network of volunteers, NGO workers available in hard to reach areas are also engaged or can be engaged in NCD prevention. The same network can be used to include snakebite prevention and first aid and treatment seeking to Upazila Health Complex (UzHC) and is expected to be promoted by the CC led team.

Private sector

There is a progressively increasing number of private clinics and hospitals across the country most of them are for -profit, but there are limited number of charity and philanthropy institutions as well. A large number of (~68) non-government medical college hospitals are providing services and developing health human resources. However, involvement of these institutions in preventing and providing treatment of snakebite is very limited so far.

2.5 Health Sector Policies and Strategies

Bangladesh achieved tremendous progress in MDG related indicators and continued the path also in SDG and UHC path. The process of UHC is going to be implemented through the essential services package (ESP) through the primary health care delivery by the Community Based Health Care (CBHC) and Upazila Healthcare Care (UHC) Operation Plans. The involvement of partner NGOs and community-based organizations is an advantage to provide ESP care in hard to reach areas for example BRAC and others.

A coordination among different directorates of MOH&FW and within the DGHS are always promoted for implementing the activities.

Non health ministry involvement in health care and prevention particularly multi-stakeholder initiatives in public health are also started in the country by involving MO Social Welfare, MO Women and Children Affairs, Ministry of Chittagong Hill Tracts Affairs, MO Forest, Environment and Climate Change to cite a few.

2.6 Socio-economic Considerations

The socioeconomic variables of Bangladesh indicate a stable economy with the Gross Domestic product (GDP) growth rate of 8.15% (2019). (Table. 4)

Table 4: Socio-economic variables of Bangladesh

Socio-economic variables	Value
Life expectancy at birth male/female (years, 2019)	70.88/74.60
Probability of dying between 15- and 60-years male/female (per 1,000 population, 2019)	149/113
GDP (billion current USD) [2019]	302.56
GDP growth (annual %) [2019]	8.15
GDP per capita (billion current USD) [2020]	1968.79
Current health expenditure (% of GDP) [2018]	2.34
Current health expenditure per capita in 2018 (current USD) [2018]	41.91
Domestic General Government Health Expenditure (% of GDP) [2018]	0.38
Domestic General Government Health Expenditure Per Capita (current USD) [2018]	7.12
Domestic General Government health expenditure per capita,(current international $)	18.62
Domestic General Government Health Expenditure (% of current expenditure) [2018]	16.98
Domestic Private Health Expenditure (% of current expenditure) [2018]	76.50
GNI (current USD) [2019]	3.17
GNI growth (annual %) [2019]	8.29
GNI per capita [Purchasing Power Parity (PPP) Current International $] [2019)	5190
Out-of-pocket Expenditure (% of current health expenditure) [2018]	73.87
Out-of-pocket expenditure per capita (current US$)	30.96

Source: https://datacatalog.worldbank.org/dataset/world-development-indicators; https://data.worldbank.org/indicator/SP.DYN.AMRT.FE;

https://knoema.com/atlas/Bangladesh/topics/Health/Health-Expenditure/General-government-expenditure-on-health-as-a-share-of-current-health-expenditure;
https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=BD

In recent decade there was a progressive decline in the poverty in Bangladesh with poverty rate of 20.5% in 2019. There was a setback due to COVID-19 pandemic. Rural poor particularly in remote areas have lack of access to education, health care and communication. The Gini Index (GI) in Bangladesh was 39.5% (2018). Gini Index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution.

Bangladesh has achieved median development category in 2020 in terms of Human Development Index (HDI) (0.632) (Table- 5).

Table 5: Human Development Report, 2020: Selected Indicators[13]

Indicators (based on UNDP report)	Value
Human Development Index (HDI) [2019]	0.632
Life expectancy at birth (years) [2019]	72.6
Mortality rate, under 5 (per 1000 live birth) [2018]	30.2
Mortality rate, infant (per 1,000 live births) [2018]	25.1
Expected years of schooling (years) [2019]	11.6
Mean years of schooling (years) [2019]	6.2
Gross national income per capita (2017 PPP US$) [2019]	4976

Source: Human Development Report, 2020 - http://www.hdr.undp.org/en/countries/profiles/BGD; World Health Organization Global Health Expenditure database; https://www.macrotrends.net/countries/BGD/bangladesh/healthcare-spending; https://datacatalog.worldbank.org/dataset/world-development-indicators

Snakebite is a rural health emergency among the agro-farming community who still continue on traditional farming methods. Agro based workers in paddy and other plantation, forest, fishing, fruit, vegetables, rubber plantation, herdsman, those engaged in firewood collection are at increased risk due to lifestyle and livelihood for example working bare foot, nighttime walk at darkness, sleeping in the floor without using mosquito net. Snake charmers/handlers, traditional healers ('Ozha') are at an increased risk as well.

2.7 Health Seeking Behaviour Following Snakebite

Snakebite is a rural health problem among the poor marginalized community where health awareness is relatively inadequate and for centuries the community rely on traditional methods of first aid and seeks care mostly/initially from the 'Ozha', 'Kabiraj' or 'Gunin'. The good network of rural primary health care of Bangladesh is still not properly utilized by the community in the first instance. As high as 97% patient population of snakebite seek traditional care or informal care before coming to hospital which delays admission and care[14]. People travel by a wide range of means of transport to seek care from a range of providers ending in hospital late accompanied by a large number of male accompaniments.

Rural houses are clustered in the middle of paddy land, green plantation, and bushes, many of which have muddy floors; family shares the dwelling house with livestock and grains an attractant of rodents which in turn attracts snakes; firewood, log and hay collection and stack are sequestered places for snakes. Day to day rural activities of farming (paddy, vegetable, fruit, tea, rubber for example) are congenial for human snake conflicts resulting in an unintentional bite. Many scenarios of real conflicts are unexplored.

2.8 COVID-19 Pandemic and Snakebite Prevention and Control

Soon after the WHO strategy for snakebite mitigation was endorsed in 2019 COVID-19 pandemic originated and delayed the initiation of country activities for the adoption of the strategy including engaging the communities. Routine data on snakebite is already meager in Bangladesh, trend, and impact due to pandemic is difficult to measure. Due to closure and movement restrictions during 2020 and 2021 the victims might not be able to attend hospitals in time, existing hospitals were repurposed for COVID-19 care causing a lack of access to care in known facilities with diversion of non-COVID emergency cases. Report of diversion of cases caused delayed critical support needed for cases of snakebite were found[15]. The records from Snakebite Clinic of CMCH found a smaller number of cases (~25%) in 2020, 2021 in comparison with previous years (Unpublished data from Snakebite Clinic of CMCH). On the positive side, the expansion and strengthening of oxygen delivery including setting up new sites of ICU care and ventilators with skilled human resources for COVID-19 care can be utilized in improving the management of cases of snakebite in future which is yet to be seen[16].

3. SNAKEBITE SITUATION

3.1. Historical Perspectives

Snakebite is a known old problem prevailing in the rural community. Chronology of its historical landmarks in our region has been briefly reviewed recently by Rashid et al[17].

Landmark snakebite activity	Year	Reference
Description of human and animal loss in the Indian sub-continent with mitigation measures: 6645 death in Bengal in 1869, 10,064 in 1880 1248 cattle loss in 1880 Mitigation: snake killing program ('snake hunters' costed) in British India	Sir Joseph Fayrer, Nature, 1882	[18]
Antivenom (AV) developed from macerated venom glands of sacrificed snakes	Dr. Albert Calmette, 1894	[19]
AV first tested in human	1895	[19]
Global snakebite study~50,000 deaths per year, with 25,000-35,000 in India alone.	WHO 1954	[20]
'Snakebite Clinic' a 24/7 one stop centre of Chittagong Medical College Hospital (CMCH) for snakebite management.	1994	CMCH data
First publication of clinical snakebite data from Bangladesh.	1995	[21,22]
Development of first Bangladesh Snakebite Management Guidelines.	2000	[5]
Snakebite by *B. niger* cuasing neuro-myotoxicity reported first time	2010	[23]
Largest case series by *N. kaouthia* (n=70)	2017	[24]
Largest snakebite study with 884 patients from CMCH	2010	[25]

WHO developed the documents related to standardization of antivenom and quality related activities in 1980s which were updated. The SEA regional office of the WHO had discussion on

snakebite in 1982 without any major subsequent follow up programme. At country level hardly there was any program for prevention, treatment, or on providing training to the health care providers.

A WHO funded programme in mid-eighties for local production of antivenom in Bangladesh at Institute of Public Health, Dhaka was not successful despite need, the endeavour was not revitalized.

Bangladesh Association for Advancement of Tropical Medicine (BAATM) conducted almost yearly international meetings for a decade on topics including snakebite since its inception in 1996.

3.2 Snakes & Snakebite Epidemiology

3.2.1 Snakes of Bangladesh

The snake fauna of Bangladesh is under collected and understudied, and mostly restricted to species identification and distribution. A literature review from 1852–2018 identifies 100 species of which the venomous ones are 16 species of sea snakes, 3 cobras (including 1 king cobra), 5 kraits, 2 coral snakes, 6 green pit vipers and 1 species of true viper (Russell's viper) (Source: Prof. Md. Farid Ahsan, personal communication).

3.2.2 Medically important venomous snakes of Bangladesh

Medically important snakes of Bangladesh can be placed into five groups:

Group I: Cobra ('Zoura')	1. *Naja kaouthia*, monocellete cobra, 2. *Najanaja*, binocellate cobra, spectacled cobra, gokhra, gokhur, khaiyagokhra, gohma/ goma. 3. *Ophiophagus hannah*, king cobra, raj gokhra, sankhochur, ***padmogokhra***, ***phanos***.
Group II: Krait – Different species are available	1. *Bungarusniger- Greater* Black krait, 2. *Bungaruswali-* Wall's krait 3. *Bungarus caeruleus*, common krait, kalach, maicha-alad. 4. *Bangarus fasciatus*, banded krait, sankhini, shakini, mama-bhagna. 5. *Bungarus lividus,* lesser black krait
Group III: Russell's Viper	*Daboia russelii*, Russell's viper, 'Chandrabora'

Group IV: Green Pit Viper	*Trimeresurus* spp., green pit vipers, green snakes, bansh-bora, sabuj-bora, gal tawa.
Group V: Sea Snakes	1. *Enhydrina schistosa*, hooknosed sea snake, samudrikshap. 2. *Hydrophis* spp., *Microcephalophis* spp., *Laticauda* spp., sea snakes, samudrik shap

Distribution of medically important venomous snakes of Bangladesh[26]

Image	Name	Distribution
	**Scientific Name:** *Naja kaouthia* **English Name:** Monocellete Cobra/ Cobra **Bangla Name:** পদ্ম গোখরা	Distributed in all administrative divisions of Bangladesh.
	**Scientific Name:** *Naja naja* **English Name:** Binocellate Cobra Spectacled cobra **Bangla Name:** খৈইয়া গোখরা	Distributed in all administrative divisions of Bangladesh except southeast part, but more common in west of the Jamuna River.
	**Scientific Name:** *Ophiophagus hannah* **English Name:** King Cobra **Bangla Name:** রাজ গোখরা , শঙ্খচূড়	Distributed in Sylhet, Chattogram, Khulna divisions. Not common.
	**Scientific Name:** *Bungarus fasciatus* **English Name:** Banded Krait **Bangla Name:** শঙ্খিনী , শাঁকিনী	Distributed in all administrative divisions of Bangladesh.

	**Scientific Name:** *Bungarus niger* **English Name:** Greater Black Krait **Bangla Name:** কাল কেউটে	Distributed in Sylhet and Chattogram divisions as well as northern part of the country.
	**Scientific Name:** *Bungarus lividus* **English Name:** Lesser Black Krait **Bangla Name:** ছোট কাল কেউটে	Distributed in Rangpur, Dinajpur, Khulna and Sylhet divisions of Bangladesh.
	**Scientific Name:** *Bungarus walli* **English Name:** Wall's Krait **Bangla Name:** ওয়ালস কেউটে	Distributed in all administrative divisions of Bangladesh.
	**Scientific Name:** *Bungarus caeruleus* **English Name:** Common Krait **Bangla Name:** কাল কেউটে	Distributed in all administrative divisions of Bangladesh
	**Scientific Name:** *Trimeresurus erythrurus* **English Name:** Spot-tailed Pit Viper **Bangla Name:** সবুজবোড়া, গালটাওয়া	Distributed in Sylhet, Chattogram, Khulna and Barisal Divisions.
	**Scientific Name:** *Trimeresurus albolabris* **English Name:** White-lipped Pit Viper **Bangla Name:** সবুজবোড়া, গালটাওয়া	Distributed in Sylhet, Chattogram, Khulna and Barisal Divisions
	**Scientific Name:** *Daboia russelii* **English Name:** Russell's Viper **Bangla Name:** চন্দ্রবোড়া	Distributed mainly in Rajshahi and Khulna division and recently found in Barisal and Chattogram divisions. Specially in the floodplain of

		the Padma and the Jamuna river.
	**Scientific Name:** *Enhydrina schistosa* **English Name:** Hook-nosed Sea Snake **Bangla Name:** সামুদ্রিক সাপ	Distributed in sea and coastal saline water of Bangladesh
 Copyright: Md. Mizanur Rahman	**Scientific Name:** *Hydrophis fasciatus*, *Microcephalis* spp., *Laticauda* spp., **English Name:** Stripped Sea Snake **Bangla Name:** সামুদ্রিক সাপ	Distributed in sea and coastal saline water of Bangladesh

3.2.3 Epidemiology of snakebite in Bangladesh

Early studies: The estimated incidence of snakebite from a study covering 10% areas of Bangladesh suggested 764 bites and 168 deaths per year found in 1988-1989[27]. Postal survey conducted in 1995-1996 covering 21 Districts of Bangladesh suggests an incidence of 4.3 per 100,000 population with a mortality of 20 percent[28]. Highest incidence of snakebite was found in Chittagong Division and Barisal Division (7 per 100,000). It is of interest to note that snakebite has been found to be more common amongst farmers (44.6%) and housewives (23%) in those studies.

Contemporary studies: According to a nationwide community-based epidemiological study of snakebite and its socioeconomic consequences in Bangladesh the incidence of snakebite in rural Bangladesh (which is substantially higher than previous estimation) is 623.4/100,000 person years (95% CI 513.4–1595.3/100,000 person–years) with an estimated 6,041 deaths annually[14]. Highest number of bites happened in Barisal division 2667.7/100,000 persons-years (CI 1787-3829) (Table- 6). The majority of the bite (71%) happened in the lower extremities. Eighty six percent of the victims receive some form of management within two hours of snakebite, although only three percent of the victims went directly to either a medical doctor or a hospital.

Most often the victim of snakebite is a poor, young and active individual. 58% bites happened in patients below 30 years (Table- 7). Biting occurs mostly when individuals are at work, engaged in activities such as cultivation, fishing, plantation, wood collection, or tending crops or gardens. Bites in home environment was 33% (Table- 8). Snakebite envenoming in Bangladesh is thus an occupational health hazard of the rural poor people who suffer bites while engaged in physical

work, most often during cultivation. However, bites were fairly common when the victims were walking on rural foot paths or while sleeping on the floor.

Table 6. Distribution of snake bite by division[14]

Division	Number of snake bites	Annual incidence per 100,000 person-years* (95% CI)
Dhaka	22	440 (285–649.9)
Chittagong	9	397.8 (211.8–680.3)
Barisal	22	2667.7 (1787.2–3829.5)
Khulna	20	936.2 (571.9–1445.6)
Sylhet	5	321.6 (104.4–750.2)
Rajshahi	20	472.7 (288–680.3)
Over all	98	623.4 (513.4–789.2)

*Weighted estimates have been used; P,0.001 from Rao-Scott chi square test (adjusted for sampling design) with 5 degrees of freedom.

Source: doi:10.1371/journal.pntd.0000860.t002

Table 7. Distribution of 98 snake bite by age group[14]

Age-group	Frequency of victims	Percent of victims	Annual incidence per 100,000*
0–10	11	11	248 (101–394)
11-20	21	22	544 (312–776)
21-30	18	18	531 (286–776)
31-40	15	15	594 (294–814)
41-50	11	11	587 (241–934)
>51	22	23	1063 (621–1506)
*Adjusted for sampling design			

Source: doi:10.1371/journal.pntd.0000860.t003

Table 8: Distribution of 98 snakebite (percent) by occupation, place of bite, and activities during the bite

Occupation	Frequency (%)	Place of bite	Frequency (%)	Activities during the bite	Frequency (%)
Housewife	29 (30)	Water	26 (27)	Lying/sleeping	15 (15)
Student	20 (21)	Field	24 (24)	Walking	28 (29)
Farmer	19 (19)	Road side	22 (23)	Working in field	18 (18)
Businessman	11 (11)	Inside home	12 (12)	Fishing	14 (14)
Day laborers	8 (8)	Home premises	11 (11)	Others	23 (24)
Others	11 (11)	Others	3 (3)		

Source: doi:10.1371/journal.pntd.0000860.t004

In a national community-based health and injury survey covering urban, rural and slum in 171, 366 household from 819, 429 populations estimated 15, 372 bites and 1709 deaths every year; 94% victims were from the poor socioeconomic condition with average monthly income of Taka 3262 ($57)[29].

Children have a high risk of dying or suffering permanent disability from snakebite envenoming. 'The incidence of bites was low during winter and began to rise with temperature and humidity to peak during the monsoon season. A second peak in October may reflect the high mobility of snakes that typically precedes the onset of mating'[25]. During the monsoon, snakebite occurrences increase as snakes leave their shelter due to rainfall.

Most of the houses in countryside of Bangladesh are not brick-built and the snakes sometimes live in the holes of the muddy floors. Moreover, most of the houses have homestead bush, which offers an ideal habitat for snakes. As a result, events of snakebite are also common when people are at home. To go to the toilet and for other domestic purposes, people often come out of their houses in the dark and become victim of snakebite. High proportion of bite (36%) happened during night time. Village people store grains including paddy, rice in their bedroom, and keep the poultry in the same dwelling house, which also provide shelter to the snakes, increasing the risk of snakebite.

Flood and snakebite: Due to its geographical location and climatic conditions Bangladesh is a disaster-prone country. Based on records of the surveillance system of the Directorate General of Health Services (DGHS), Bangladesh, snakebite envenoming was identified as a leading cause of mortality in several flood disasters, second only to drowning. During floods of 2007, 76 cases of snakebite and 13 deaths and in 2019, out of 90 reported cases 32 died. Eighteen upazila in two most commonly flood affected districts (Sirajganj and Pabna) recorded 111 snakebites with 24 (21.6%) deaths over a period of six months from May 2012 - October 2012[30].

A very early observation by Calmette from Vietnam provided a vivid description: "A village in the environs of Bac-Lieu (Cochin-China) was invaded, in October 1891, at the time of the great rains, by a swarm of venomous snakes belonging to the species *Naja tripudians* or *cobra capel*. These animals, driven into the native huts by the flood, bit 40 individuals of whom four, as reported to us, died almost immediately"[31].

3.2.4 Populations/Occupation at Risk

The rural family engaged with different farming activites in the paddy field or at home environment are vulnerable for snakebite. Russell's viper in certain parts of Bangladesh emerged as an important snakebite accident while cultivating in the paddy field. Fishing either at fresh water or deep sea or river estuary are also important. Sleeping in the floor without properly tucked mosquito net is a risk factor; may also happen while watching the garden. A large number of snake charmers are engaged with unscientific snake handling putting them into risk. Forest workers, plantation workers, are at increased risk as well.

3.2.5 Snakebite and issues related to gender, children and human rights

Rural population of either sex are vulnerable to snakebite. Children with envenomation require same dose of antivenom like an adult is a unique example in pharmacology. Pregnant women requiring antivenom will not be excluded thus need a follow up until delivery and the baby during childhood. Migrant population like Forcefully Displaced Myanmar Nationals (FDMN) residing in rural camps in forest area at Cox'sbazar are at increased risk and few cases are also reported (Dr. Md. Shahjahan, personal communication). All envenomed patients those require AV should receive it, unfortunately no AV for green pit viper and sea snake is available in Bangladesh.

3.3 Snakebite Situation in Bangladesh

Bangladesh as one of the most severely snakebite affected countries worldwide has achieved internationally recognized activities for improving the clinical management of snakebite envenoming for more than the last two decades and has had a national guideline on this topic as early as 2000[4,5]. The management of snakebite in Bangladesh has been encouraged by the

Director of Non-Communicable Diseases (NCD), Directorate General of Health Services, Government of Bangladesh, and supported for long with the provision of imported antivenom and providing some training to medical doctors working in public sector. Through a local initiative by Professor M A Faiz & team, a round-the-clock 24/7 'Snakebite Clinic' has been in operation in Chittagong Medical College Hospital (CMCH), Chattogram, since 1994. This facility soon became a vibrant hub for human resource development in clinical toxicology, the creation of professional awareness, and a number of milestone research projects on different aspects of snakebite that attracted the collaboration of researchers from other institutions in Bangladesh as well as from international partner countries. In addition to greatly improving the clinical management of snakebite envenoming in CMCH and its catchment area, and dramatically reducing case fatality, internationally appraised outputs of this snakebite clinic have also included the discovery and clinical as well as immune-histochemical characterization of envenoming by the greater black krait (*Bungarus niger*), defining a unique clinical syndrome of neuro-myotoxicity[23], and the clinical characterization of monocled cobra (*Naja kaouthia*) envenoming and its response to para-specific (Indian) antivenom and anticholinesterase[24]. With 70 positively identified cases which revealed local tissue necrosis besides the well-known neurotoxicity as common features, this study is still the largest case series of *N. kaouthia* bites worldwide[24].

A snakebite registry was set up in CMCH in 2018 where 3443 snakebite cases were treated over a period of around 44 months with 10 deaths. Salient parameters from CMCH snakebite registry are: mean age 30.2 years (SD 16.7), male 68%, 91% had ligature applied, 2% had bite during sleep, 3% had previous history of bite, 16 patients were pregnant, 111 patients received antivenom, 24 patients required assisted respiratory support.

For the first time in Bangladesh, a dedicated Venom Research Centre (VRC,B) was established at CMCH through the NCDC, DGHS where the collection, housing and rearing of venomous snakes with scientific rigor is ongoing with collaborative research mostly using the collected venom from venomous snakes of Bangladesh, with the ultimate aim of providing scientific guidance and high quality biological primary materials for the production of safe, effective, affordable and locally appropriate antivenom on a pilot basis[2].

Trained professionals are managing cases of snakebite in public medical colleges across the country. For example, for the first-time worldwide Wall's krait (*Bungarus walli*) was found to be involved in snakebite envenoming while managing the snakebite cases at Dhaka Medical College Hospital (DMCH). Since then, the team and collaborators have shown that this species is a major cause of neurotoxic snakebite envenoming in Bangladesh and Nepal. The recent resurgence of Russell's viper envenoming in different parts of Bangladesh, especially in Rajshahi division, is

another new challenge because it comes with the need to manage cases having rapidly deteriorating multiple organ involvement including consumption coagulopathy, increased vascular permeability, oedema, haemorrhage, myotoxicity, cardiovascular shock, and acute kidney injury (AKI)[32]. In Rajshahi Medical College Hospital alone more than 100 cases of Russell's viper envenoming were treated in the last 5-6 years (Dr. Abu Shahin M M Rahman, personal communication).

First aid following snakebite is provided by the victims or relatives taking care at the scene or following the bite. The traditional practice of using one or multiple (1-8; mean 3 +/- 0.02) ligatures on the bitten extremity following the bite is frequently followed. There is no evidence that such ligatures have any benefit, but it is well documented that they can cause or aggravate local necrosis and other tissue damage. Still 42% of patients with envenoming seek treatment from traditional healers ('Ozha') as first contact providers, spend around one hour with them and arrive late in hospitals spoiling precious time and putting them at the risk of poor outcome[25]. Pressure-immobilization is currently recommended as first aid following snakebite in the National Guideline for Management of Snakebite which was mostly based on the latest edition of the Guidelines for the Management of Snakebites in the WHO SEARO Region[4,33]. In reality, pressure immobilization is hardly practiced in the community, and the feasibility of applying it with the correct pressure in rural settings has been questioned. School books providing basic education on snakebite first aid still recommend old harmful methods that are contraindicated[34]. A large number of other ineffective but harmful practices, for example giving incision, local application of various substances, is still widely practiced in the rural community and contributes to poor outcomes[25,35].

Most of the bites happen during working or when walking mostly bare-footed on rural foot walks, in and around homes. Sharing houses with domestic animals like poultry that directly or indirectly (via food provided which in turn attracts rodents) attract snakes puts the inhabitants into an increased risk of bites inside and around houses[36,37]. Snakebite inside houses at night time on sleeping people is the hallmark of kraits (*Bungarus* species) whose venoms causing irreversible neuromuscular paralysis pose particular clinical problems associated with high case fatality[23]. Simple sleep safety interventions like the promotion of the use of 'cot and bed net' may have a dramatic effect preventing such bites but are yet to be scientifically evaluated in the context of Bangladesh. Likewise, a number of simple preventive practices at work like keeping a close watch and using basic preventive tools while fishing or doing cultivation work may be assumed to be highly effective, but their feasibility and acceptance by the population at risk especially during the hot and humid seasons have not been evaluated yet in Bangladesh[37]. The exact situations including environmental-climatic consideration causing human-snake conflict in the backdrop of

day to day human and snake activities has not been evaluated properly in the country context[38,39].

In rural areas of South Asia, ambulances are not readily available during an emergency, and the transport of patients during the main snakebite season (monsoon) is never smooth. Usually, a number of different types of transportation is sequentially used by a single patient to seek treatment in different tiers of the health care system, putting the patient's party under great psychological stress and significant economic pressure, and greatly delaying treatment which in turn results in poor outcomes[40,41]. In the lowlands of south-eastern Nepal, the establishment of self-organised, community-led motor bike ambulance services for snakebite victims in combination with the provision of community health education and snakebite treatment with antivenom in rural primary health care centres has significantly reduced snakebite mortality[42]. Large parts of Bangladesh have the same or similar species of venomous snake as lowland Nepal. Thus, this or a modified approach of rapidly transporting patients to medical care has great promise for reducing snakebite mortality in our national context, too, and its suitability and effectiveness can be addressed in an intervention study.

Despite some improvements of the management of snakebite in major public Medical College Hospitals of Bangladesh, provision of antivenom by the Government of Bangladesh through DGHS, and well-noted research and advocacy achievements, the delivery of basic health care to snakebite patients in Bangladesh has not progressed in a satisfactory manner. Although best-practice treatment is available in a couple of hospitals, at the national level snakebite management is so much below the standard of care Bangladesh has achieved for many other diseases that the mortality, morbidity, disability and socio-economic impact of snakebite threaten to affect health and development indicators. This is particularly unfortunate in view of the fact that snakebite envenoming is a preventable, acute disease that is eminently treatable with a highly cost-effective drug. However, most of the doctors working in upazila hospitals are not confident enough (i.e., not trained well enough) to treat snakebite cases at their UzHC and habituated to refer the patients to higher centres[15]. This routinely results in delayed treatment and poor outcomes including many avoidable deaths during referral. The snakebite affected population, on the other hand, has little to no knowledge about how to prevent snakebite, what to do if a snakebite happens, and where to turn to for help and where antivenom is available. This along with little confidence in local healthcare providers (who usually do not provide snakebite treatment but refer patients to medical college hospitals, see above) leads the vast majority of people(as high as 98%)[14,25] to first consulting a Traditional Healer ('Ozha').

Last but not least, snakebite has also recently been considered an important animal health condition because it causes damage to domestic animals thus posing economic pressures on livestock owners and their families and contributing to food insecurity[43,44]. However, there is still a dearth of information on snakebite in domestic animals, high lighting the need for dedicated research on this topic and its socio-economic impact.

Marginalized rural farming & fishing communities and 'Traditional Healers/Ozha's' are vulnerable. Snakebite is considered as an occupational health problem of the rural farming community. Young people, females are affected. Seasonal peaks- monsoon; natural disaster like floods are risk factors.

Medically important snake species: In addition to the 'Big Four' other relevant species- Green pit viper, Monocled cobra, Black krait, Walls' krait are important in Bangladesh. There is no proof of existence of saw scaled viper (one of the 'Big Four') in Bangladesh.

There are challenges to snakebite mitigation, specific to the Southeast Asia region, are also applicable in Bangladesh.

Concept and practice of prevention of snakebite is mostly absent in the community. There is heavy reliance and trust on the traditional healers/'Ozha's'; poor scientific practice of first aid following bite; ill equipped primary health care facilities for managing snakebite (human resources not well trained during their courses and afterwards), logistics are not always available, supply chain is irregular specially antivenom.

4. METHODOLOGY FOLLOWED IN THE DEVELOPMENT OF NATIONAL SNAKEBITE STRATEGY

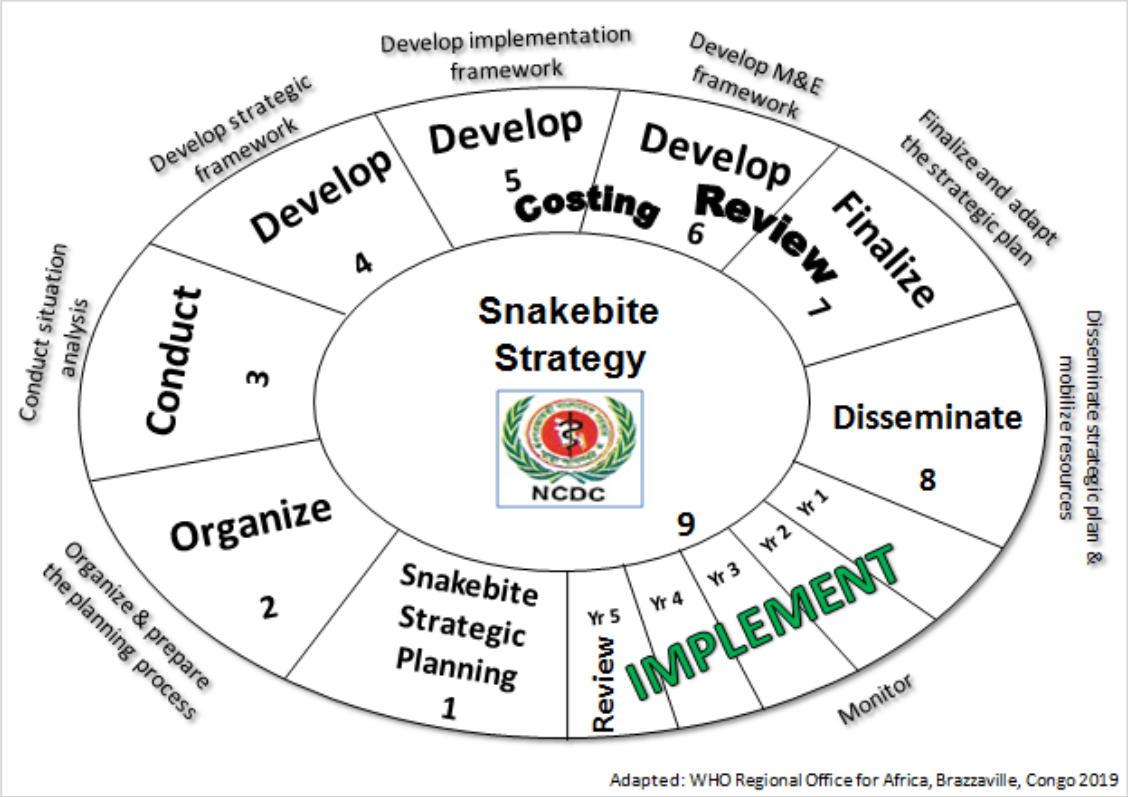
- Review of background documents
- National programme on snakebite as mentioned in the 4th HPNSP PIP document NCD Operational plan
- Global strategy: Snakebite Envenoming- A Strategy for Prevention and Control
- The Regional Snakebite Prevention and Control Plan of Action (Draft)
- National Guideline for Management of Snakebite 2019, DGHS, GOB
- Primary Treatment and Prevention of Snakebite for Health Workers (Training module in Bengali) DGHS, GOB
- Learner's Guide for Management of Snakebite 2020 DGHS, GOB. (Training module in English)
- Available IEC materials on snakebite prevention and first aid for creating community awareness
- Literature review from important documents of WHO on snakebite and "Ending the neglect to attain the Sustainable Goals A map for neglected tropical diseases 2021-2030" and 13thGeneral Programme of Work 2019-2023- promote health keep the world safe serve the vulnerable.
- Discussion with investigators and staff of Venom Research Centre, Bangladesh (VRC,B) of Chittagong Medical College, Chattogram and 'snake rescuers', and wildlife biologists.
- Discussion with senior health professionals of different medical college hospitals, divisions, and districts: Rajshahi, Chattogram, Barisal, and Patuakhali
- Three webinars on International Snakebite Awareness Day (ISBAD), 19 September, 2021: (i) Community and community clinic staff & UzHC organised by CBHC, DGHS; (ii) For doctors at UzHC and district hospitals (DH) organised by NCDC, DGHS; (iii) Four clinical case presentation organised by professional societies BSITD, and TSB for postgraduate trainees.
- Workshop on 'Development of Snakebite Strategy' 26-28 September 2021, and meeting on 16 September, 2021, 16 November, 2021, 06 December, 2021 at NCDC/DGHS, Dhaka, Bangladesh. The participants were the members of the technical committee formed by the Director, Non-Communicable Diseases Control (NCDC) for development of the strategy. Through the three days' workshop and based on the core documents of

WHO on snakebite, country documents, and literature search a framework and roadmap to develop the strategy was prepared. A SWOT analysis was made by active involvement of individual members of the committee (Annex- 01). A theory of change on snakebite prevention and control was adopted from a similar document of health action international (Annex- 02). The goal and objectives were identified.

- For each objective the strategies were identified and for each strategy a number of activities were proposed. The other elements of the strategy were also discussed: indicators; planning, monitoring, and evaluation; resource matrix; elements essential for emergency management of snakebite victims; managing risk; risk categories, key risk mitigation action. The workshop recommended incorporating the point discussed and also including suggestions from the committee members. The strategy drafted after the workshop and after each meeting was shared with the members for reviewing and providing feedback.
- Stakeholder consultation: (i) IDI with traditional healers, 'Ozha' (ii) FGD with community (female, key vulnerable male population, opinion leaders). (iii) UzHC: KII with doctors, nurse, and SACMO. (Summary Report. Annex: 06)
- National workshop on developed strategy completed on 26-28 October 2021 where two sets of group works, and eight plenary sessions was conducted; incorporation of comments and finalization of the draft strategy was made; on 22nd November 2021 on stakeholders consultation on Community Engagement for National Snakebite Strategy.
- Based on the developed strategy and action plan costing was be made in consultation with WHO consultant engaged for costing.
- The draft strategy was put in the website of DGHS for comments and shared with the stakeholders for review. A review panel was formed; opinion was sought and considered.
- Comments from stakeholders was considered for incorporation.
- Final stakeholder meeting/workshop was conducted on 29-30 November, 2021.
- Approval and adoption of the strategy by the committee.
- Preparation of the executive summary of the strategy: few pages with goals, objectives, key activities expected impact.
- Launching and dissemination of the strategic plan has been proposed.

The summary activities of the methodology for development and implementation of snakebite strategy are provided (Figure- 2)

Figure 2: Steps in Bangladesh Snakebite Strategy Development



5. SWOT ANALYSIS OF SNAKEBITE CONTROL PROGAMME, BANGLADESH

Analysis of programme internal environment, analysis of programme external environment, definition of strategic issues.

	Helpful	Harmful
Internal Origin	Strengths	Weakness
External Origin	Opportunities	Threats

Details of the SWOT analysis are provided in Annex 01

Part B

6. STRATEGIC FRAMEWORK

Vision

A community and health system where every snakebite victim has an opportunity of getting scientific treatment

Mission

To build a system to reduce snakebite mortality and disability

Goal	To prevent and control snakebite envenoming in order to halve the numbers of deaths and cases of disability that it causes by 2030
Objectives	1. **Community engagement and involvement**: Empowering and engaging communities
	2. **Treatment**: Providing safe and effective treatment including antivenom
	3. **Health system strengthening**: Strengthen health systems
	4. **Coordination**: Partnerships, coordination, and resources mobilization

Target groups

- Communities
- Civil society organisations
- International policy makers
- Experts and academia
- Healthcare providers
- National policy makers
- Development partners
- Research Organizations

Problem	There are inadequate resources like antivenom, inappropriate management, and non-existent prevention practices of snakebite prevailing in the country (and snakebite mortality is high).

6.1 Objectives, Strategies, and Activities

Objective 1: Empowering and engaging communities

Empower communities to adopt preventive measures against snakebites and effective engagement to respond with appropriate first-aid and rapid access to healthcare facilities by the snakebite victims. It requires the creation of massive public awareness (Self-care model of WHO).

Strategy 1.1: Identify high risk communities: Targeted interventions in high-risk groups.

Activities

1.1.1 *Identification of high-risk occupational groups through a workshop and other methods.*

Some occupations have higher risk of snakebite like farming communities, forest workers, fishermen, snake handlers- charmers and rescuers. Initial information will be collected from the literature and hospital data particularly, snakebite register of Chittagong Medical College Hospital, Chattogram and other hospitals having Russell's Viper cases including Rajshahi Medical College Hospital, Rajshahi.

1.1.2 *Community and Hospital based surveillance using DIHS2 based MIS system.*

ICD 10- code 63 and others will be used for reporting definition of 'snakebite', 'envenomation', 'death', 'disability' (physical and psychological) and long term follow-up will give emphasis on data generation, analysis, and interpretation at district and upazila level. It is also a part of Health System Strengthening (See 3.5.2). Reports of death can be collected and reported by various means- birth and death registration at Union Parishad, information from community by Community Healthcare Workers (CHWs), and hospital data.

1.1.2.1 Pilot areas of surveillance- two upazila (community) and two Upazila Health Complex. Upazila having MHV will be selected for the piloting and completed at immediate/short term- within June 2025. Required activities will be a workshop for finalization of various definitions, training of health care professionals, coordination with MIS and TA from the WHO to adopt DIHS-2 using ICD code. Physical register will be used till the development of DIHS-2 using ICD code.

1.1.2.2 Roll out of surveillance: Mid-term (up to June 2028 covering 50% upazila) and long term (5 years beyond 2028, covering whole of the country). Basic retraining for new staffs will be arranged periodically.

1.1.2.3 Data from District Hospitals and Medical College Hospitals will also be collected in time as stated at 1.1.2.2)

1.1.2.4 Sex and age segregated data will be analysed from DIHS2 and from snakebite register of CMCH. Pregnant women with envenomation will be followed up to see the outcome of pregnancy and effects on foetus/newborn, and impact on child development can be assessed by a cohort study. Information on snakebite among FDMNs will be recorded and first aid & preventive actions by ACSM can be promoted through UNHCR, IOM and other DPs & NGOs working at FDMN.

1.1.3 *To develop a snake atlas for entire Bangladesh a phase-wise Geographical Information System (GIS) mapping will be prepared involving snake 'rescue team' with the support of herpetologists, academicians, and IUCN, in collaboration with the Forest Department. Wildlife Act 2010/ Wildlife (Conservation and Security) Act-2012 will be followed. A joint plan will be developed, SOP will be prepared, and MoU will be signed. The Atlas preparation will be started in the pilot area (1.1.2.1) when a TA support will be requested from the WHO.*

However, snakes brought by patients to hospitals will also be used for snake mapping. Representative samples of medically important snakes will be preserved for academic purpose & training and may be used for health education as well. Volunteers will be used for collecting GPS; assistance from VRC'B, Government Zoo, and Safari will be sought. Live snakes brought by patients may be transferred to VRC,B. Coordination with Forest Department will be made and support will be requested.

1.1.4 *Study on human-snake interface: Understanding the ecology and epidemiology of various interactions of human with snakes would help to frame interventions to reduce or eliminate risks (occupation, environment, and behaviour factors for risks exposure). Study will try to find out under what circumstances the conflict happened?*

(Research part: Human snake conflict. Available hospital data from Snakebite Register may give a quick information. Study will be conducted within short term to mid-term)

Strategy 1.2: Active community engagement and participation

Active community engagement and participation to be ensured by community education programmes to prevent or reduce the risk of snakebite. Programmes will mostly be arranged through Community Group (CG)/Community Support Groups (CSG) in place.

Activities

1.2.1 Forming a ward level empowered community centering the community clinic (CG and CSG at villages with developed TOR (immediate). Holding meetings and health education periodically by CHCP at the CC level will be an advocacy (Note: already a page in calendar dedicated to snakebite prevention by CBHC, DGHS). (Including community leaders such as religious leaders, local government representatives, teachers, local journalists, local health care

providers or field level health workers, traditional healers or 'Ozha's' and disaster management activists, existing ToR of CC group and community support group will be followed).

1.2.2 Involve snakebite survivors and 'rescuers' as ambassadors to motivate and aware the community. They may be included in the community group if available in that community clinic area.

1.2.3 Use of existing networks working in the communities like schools ('Little doctor' programme, child-to family communicate, seminars, holding competition etc.), NGOs etc. Snakebite to be included in the existing activities of 'Little Doctor' programme (Snakebite to be included as flip chart and yearly calendar in collaboration with DPM, CDC).

Strategy 1.3: Improve the prevention, reduce risk, and increase avoidance of snakebite envenoming (Educate the communities at risk).

Activities

1.3.1 Development of a communication strategy (advocacy, communication, and social mobilization, ACSM based on SBCC strategy 2016, GOB) for snakebite prevention, first aid, quick referral, and conservation of snake. (Immediate by June 2025)

Before the development of the communication strategy adhoc programme for ACSM will be started.

1.3.1.1 Target-group-specific and locally appropriate BCC materials for ACSM

Key messages will include but not limited to, mosquito net and not sleeping on the floor.

1.3.1.2 Communication by channel mix: Health staff, community health workers and volunteers will work together to implement community-based BCC campaigns. Local champions will be identified for message dissemination as well.

Interpersonal communication (IC): IC facilitates comprehension of concepts and demonstration of new practices. One-on-one contact between the health worker/volunteer/peer and target group - individual/family, etc.

Providing training to 'Ozha' in the pilot area may be considered (training will be based on materials developed for the community and community clinic) (Ref. Qualitative study on traditional healers). Mapping the 'Ozha': They will be involved in providing appropriate first aid, quick referral and educating the community about prevention and first aid.

School-based initiatives (School and religious school): orientation for students, principal, teacher– seminars/debates, message dissemination during morning assembly. In addition, hold different competitions - Poster/Painting/ Projects/Essay/Slogans/Drama.

Awareness meeting may also be arranged in higher education institutes example, Department of Zoology and Forest & Environment.

Appropriate mass media/mega events/community radio communication.

Social media: Platforms like Facebook, twitter, etc.

Mobile technology/telephone: mass messaging (SMS)/calls, Interactive Voice Response(IVR).

Call centre service: Utilise existing 16263 with coherent guideline-based information to be provided or a dedicated hot line number for snakebite emergency.

Scroll of statutory caution for any non-scientific acts/misconception regarding snake, snakebite and healing in dramas or cinemas.

Outdoor publicity: Hoardings/billboard, Glow signs, branding on wheels.

1.3.1.3 Publicizing of achievements and success stories will be made.

1.3.2 Developing a package for snakebite prevention: Package will include information on the use of cot & net, snake hook, boots, leg guard, torch & stick, workplace safety- for the farming (safe farming) and fishing (safe fishing) community, not to share the sleeping room with animals and grain storage, safe- fresh water fishing. (Piloting Immediate, mid to long term).

1.3.3 Training on snakebite prevention, control & first aid for the ward level committees (CG and CSG) and 'rescuers' using the package: Training should include safe housing and lifestyle like use high boots, torchlight and stick, a mosquito net and not sleeping on the floor; as well as not to kill snakes because they are eco-friendly; so that committee scan disseminate the information to the community by various means including 'Uthan Boitak'. A certain number of health education sessions may be arranged by this group in the catchment area of the CC (3×5=15, 5 in each small ward area). Community health workers like HA and MHV should be involved. For creating uniformity, training will be provided to the involved people using the common developed package materials by CHCP, health assistant (HA) and few other members from CG/CSG who will be trained by upazila team. (Immediate: pilot, Mid and long term: scale out).

Another three Uthan Boitak around an event of death or venomous bite will be conducted.

1.3.4 Educational session on snakebite prevention, control, first-aid and basic information/addressing misinformation about AV and availability of AV to the patients &

attendants who come to the hospital (UzHC, district hospital, and medical college hospitals) will be arranged. (See also 3.3.3).

Snakebite hospital data can be used for arranging community awareness sessions by CHWs, volunteers, social organizations, and medical students. A similar campaign will be conducted by the mobile medical teams run by Upazila Health Care OP (part of tribal health) and by the "snake rescuers" during rescue.

1.3.5 Advocacy for a mobile emergency van having logistics and facilities for providing emergency treatment on community emergencies including snakebite. A piloting may be conducted first. Meeting for development of logistics, resources need, cost and operational manual of the emergency van, piloting and scale out after assessment.

1.3.6 Discussion on snakebite in different stakeholders' internal meeting as a shared responsibility: about first aid, prevention, quick arrival to hospital, conservation of snake and other issues related to snakebite and other issues of snakebite. Materials to be developed in Bengali (See also 1.3.1.2) and circulated widely

1.3.7 Health talks with structured and prepared advocacy materials (See updated Bengali training module for HCW) on snakebite prevention and control may be arranged during coordination meeting at district, upazila, and union level.

Strategy 1.4: Effective first aid practices and bike/ambulance/motor transport to hospital

Activities

1.4.1 Providing appropriate first aid (immobilization)- training to the community by the empowered community group and community support group (CG & CSG), 'rescuers', HCWs and volunteers (MHV, Girls' Guide, Scouts, Rover Scouts, RCY-Red Crescent Youth Volunteers, BNCC, Ansar & VDP and Gram Police).

[Immediate: Pilot, Intermediate and long term: scale out (part of HSS as well)]

1.4.2 Basic access to quality health care- rapid/quick transfer of the victims by motorized transport vehicle: Availability of multipurpose quick ambulance/transport system with trained crew/staff will be promoted/arranged by the CG/CSG. Identification of bike owners at smallest unit (CC area, Ward) will be made, mobile number be made available to the community, cost of transport to UzHC or nearest public hospital may be reimbursed by Union Parishad or NCDC with the support of Social Welfare/philanthropy.

Strategy 1.5: Participate in accelerated development of pre-hospital treatment by participating in clinical trials

Like 2.6 (New oral repurposed drug is in development): proof of concept yet to be developed- PLA2 inhibitors (varespladib and pro drug – varespladib-methyl & metalloprotease inhibitors marimastat) serine proteases inhibitor nafomastat. (Research)

Strategy 1.6: Improve health care-seeking behaviours

Activities

1.6.1 SBCC for scientific treatment seeking- for providing appropriate advice for first aid, quick referral and prevention.(Part of SBCC) Include topics like avoid harmful and useless first aid measures (Clarification/explanation of harmful & useless to be included). Will be delivered at multiple sites at the community by HA, MHV, HCWs, NGO workers, volunteers and others; at CC by CHCP; during 'rescue' session; during hospital stay; during follow-up at OPD of UzHC; at DH, MCH; at coordination meetings.

Strategy 1.7: Build a strong understanding of socio-cultural- epidemiological (anthropological, qualitative), economic factors and 'One-Health' affecting outcomes (Research)

Activities

1.7.1 Addressing 'stigma' related to snakebite: As a study

1.7.2 Rehabilitation of disabled victims and the traditional healers in alternative livelihoods: Collaboration with Social Welfare (2.2.4) (Research).

1.7.3 Addressing Economic factors: As a study (also in 3.2.2).

1.7.4 Burden of snakebite in human and domestic animals: One Health approach through collaboration with relevant stakeholders like One Health secretariat, livestock department.

Strategy 1.8: Provision of incentives for snakebite victim's family and follow up cost

Activities

1.8.1 Payment for travel, free treatment (Also in HSS part)

1.8.2 Explore the provision of compensation for 'death' and disability following snakebite (like wildlife by law 2010- elephant, tiger, and crocodile) (from department of forest and environment. Compensation for death 100,000 BDT, disability 50,000 BDT, crops/domestic animal/house loss 25,000 BDT). (বন্য প্রাণী দ্বারা আক্রান্ত জান-মালের ক্ষতিপূরণ বিধিমালা- ২০২১)

Strategy 1.9: Conservation of snakes (Collaboration activity of snakebite programme with the Forest Department).

Snakes are causing benefit to human, and environment in different ways. Indiscriminate killing of snakes should not be done. Conservation of snakes will be promoted by 'snake rescuers', health care professionals and by community along with forest department.

Training sessions on snakebite or snakes in health department and forest department should cover areas of prevention, first aid and snake conservation. Important topics should include: restoration and protection of snake habitats; avoid snake originated products like shoes, bags etc. and traditional drugs; livelihood improvement of people who live in high-risk zones/areas; education campaign to minimize snake human conflict and killing of snakes due to fear; empowered local people like the concept of "Citizen Scientists/Para Ecologist".

Objective 2: Providing safe and effective treatment including antivenom

Antivenom (AV) is the essential medicine for the treatment of venomous bite. It is produced 'from hyperimmune plasma obtained by immunizing donor animals with venoms (example, horses). Toxins present in snake venom generate an immune response in the donor animals that is largely specific to those toxins and others with high homology'[45].

All envenomed patients those require AV should have access to it. Currently, AV is not produced in Bangladesh. Imported AV from India is produced without consideration of local venomous snakes. There is no AV for green pit viper and sea snake is available in Bangladesh. The WHO was advising for long period to use venoms from local snakes for producing AVs. AV used in Bangladesh is not entirely safe and efficacy is variable.

Strategy 2.1 Training and education of health care professionals

Activities

2.1.1 TOT on management and prevention of snakebite based on the training module of health care workers (HCWs) and doctors (Invited a team of Medicine/Tropical medicine specialist, pediatrician, and Anesthesiologist/ICU/critical care specialist from each division) (short term, medium and long term).

2.1.2 Education and training for healthcare professionals working at district and upazila level through a 'team approach' (i. Doctors, Nurses & SACMO, and ii. HCWs- CHCP, HA, MHV and other volunteers) from each upazila on snakebite management and prevention with prepared training modules covering – (short term, medium and long term).

2.1.2.1 Basic life support (BLS): Participants will be doctors, nurses, and SACMO.

2.1.2.2 Advanced life support (ALS) (for doctors): Topics would include respiratory and renal support including antivenom related early adverse reactions (anaphylaxis), and pharmacovigilance (short term).

2.1.2.3 Providing 'team-based care', team building and task shifting, communication skills including community engagement through providing health education (ACSM) for prevention and first aid in OPD health education facility and while the patients are admitted in hospital with snakebite.

Duration of training: 3 days

Resource materials and methods: module-based training session, workshops, competency, real life, video, distance and continued learning, and CME.

2.1.2.4 Training for HCWs (CHCP, HA, FWA, and others) on prevention, first aid, and quick referral

2.1.3 Orientation training on snakebite management for batches of doctors, nurses, working at public and non-government medical college hospitals, and district hospitals (1 day).

2.1.4 Training module development

2.1.4.1 Updating the training module (Hard copy, book) on management and prevention of snakebite- incorporating 'definitions' like end of AV, AV reactions, and follow up (long-term) for detection of physical and psychological disabilities with tools as well as pharmacovigilance & AV use reporting form to be developed. (See 1.1.2) The updated training modules for health workers will include specific guidance for providing community health education on snakebite like 'Uthan Boitak', stakeholders internal meeting and structured health talks (See 1.3.5 and 1.3.6).

2.1.4.2 Interactive online training module (will be made available in online in NCDC website, free for all and can get a certificate upon completion of the course) to be developed for doctors and other community health workers, SACMO & Nurse, (Total 3).

2.1.5 Students learning material

2.1.5.1 Development of learning materials on prevention, first aid and management of snakebite for health care professional students' curricula (MBBS, nursing, medical assistant) (example students' module for TB) in collaboration with DG Medical Education and CME. (3 modules plus 3 online module).

Advocacy with stakeholders like BMDC, HSM, MCHs: All medical students and doctors should be trained in Acute Emergency training: cardiopulmonary resuscitation

(CPR)/Endotracheal intubation (ALS, BLS) during studentship and internship as per curriculum for under-graduate medical education in Bangladesh- updated 2021, and Rotatory Internship Programme and Log book 2003 of Bangladesh Medical & Dental Council (BM&DC).

2.1.5.2 Advocacy to include snakebite management training in postgraduate curricula.

Methods: seminar and/or round table with faculty

2.1.6 Updating the 'National Guideline for Management of Snakebite 2019' by Working Group (See 4.1.2 governance) to improve and standardize the prevention, diagnosis, treatment, pharmacovigilance, follow up and rehabilitation of snakebite victims (short term). See also 1.1.2

2.1.7 To establish 'snakebite clinic' & follow up 'Snakebite Support Clinic' in every public Medical College Hospital (with a prior developed concept): to ensure a uniform management (Part of HSS).

Poisoning and Snakebite cases can be managed together in a single place in big hospitals: may be piloted in few places. (Collaboration with HSM)

Strategy 2.2 To improve clinical decision-making, treatment, recovery and rehabilitation

Snakebite is mostly regarded as an acute medical emergency. Long term sequelae in survivors are detected but the exact burden is not known. Follow-up and rehabilitation services for screening and treating neurological, renal, musculoskeletal, endocrine and psychological sequelae in survivors are required. Protocols for follow-up and rehabilitation will be developed and will be incorporated in treatment guidelines. Post-discharge follow-up could also be used as an opportunity to educate survivors in snakebite prevention and first-aid with the aim of preventing repeat snakebite incidents in victims and their families.

Activities

2.2.1 Development of definitions for updating the national guideline with a prior concept developed including topics:

Acute stage: clinical syndromes and clinical end-points of effective treatment;

Chronic stage: post discharge follow-up criteria to detect physical and psychological disabilities, and rehabilitation parameters. (Short term): workshop

2.2.2 Using definitions by the team during management of acute conditions (study) and follow up of cohort of survivors based on definition: for identification of physical and psychological disabilities (short term pilot, medium and long term). Follow up of patients through a multi-centre study.

2.2.3 Modalities of follow up and rehabilitation: to be decided by a workshop (short term)

2.2.4 Rehabilitation of disabled (differently abled) snakebite survivors in collaboration with NCDC rehabilitation in disability component, Social Welfare, and Forest department) (See 1.7.2) (short, medium, and long).

Financial incentive for snakebite victims and support for devices and appliances for differently abled survivors should be considered as well. (See 1.8)

Strategy 2.3 Anti-venom development, production and monitoring

Consensus of the workshop conducted during development of the strategy- Bangladesh should have own antivenom. For both testing the efficacy of AV and development of AV, quality venom source is an essential need.

Activities

2.3.1 Sustaining the Venom Research Centre, Bangladesh (VRC,B): Strengthening and institutionalization of VRC,B established by NCDC, DGHS at Chittagong Medical College, Chattogram (Short to long term).

2.3.2 Expanding venom repertoire (Stock)

Snake 'rescue', rearing etc of the snakes as per standard procedure.

2.3.3 Assessing the feasibility of producing AV in Bangladesh either by the government pharmaceutical manufacturer Essential Drug Company Limited (EDCL) or through a public-private partnership with cost estimation (short term). (To be discussed and decided after the feasibility study by a consultant with TA from WHO or by GOB, Short term)

2.3.4 Antivenom production if feasible by study (See 2.3.3)

Strategy 2.4 Ensure safe and effective treatments (AV) available, accessible and affordable to all

Activities

2.4.1 Ensuring acquisition and availability of treatment of snakebite including AV at UzHC and according to different levels of heath care system including supportive care (See 3.3.1 and 3.3.2). AV should be part of Essential Service Package (ESP).

Increase access to antivenom by a supply system with distribution strategies developed: (at least 20 vials/2 doses of antivenom should be available in every UzHC, (whether it is used or not). AV should be collected before the snake bite season e.g. March-April.

2.4.1.1 Ensuring snakebite management in remote areas through collaboration with armed forces (DGMS), non-government hospitals and philanthropy.

2.4.2 Ensuring availability of AV free of cost (HSS)

2.4.3 Establishing a pharmacovigilance programme for antivenoms (currently in-use AV or to be newly introduced AV) in collaboration with DGDA: Reporting of the use of antivenom (PV) should be mandatory. The PV report collected will be assessed by a 5-member committee composed of a physician, paediatrician, pharmacologist, responsible officer from DGDA and from NCDC who will meet 3 months interval (quarterly) (2.4.3); require development of SOP, training and reporting format. (Short term, midterm and long term). Training to be provided (2.1.4.1)

Strategy 2.5 Improved control and regulation of venom and antivenom

(A collaboration with DGDA)

Activities

2.5.1 Strengthening antivenom quality and safety regulation (DGDA): Ensuring quality and efficacy of AV using neutralization and other assay/methods. SOP to be developed.

Task: consultant TA/hiring

2.5.2 Introducing prequalification for antivenoms

(A collaboration with DGDA) TA will be required

Task: Consultant TA/hiring

2.5.3 Ensuring sustainable quality venom source (example VRC,B)

2.5.3.1 Venom extraction: quality control is essential to ascertain that venom used for testing AV and AV product design are indeed representative of the species inhabiting the area for which the antivenoms will be manufactured. Venom collection units and associated serpentaria must be licensed by National Regulatory Authorities (NRAs) before operations commence. For a license to be granted, the following requirements must be successfully met by venom extraction and supply facilities.

Serpentaria must maintain standard (1) Protocols for all aspects of snake husbandry including (a) venom collection, (b) handling and (c) stabilization and storage so that the venom extracted is controlled for quality and appropriate storage.

Each venom batch must be traceable through a unique identifier in order to allow for a rapid detection of errors during the preparation process.

(2) Vital information pertaining to the (a) snake species and sub-species, (b) geographical origin and number of animals used, (c) date of collection, and (d) stabilization method including details of the preservative must be displayed on each batch.

(3) Continuations of activities of VRC,B established at Chittagong Medical College, Chattogram by NCDC, DGHS. Venom samples essential for conducting venom and antivenom research will be arranged by VRC,B. Venom and antivenom neutralization assay will be performed. Collaboration for antivenom production using venom source from VRC,B through technology transfer will be arranged. A dialogue between DGDA, EDCL and pharmaceutical sector coordinated by DGDA will be made. (DGDA can play a vital role of bridging or coordination between the AV registering and manufacturing companies including EDCL) a separate document and costing need to be prepared for antivenom production in Bangladesh (see also 2.3.3 & 2.3.4).

2.5.3.2 Quality control of venom: Batch-wise information on venom quality must be supplied by establishments in order to ensure that consistent results in terms of composition and quality of venom batches produced over time for the same species and from the same source of origin are maintained. Basic monitoring parameters to assess venom quality could include protein concentration, biochemical and biological activity and immune profiles by SDS-PAGE and/or size-exclusion or reverse-phase high performance liquid chromatography (HPLC). (Require support and TA from WHO)

2.5.4 Promote and perform venom and antivenom research: toxicity, neutralization assay, and others: To strengthen VRC,B and other labs, centres or institutes' ability to perform research in the field of venomics and anti-venomics either alone or in collaboration. (Research topic)

Strategy 2.6 Encourage participation in preclinical and clinical trials on new AV or therapeutics. (Research)

Objective 3: Strengthen health systems

Strategy 3.1 Strengthen community health services. (Develop a community emergency transport system: a cross-cutting issue) (Also in strategy1.4)

It needs coordination and collaboration with Community Based Health Care (CBHC), Upazila Health Care (UHC), and Hospital Services Management (HSM) OPs, MO LGRD and other NGOs.

Activities

3.1.1 Ensure universal provision of rapid transport from scene to health facilities (through community engagement, and with other health programmes) (To be coordinated with CBHC & UHC). Need agreed policy and manual to make a sustainable system. (Emergency transport system) (See 1.4.2)

Community group will arrange with the support of local government (Union parishad); few contact phone number of volunteer driver of vehicles like van, motor bike, auto etc. will be made and distributed to the community. The vehicle will be multipurpose not earmarked for snakebite. (Example: Motorbike ambulance in Nepal). A workshop on 'community emergency transport' will be conducted.

Responsible person-community group: Local union member, CHCP, health assistant, local support group like MHV, self-motivated volunteer etc.

3.1.2 Improve referral, pre-hospital or in-transit care- providing training to ambulance crew and other transport personnel carrying patients to higher centres or bringing patients from home to hospital and ensuring essential logistics in the ambulance (Emergency transport system)**.** Examples: set oxygen, lateral position of unconscious patient, measure BP, respiratory supports if needed Ambu bag, accompanying a paramedic (available person ensured by UH&FPO). (A collaboration with UHC OP)

Pilot in two Upazila (short term)

3.1.3 Strengthened Primary Health Care by UHC OP capable to provide initial treatment of snakebite envenoming including administration of AV and other life-saving interventions (3.3.2 below). Management of snakebite is an example of delivery of essential emergency care.

Indicators: Number of upazila health complex capable of AV delivery, manage reactions (example, anaphylaxis), and provide other emergency interventions (example, respiratory support and stabilization of critically ill patients).

Arrange an emergency trolley with possible setup of an emergency intervention room.

Drugs, equipment, and logistics for emergency trolley: example- I/V canula, Inj. antivenom, Inj. hydrocortisone, Inj. antihistamine, Inj. adrenaline, syringe 10cc, 5cc, Insulin syringe (100IU), microspore, sterile gauge etc. (Annex: 03)

Pilot in two Upazila (short term).

Strategy 3.2 Facilitate research and policy development to reduce treatment costs

Activities

3.2.1 Identify centres of excellence (Medical College Hospital or District Hospital) in snakebite treatment (to develop 'Hub-and-Spoke Model') for providing supportive supervision to the team of HCPs of Upazila Health Complex, initially one in each division. To establish 'hub and spoke' model of coordinated management among different levels of health care facilities.

Short term plan, mid-term- pilot and long term- scale out

Supportive supervision for UzHC team from District Hospital/Medical College Hospital by 'hub-spoke model' may be considered using digital technology (like community vision centre and base hospital using in National Eye Care Operational Plan, NEC, DGHS). Protocol for 'hub-spoke model' should be developed which will cover early detection of deterioration or development of complications like acute reaction and referral. Guidance for stabilization of patients (blood pressure, respiration) before transfer should be given. Use of social media is highly recommended among health care providers, like– WhatsApp, Imo, Messenger etc. Regional/institutional WhatsApp group on snakebite my be used.

3.2.2 Understanding economic costs of snakebite envenoming and approaches to include it as disease eligible for coverage by public and private finance schemes. (See also 1.7.3)

Research to be conducted to understand direct and indirect costs of treatment and recovery of victims of snakebite envenoming and into models for financing and cost-mitigation schemes (Part of investment case: Economic models for government support programme). (Research study)

Short term

Strategy 3.3 Improve infrastructure, services, and health facilities

CC, Union Health Centre/HFWC, UzHC, DH, Medical College Hospitals can all improve the prevention, first aid, quick referral, treatment and recovery of snakebite as well as rehabilitation of disabled patients and needs strengthening in line with SDG3 and UHC 2030.

Activities

3.3.1 Development of AV supply system:

Strengthen supply chain and surveillance system of AV: Need assessment of AV for the country, procurement, supply, storage, ensuring availability, and appropriate use. Research on improved distribution system of AV. (Research 2: 1 (a) one for need assessment another one (b) for distribution system of AV).

Increase access to antivenom: (at least 20 vials/2 doses of antivenom should be available in every UHC, whether it is used or not. AV should be collected before the snake bite season e.g. March-April. (also in 2.4.1).

Storage of AV

Free/subsidized antivenom should be made available in sufficient quantities in both government and non-government hospitals and monitored for storage under appropriate conditions. If liquid antivenom used the maintenance of an adequate cold chain must be guaranteed. Antivenom must be stored at a temperature within the range that assures stability. Liquid formulations require storage at between 2-8°C. Powder formulation is preferably required for upazila level for easy storage purpose.

Procurement and distribution of antivenom will reduce stock shortage in rural UzHC & DH. A system for the procurement and distribution of antivenoms with a focus on remote rural areas must be set up. Coordination for drug procurement and distribution mechanisms with Central Medical Stores Depot (CMSD) is required. Alternatively, distribution policies used by Expanded Programme on Immunization (EPI), national vaccination programmes can be adopted for the transportation and storage of antivenoms.

3.3.2 Human resource, supply & logistics: Hospital co-ordination committee will oversee the availability of trained team; continuous availability of logistics (AV & other relevant commodities) requires for management of snakebite as per tier specific resource matrix. (Annex: 03)

The tier specific emergency logistics tray to be available at the point of emergency management of snakebite.

Availability of assisted respiration, dialysis, management of shock, blood transfusion, critical care at Medical College Hospitals and District Hospitals will be ensured for improved possibility of survival of the critical ill victim, pharmacovigilance (ADR monitoring) will be established through a coordination within the hospital. (Collaboration and coordination with HSM, see also, in 2.4.3). Death audit of snakebite cases happened at different hospitals and community.

Recruitment, training, and the deployment & retention of skilled health care professionals in rural areas is a cross-cutting issue.

3.3.3 Health educational session on snakebite prevention, control, and first-aid to the patients and attendants who come to the hospital (UzHC, District Hospital and Medical College Hospitals). During the session in addition to prevention information about availability of AV and other treatments in UzHC and other hospitals will be provided. (See also community engagement1.3.4)

Strategy 3.4 Include snakebite envenoming in national and sub-national health plans

Snakebite control is part of meeting SDG, UHC 2030 and improved lives of the poor.

Activities

3.4.1 Snakebite focal person at the directorate general of health services (PM) and Ministry of Health and Family Welfare should be identified (short term)

3.4.2 Advocacy at different levels in the Ministry of Health and Family Welfare (part of coordination) (Objective 4)

Strategy 3.5 Enhance monitoring and surveillance of the disease burden

Capacity of the health systems to collect, compile and analyze data on snakebite

Activities

3.5.1 Make snakebites notifiable and setup reporting systems (Monthly). Notification of snakebite cases.

Need a government circular to make snakebite as a notifiable disease. Will need an operation manual.

3.5.2 Estimation of 'disease' burden of snakebite to be made, covering incidence, death, and disabilities (physical and psychological). (Data collected by DIHS2) (See also Community engagement 1.1.2)

An initial study (base line) to understand the present burden of the problem (short term).

Methods of continuous data collection to be developed as per WHO guidance: (Maintain snakebite register in each health facility).

Key: standardized, comparable, reliable; needs investment in data collection methods, storage, analysis and reporting, tools and application, software packages.

Surveillance system at community and hospital to be developed in collaboration with Management Information System (MIS) using DIHS2 and ICD10

Technical assistance, workshop, and training on data handling in different levels. (Short, medium, and long term)

3.5.3 Representative sentinel sites at the community and hospitals will be considered in a digital platform. From the community, monthly data can be collected at community clinic and onward transmission to UzHC-CS-NCDC/MIS.

3.5.4 Data from non-government health facility (charity, non-profit, other facilities)

Example: Kumudini trust, Patwary hospital in Natore district, Christian mission hospital at Malumghat, Chakaria, Chandrogona, Maini hospital in Rangamati.

3.5.5 Support from development partners (DPs) including WHO will be sought for collection, analysis, and reporting of surveillance data.

3.5.6 One-health approach of collection of data about snakebite among domestic livestock as a model collaboration between human health and animal health under One-health strategic framework and One-health Secretariat. There are economic losses due to disability and death of livestock and working animals. (Annex: 04)

(To be an initial study with livestock department and one health Bangladesh and develop an effective methodology for data collection and surveillance)

Strategy 3.6 Foster research on the ecology, epidemiology, clinical outcomes, and therapeutics of snakebite envenoming

(A list of research topics as an example provided in page 59)

Activities

3.6.1 Capacity development for clinical research in identified field sites on snakebite envenoming (Short term).

3.6.2 Capacity development in collaboration with VRC, B and DGDA for new testing procedure for testing efficacy of antivenoms in laboratory animal. (3R: replacement, reduction, and refinement) (Workshop and training) (Short and medium term)

3.6.3 Research with geo-spatial and other tools to build an accurate picture of the distribution of the incidence of snakebite. (Snake atlas will be developed in collaboration with Zoological Society of Bangladesh/Wildlife Biologists and Forest Department)

3.6.4 Clinical research on different topics including clinical trial, improve understanding of snakebite envenoming and disability following bite, effectiveness, safety, and affordability of treatment.

3.6.5 Local development of species specific antivenom in future- long term.

3.6.6 Local development of bed side rapid diagnostic test (study).

Objective 4: Partnerships, coordination, and resources mobilization

Strategy 4.1 Support governance and leadership

Activities

4.1.1 Separate programme officials like programme manager (PM) for snakebite prevention and control with a small secretariat

Creation of position of PM (n=1), DPM (n=1), evaluator(n=2), and surveillance officer, SO (n=2), office assistant (1), driver (2) dedicated for snakebite prevention and control by NCDC. One SO (Medical doctor) for snake atlas, one SO (Herpetologist) for snakebite cases.

4.1.2 Multi-stakeholder coordination to oversee, coordinate, harmonize, and implementation of strategies at all levels across all partners and stakeholders. (Annex: 05)

- Develop an NTD coordinating mechanism including snakebite:
- Formulation of multi-stakeholder committees at different tiers with TOR
- Approval of Committees
    a. One Multi-sectorial Steering Committee for NTDs including snakebite- will meet twice/year
    b. One technical committee in DGHS for snakebite- will meet thrice/year
    c. Working group (Snakebite Envenoming Working Group, DGHS)- will meet 6 times/year
    d. Medical college hospital, BITID, and District hospital
    e. District coordinating committee (health and administration) with specific agenda on snakebite.
    f. Snakebite coordinating committee in upazila (Sub-district) yearly one meeting.
    g. Community clinic level existing committee, existing Community group and support group- additional stakeholders may be invited
    h. Union Coordination Committee- existing union parishad

Strategy 4.2 Promote advocacy, effective communication, and productive engagement

(By Snakebite programme)

Activities

4.2.1 Mapping the stakeholders and coordination among the stakeholders with developed TOR for snakebite prevention and control:

Mapping

- DGHS: NCDC,CDC (NTDs), CBHC, UHC, HSM, LS & HEP, MIS
- BTV, Bangladesh Betar, Community Radio
- Snakebite survivor forum
- Bangladesh Society of Medicine (BSM)
- Toxicology Society of Bangladesh (TSB)
- Bangladesh Society of Infectious and Tropical Diseases (BSITD)
- Bangladesh Paediatrics Society
- Wildlife biologist/Snake rescuer
- Public Health Association of Bangladesh
- Friends of snake bite
- Federation for Medical Students' Association, Bangladesh
- Zoological Society of Bangladesh
- One Health Secretariat
- Islamic Foundation and other faith-based organizations
- PKSF, BRAC, Ahasania Mission
- Scout, Girls' guide, BNCC
- Representative of Rotary Governor, Bangladesh
- Representative of Lions Governor, Bangladesh
- Forest, Environment & Climate Change, Livestock, Agriculture, LGED, Social Welfare, and Communications, Red Crescent, and communication
- WHO, FAO, OIE, NGOs, INGOs and other DPs
- Non-government health facility (charity, non-profit, other) Example. Kumudini trust, Patwary hospital in Natore district, Christian mission hospital at Malumghat, Chakaria, Chandrogona, Maini hospital in Rangamati
- Non-government medical colleges and hospitals (around 70)
- Lifebuoy Friendship Hospital, 'Jibon Tori'
- IUCN and Zoo
- Other NGOs and philanthropies

4.2.2 Broad advocacy on various aspects of snakebite envenoming specially prevention and control through community engagement

- Engage a consultant for stakeholder engagement who will facilitate coordination amongst the various groups and the different levels of meetings
- Organize consultative and coordinating workshop (cost for yearly basis)
- Advocacy for community engagement by the stakeholder (yearly meeting).
- Advocacy for Teaching and Management of Snakebite (Scientific Seminar, CME)
- Engagement of Civil Society organization (CSO), Academia and Research Organization

  - Policy Dialogue (every 2 year)

  - Round Table discussion (yearly)

Strategy 4.3 Enhance integration, coordination, and cooperation

Activities

4.3.1 Develop operational manual for integrated approach

- Develop an Operational Manual for Multi-sectorial Co-ordination and between NTDs either by working group meeting or workshop/ by engaging a consultant (Workshop)
- Validation of the Operational Manual

4.3.2 Integration between health and non-health sectors and integrated message on snakebite.

- Employing a communication expert to develop message for Integrated NTD approach; 6 months (In SBCC strategy for snakebite)
- Consultative workshops (2/3) for development and finalization of integrated messages with relevant stakeholders
    - Validation of messages
    - Effective communication of relevant messages with different stakeholder at different tiers
- Update snakebite topic in school books in collaboration with School Textbook Board.

Prevention

Precise and concise description:

Health: Soil Transmitted Helminthiasis of CDC for encouraging footwears to prevent STH/ podoconiasis and snakebite

- Malaria programme advocating for LLIN/mosquito net to prevent malaria, kala-azar, dengue, and snakebite ('cot and bed net')
- WASH programme for improve sanitation and human behaviour to reduce risk of snakebite.

Non health: (Snakebite is a rural poor men's health problem, related with poverty reduction and a right to health issue, may be a "Litmus test" for universal health coverage and SDG):

- Agriculture outlets (fertilizer, pesticide, medicine): Snakebite prevention as a promotion of health safety of farmers by agriculture extension officers, pesticide distributers
- Snakebite prevention as a promotion of health safety of domestic animals and poultry by livestock extension officers, dealers.
- Snakebite prevention as a promotion of health safety of forest workers, forest goers, tea plantation workers, rubber plantation by forest workers and officers.
- Ansar/VDP, Red Crescent, Scout/Girls' Guide, BNCC, local government elected representative (UP members).
- School based snakebite prevention and first aid programme by teachers and 'Little Doctor' both in formal and informal education institutes.
- Advocacy for creating community awareness by the members of print and electronic media through workshop, seminar, and competition for write up and programmes. Orientation & briefing programme.
- Encouraging Corporate Social Responsibility (CSR) by business communities, industrialists, bank owners, philanthropist, pharmaceuticals, telecommunication, transport agencies for prevention and first aid of snakebite.
- Engaging civil society for creating community awareness for prevention, first aid, and quick transport of snakebite victims.
- Engaging non-government organizations for creating community awareness for prevention, first aid and quick transport of snakebite victims.
- Engaging faith-based organizations for creating community awareness for prevention, first aid and quick transport of snakebite victims.
- Engaging non-resident Bangladeshis (NRBs) for support for creating community awareness for prevention, first aid and treatment of snakebite victims by different stakeholders.
- Engaging wildlife biologist and 'snake rescuers' for creating community awareness for snake identification, prevention, and first aid of snakebite.

Treatment (Chronic care)

- Chronic wound: some snakebite survivors after cobra bite in particular develop wound, ulceration, and blistering necrosis requiring prolong wound care.
- Prolong wound management in cooperation with surgeons/reconstructive surgeons similar to wound care/foot care in filariasis, leprosy, Buruli ulcer, diabetic foot, Madura foot.

- Chronic physical disability: Foot drop, wrist drop, contracture, paralysis require physiotherapy cooperation with physiotherapist and social welfare.
- Chronic psychological disability: It needs support from psychiatrist and psychologist.
- During acute condition multidisciplinary co-operational support from ICU, nephrology, surgeons (within the institute) may be required.

4.3.3 Functional mechanism for effective coordination and communication

- Arranging regular meetings of different committees at different tiers according to TOR.
- Arranging regular multi-stakeholder coordination meeting according to TOR. (Yearly)
- Development of dedicated website and regular update to share data/policy documents/ guidelines/communication materials etc. (In NCDC website)
- Formal data sharing among potential stakeholders
- Celebration of International Snakebite Awareness Day (ISBAD) etc at different levels (National/District/Upazila/Community/Schools). (Divisional headquarters and corresponding districts could have a joined meeting).
- Organize joint Programme with forest department for example
- Collaboration for joint operational research (protocol development, funding, implementation).

Strategy 4.4 Strengthen partnerships, cooperation, and alliances

Coalition of partners and stakeholder: A local level (at UZ, district) multi stakeholder coordination will be established involving health professionals, and representative of other ministries- administration, local government, agriculture, livestock, education, forestry, social welfare, labour, science, communication, disaster, women and children; voluntary organizations, religious leaders, civil society and NGOs. They will be champions, advocacy groups and activists for snakebite mitigation. Massive advocacy for behavioural, social change and communication for snakebite prevention and control will be initiated. Core message will be standardized and consistent to be prepared by snakebite programme.

Activities

4.4.1 Technical assistance from WHO and other development partners:

Recruitment of a Technical Expert by WHO/other DPs for five years

Development/update of policy, strategy, guidelines, quality assurance, review and assessment, supply chain management, research, sustaining and strengthening VRC, DGDA, and pharmaceuticals (Essential drug company limited) for local antivenom production.

4.4.2 International cooperation and support:

For technology transfer, workshop, host meetings, seminars, conferences, exchange programme. During these events NCD snakebite programme will be able to share success stories, best practice, lesson learnt, and challenges. Besides UN organizations, cooperation and collaboration can be sought/strengthened with other platforms like Asia Pacific Association of Medical Toxicology (APAMT), SAARC, IUCN.

- Formation of Alliance
- International Society of Toxinology (IST) and others
- Multi-Disciplinary Scientific Meeting (in every two year)

4.4.3 Cooperation and collaboration with ministry of Forest, Environment and Climate Change, Science and Technology, academia, research institutes both within and outside Bangladesh.

Joint/Collaborative Research (KAP Study).

Meeting for selection of priority research topics

Strategy 4.5 Coordinate data management and analysis

Establishment of Data Sharing Mechanism across the concerned partners/stakeholders (DHIS2, WHO)

- WHO Global Health Observatory
- MIS DGHS
- BBS

Regular data analysis and publication for evidence-based decision making

- Publication of research articles
- Publication of annual review report prepared by snakebite programme.

Strategy 4.6 Establish a strong, sustainable investment case

- Development of NSSP & Costed NAP with identification of potential stakeholders/funders
- Sharing of the NSSP & Costed NAP among potential stakeholders
- Exploration of the opportunities for getting support from potential National and International Donors/NGOs/DP Consortiums
- Independent review of Snakebite programme by WHO every 3-5 years.
- Dissemination meeting for the strategy to multi-stakeholders (1 at Dhaka national & divisional together + 7 at other divisional level coordinating between medical college,

director health, and civil surgeon with other stakeholders). Composition of the attendees will be provided by snakebite programme.

Research (embedded in different objectives)

Research List examples: (To be determined through a workshop and updated periodically)

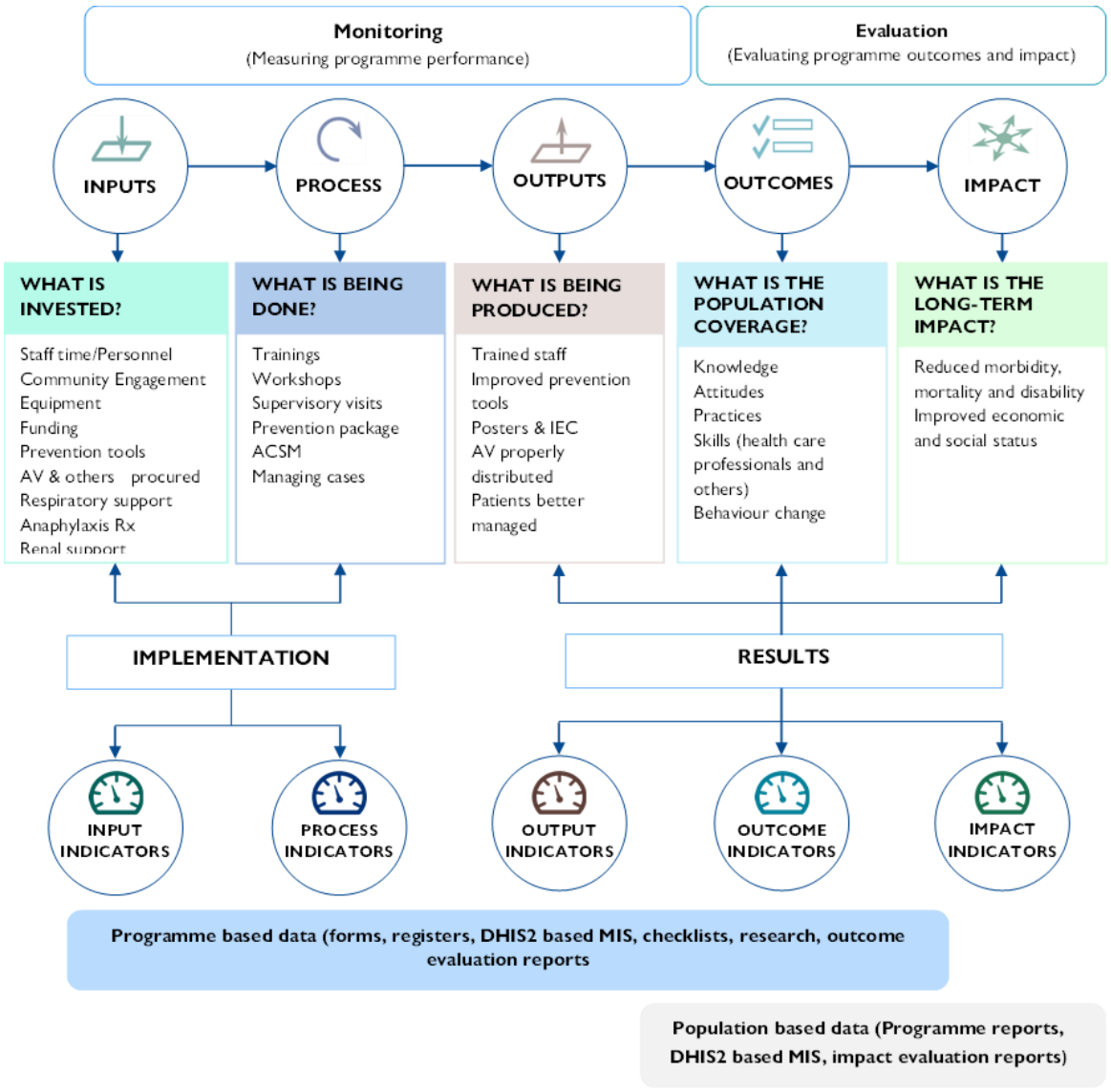
1. Occupations risking snakebite- agricultural, high risked exposure, ecology, epidemiology, behaviour, occupation, environment. Risk mitigation
2. Geospatial understanding of determinants of snakebite envenoming
3. Number of rural populations that slept under mosquito net and cot previous night
4. Proportion of households sharing animal/food store as dwelling house
5. Antivenom (system validation): procurement, distribution, surveillance system, post marketing surveillance
6. Series of benchmark to be established- community, hospital
    - Preclinical-'replacement, reduction, refinement' 3R models for AV safety, and efficacy; Innovations for improved AV access
    - Percentage of patient reaching UzHC/Upper-level hospitals for management of snakebite
    - Percentage of patient reaching UzHC/Upper-level hospitals for management after getting treatment from traditional healers for snakebite
    - Percentage of snakebite victims recovered after treatment
    - Percentage of snakebite victims are correctly diagnosed and appropriately treated
    - Percentage of antivenom associated adverse event (anaphylaxis) managed effectively and reported accordingly
7. Data system (to understand burden): tools, applications, minimum data. Hospital, community. Data collection methods- tools, application, development of standardized application, software package, disease surveillance.
8. Collection- analysis- storage- reporting
9. End point to see effectiveness in different syndromes following bite: objective criteria
10. Post-acute care services: disability and rehabilitation; snakebite in pregnancy -pregnancy outcome-impact on pregnancy & newborn, neurocognition
11. Finance: treatment cost- direct and indirect. Modalities of financing with cost mitigation. Public and private
12. Context wise ideal communication method (ACSM) to be used for the community; best method of first aid; best method of transport from the community to hospital.

7. PLANNING, MONITORING, AND EVALUATION

To develop a work plan. Key actions for each strategy will be SMART- specific, measurable, achievable, relevant, and time bound. Key actions must be defined in term of time frame of implementation. For each activity the year(s) it would be implemented must be determined and marked.

7.1 Operational Plan

Hierarchy of performance indicators



Performance framework with indicators (Table 09):

Impact (monitors the Goal): snakebite cases, snakebite deaths, snakebite disability

Outcome (monitors Objective)

Output (monitors Strategy)

7.2 Implementation arrangements

7.3 M&E system

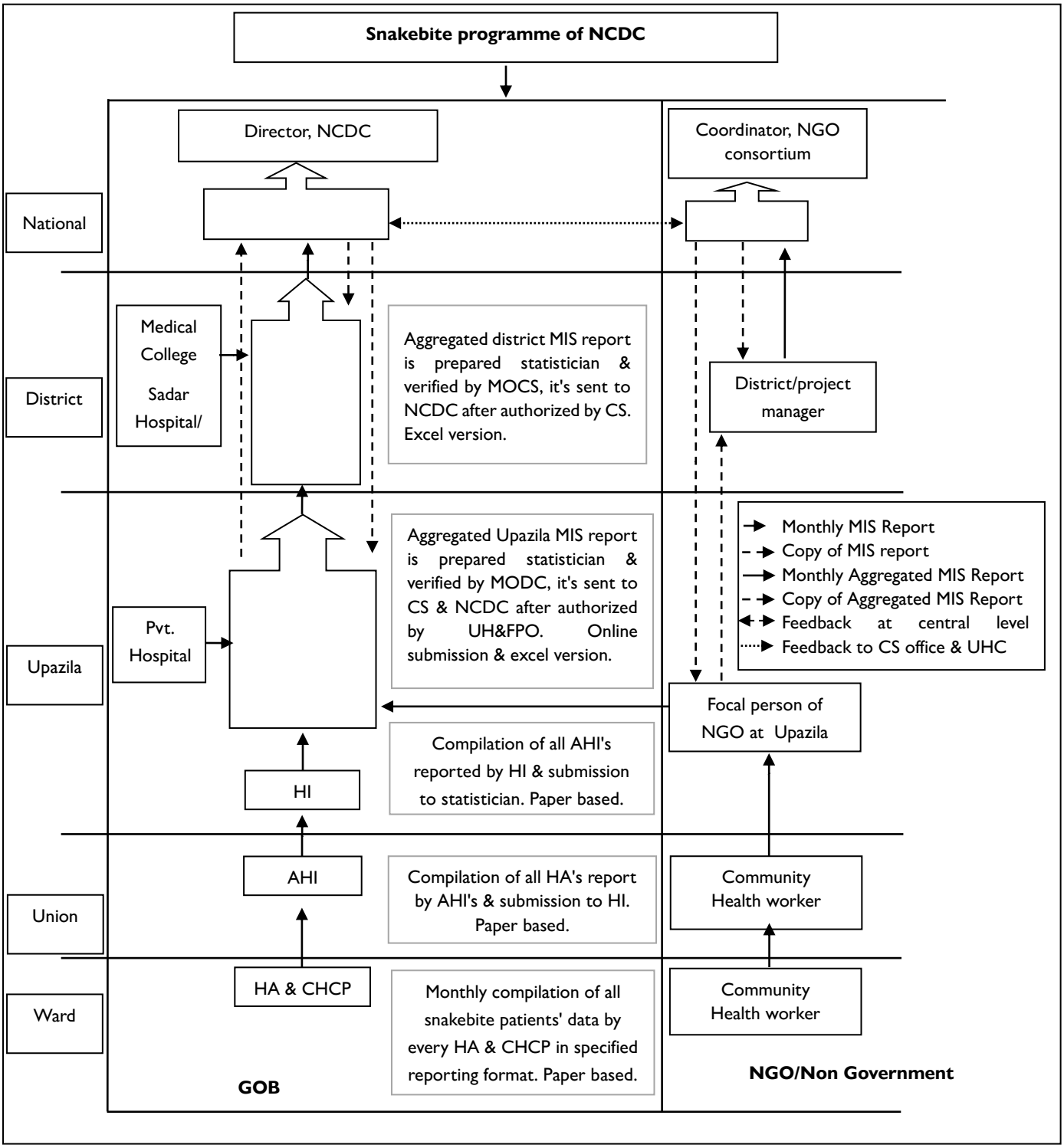
7.3.1 Routine data collection, analysis and reporting

7.3.2 Data quality assurance

7.3.3 National Health Data Warehouse

7.3.4 Performance Framework with Indicators (PME)

Proposed snakebite MIS, data flow and feedback in Bangladesh



Planning, monitoring and evaluation

Data requirement (tools and applications based on consensus and from research)

1. Accurate data on burden of disease (i.e. incidence (venomous- envenomation+; non venomous envenomation-; morbidity, disability and mortality) for geographically defined sub-national, national areas: Data require and the process of data acquisition & analysis. (Standardized reporting using ICD10 code: T63.0 (toxic effects of venom) and death: WHO Integrated Data Platform needs to be adapted: needs training, HRs, coordination between MIS & snakebite programme, NCDC). DIHS-2 and module- to be introduced; designating snakebite as notifiable disease would improve hospital reporting rates.
2. Snakes' information- venomous snakes, distribution map (snake atlas)
3. Access to data on antivenoms and other commodities used in the treatment of snakebite envenoming;
4. Data on community prevention, health care-seeking behaviour and sociocultural perceptions of snakebite events and their consequences;
5. Training monitoring: Assessments of the clinical skills, competencies, and knowledge of health care professionals (routine and study);
6. Analysis of the capacity and needs of national and local health systems in addressing snakebite;
7. Analysis of gaps in antivenom currently in use/produced by good manufacturing practice;
8. Evaluation of the shortfalls in venom source, regulatory agency (DGDA) capacity, training and resources.

Immediate need

1. Develop reliable estimates of the current burden of snakebite mortality and morbidity in the country that may then be used as a baseline to monitor outcomes.
2. Engaging community for prevention and first aid, training health care professionals for managing snakebite.
3. Setup pilot sentinel snakebite reporting systems to provide prospective epidemiological information on snakebites in order to quantitatively monitor response to mitigation measures and reach SDG target by 2030.
4. Establish a nodal centre and focal person to collate data and co-ordinate action.
5. Identify centres of excellence in snakebite treatment and research in the country as training and research centres.
6. Generate information on the AV: need, supply system, quality, safety, specificity and effectiveness of available antivenom.

Short term (02 years)

1. Develop/update national snakebite guidelines, training modules
2. Identify high risk communities based on nationwide study and by a workshop
3. Include snakebite in national health programmes
4. Make snakebites notifiable
5. Providing AV and logistics as per developed resource matrix for elements essential for the emergency management of snakebite victims at different tiers of care
6. Initiate research on priority areas including epidemiology, venom/antivenom research and mapping medically important snake species
7. Increase awareness and capacity in communities (Community engagement)
8. Increase capacity of health care providers
9. Introducing venom source through sustained activity of VRC,B and improve quality and efficacy and effectiveness of current antivenom
10. Increase availability of research data
11. Increase political and financial support at all levels

Mid-term (from year 03- year 05 – 03 years)

1. Empower identified communities to adopt preventive measures against snakebites and respond with appropriate first-aid
2. Strengthen capacity of health-care workers to provide emergency care, manage snakebite envenoming and antivenom related complications and integrate health worker training and medical education
3. Establish/pilot model community snakebite initiatives
4. Establish/pilot model clinical snakebite management centres and 'Hub-and -Spoke model'
5. Increased access to antivenom
6. Establish national venom standards through VRC,B
7. Setting a system of adherence to good manufacturing practices based on the existing WHO guidelines on production, control and regulation of antivenoms, to start with venom standard.

Long term (5-10 years)

1. Snakebites are treated in all hospitals (UzHC, DH, MCH)
2. Universal access to antivenom
3. Universal access to rapid transport to hospitals
4. Improve first aid, pre-hospital or in-transit care, and prevention practices
5. Introduce pre-qualification for antivenoms

6. Establish national venom collection centre (VRC, B)
7. Establish sentinel surveillance centres
8. Expansion of mid-term initiatives to entire country
9. Manufactured antivenom to be licensed for quality by regulatory bodies

Monitoring mechanism:

(To be finalized after discussion with monitoring and evaluation department of DGHS, WHO, Partners).

By routine surveillance data: DIHS platform by snakebite programme, NCDC, DGHS: 6 monthly reporting of supplies & distribution, training/workshop Reporting to Line Director, NCDC or Programme Manager, NCDC and MIS, DGHS.

From UzHC: monthly reporting: Suggested reportable items: Number of bites(Venomous/Non-venomous), number of referrals to District Hospital or Medical College Hospital, doses of AV used, AV stock, AV reaction and number of deaths.

Method of reporting: Through DIHS2 system to district CS Office or Directly to NCDC by Google form.

Performance monitoring by case studies, death reviews, medical audit: On behalf of NCDC by a team of medical experts and working group members.

Supervisory visits: by members of working group/ NCDC, DGHS officials

Evaluation

Analysis of collected and pooled routine surveillance data

KAP study and Survey

Table: 09: Performance Framework with Indicators

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
Impact (n=4): i) Snakebite case rate per 100,000 persons per year	623	2010	PLoS NTD 2010	Survey 0% reduced						Cross – sectional survey 2009 on 18,857 individuals from 3,993 household from all over Bangladesh detected 98 snakebite and 1 (one) death.
	244	2022	BIHS NCDC		5% reduced	10% reduced	20%reduced	25% reduced	312 (50% reduced)	Baseline Survey (2022) and initiation of Surveillance NCDC, MIS, and IEDCR
ii) Venomous Snakebite (envenomation) case rate per 100,000 persons per year				Survey needs to be done	5% reduced	10% reduced	20% reduced	25% reduced	30% reduced	Not known, to be defined by surveillance yet to be established.
iii) Snakebite deaths per year: rate per 100,000 persons per year				Survey needs to be done	5% reduced	10% reduced	20% reduced	30%	50% reduced	Not known, to be defined by surveillance yet to be established. Cross - sectional survey 2009 on 18,857 individuals from 3,993 household from all over Bangladesh detected 1 (one) death, estimated snakebite death 6,041.

Indicator	Baseline			Annual Targets					Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
iv) Snakebite disability: a) Physical Snakebite disability b) Psychological Process indicators/Outcome indicators					5% reduced	10% reduced	20% reduced	30% reduced	50% reduced	Not known, to be defined by surveillance yet to be established. Definition of disability to be established. 35-50% to be reduced 2026-2030
1. Number (%) of community group (CG) having regular agenda on snake bite in monthly meetings				0%	10% to be achieved	20% achieved	30% achieved	50% achieved	75% of achieved	Existing number of Community groups (CG): 14,073+ others 39,000 approx. Snake bite agenda per year: 6
2. Number of community support group (CSG) having regular agenda on snake bite in monthly meetings				0%	10% to be achieved	20% reduced	30% reduced	50%	75%	Existing number of Community Support groups (CG):14,073 X 3 and others 39,000 approx. Snake bite agenda per year: 6
Community engagement (n=4): i) Percentage of high-risk population using preventive				0%	10% to be achieved	20% to be achieved	30% to be achieved	50%	100% to be achieved	100% of the community members will be oriented about snake bite prevention and first aid

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
measures in communities (Survey- KAP)										
ii) Percentage of community members using appropriate first-aid following snakebite (Survey- KAP)	2%	2010	TRSTMH	2%	20%	30%	40%	50%	70%	Hospital based data from 884 patients at CMCH, 1999-2002 published in Trans R S Trop Med Hyg; 2010
iii) Percentage of patient visiting traditional healer (hospital data or community survey)	42%	2010	TRSTMH		40% (10% reduced)	38% (20% reduced)	35% (40% reduced)	30% (50% reduced)	20% (80% reduced)	Hospital based data from 884 patients at CMCH, 1999-2002 published in Trans R S Trop Med Hyg; 2010
iv) Percentage of patient using tourniquet/ligature (hospital data or community survey)	98%	2010	TRSTMH	90%	80%	70%	60%	50%	20%	Hospital based data from 884 patients at CMCH, 1999-2002 published in Trans R S Trop Med Hyg; 2010
Treatment (n=3): i) Percentage of Upazila Health Complex	424			20%	30%	40%	50%	80%	100% all hospitals to be covered	AV supplied. Data not known, to be defined by hospital surveillance yet to be established.
DH	60			50%	60%	80%	100%	100%		
MCHC	36			60%	80%	100%	100%	100%		

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
(In identified high-risk areas) stocked with anti-venom										
ii) Percentage of Antivenom associated adverse event (anaphylaxis) managed effectively and reported accordingly (as Pharmacovigilance)	57%	2008	JVATiTD	10% PV form return	20% PV form return	30% PV form return	40 PV form return	70% PV form return	100% PV form return	Phamacovigillance yet to be established. Data it's from MR Amin et al. J Venom. Anim. Toxins incl. Trop. Dis., 2008, 14, 4 p 662
iii) Percentage of snake bite victims recovered after treatment (research or hospital data)			30%	40%	50%	60%	80%	100%		
Health system (n= 5) i) Percentage of snakebite victims transported to nearest health facilities by 100 minutes following bite				10%	20%	30%	40%	50%	80%	Not known, to be collected by surveillance/study yet to be established.

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
ii) Percentage UzHC having trained team/provided training (doctor nurse, and SACMO) on management of snakebites (Training records)				10%	20%	40%	80%	90%	100%	Not known, to be collected by surveillance/study yet to be established
iii) Snakebite teaching becomes part of national curriculum of health care professional students				Initiation	Completed					Training module development or modification
iv) Snakebite is included in the national health programme				Initiation	Completed					
v) Percentage of health facilities equipped with tier specific amenities for snakebite management **(Annex 3)**										Not known, to be collected by surveillance /study yet to be established.
UzHC				5%	10%	20%	30%	50%	80%	

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
DH MCHC Facility Survey				50% 50%	60% 70%	80% 80%	90% 90%	100% 100%	100% 100%	
Coordination (n=5) i) Separate programme manager, DPM, and evaluator				Initiated	Completed					
ii) Multi-stakeholder NTD coordination mechanism established				Initiated	Completed					
iii) Number of districts having 'snake rescue' team (Rescue team will be formed by Forest department)				60%	70%	80%	90%	100%		5 rescue teams in each year; minimum 1 team in 1 district. This teams need to be formulated and organised by Bangladesh Forest Dept. with collaboration of other depts.
iv) Snakebite data from Bangladesh is provided to WHO				Training Started		Established				

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
Global Health Observatory										
v) MIS DGHS using DIHS2 data for snakebite Health facility (UHC, DH, MCHC) data is collected and fed into the national health system				Establishment of DHIS2 data platform for snakebite. Training Started	Initiated	Established				
Monitoring (n=3): i) Snakebite is made notifiable				Initiation	Completed					Policy level decision Established snakebite notification. Law, by law, and GO
ii) Sentinel surveillance centres established (2 Upazila)				Completed Collaboration with IEDCR						Collaboration with IEDCR as One Health secretariat.

Indicator	Baseline			Annual Targets						Remarks
	Value	Year	Source	2023-24 (Y1)	2024-25 (Y2)	2025-26 (Y3)	2026-27 (Y4)	2027-28 (Y5)	2028-32 (Next 5Y)	
iii) Hospital surveillance centres established (2 Upazila health complex) Include DH and MCHC phase wise				Completed Collaboration with IEDCR						Collaboration with IEDCR as One Health secretariat.

8. RISK MANAGEMENT AND MITIGATION

8.1 Identify risk

Risk assessment tools, consult with stakeholders.

Internal factors and external factors to be kept in mind.

8.2 Assessing their consequences

Use a matrix to identify the likelihood (probability) that a risk will arise and evaluate the severity of the consequences and the effect on the programme overall or on a specific project.

8.3 Risk rating

Risk appetite/acceptance:

Risk register/log book

Risk ID, origin, short description, long description evaluation, risk owner, risk status, and risk closure.

Strategies to minimize them

Consultation, Monitoring, and Regular review

Table 10: Managing Risk: Risk categories, key risks, and mitigating actions

Risk category	Key risk	Mitigating actions	Timeline
Financial risk	Lack of adequate and sustained funding for snakebite prevention and control in Bangladesh and unsuccessful efforts in mobilizing resources (from within and outside country) commensurate with the need for snakebite prevention and control.	• Transform political commitment in terms of adequate and sustained domestic resources for snakebite prevention and control. • Advocate for funding for snakebite prevention and control as an investment case for ending suffering and poverty and for achieving overall socio-economic development, UHC and SDGs to in-country corporate sector and others as well as to development partners.	From 2022
Financial & fiduciary risk	Issues relating to low absorptive capacity; suboptimal financial efficiency	• Efforts will be taken to accomplish all activities and regular review of progress. • Efforts will continue exploring efficiency.	Ongoing

Risk category	Key risk	Mitigating actions	Timeline
Financial and extrinsic risk	COVID-19 pandemic (and/or such crisis in future) impacting timely and quality service delivery, re-purposing of funding and human resources, issues of safety of health workforce/volunteers	• Develop, adapt and implement appropriate guidelines in line with the WHO and other international/national guidelines to maintain uninterrupted essential services including health care service delivery with safety. • Strategic planning and 'catch-up' plan to mitigate adverse impact of pandemic is ongoing drawing guidance from the WHO, other partner stakeholders/agencies, as well as MOHFW and various health programmes, Snakebite Technical Committee as well as regular engagement with implementation levels.	Ongoing
Extrinsic risk	Natural disasters, cyclones, rainfall and floods occur frequently in Bangladesh; and these affect timely implementation of interventions especially during monsoon and post-monsoon months, which also coincides with peak snakebite season, adversely impacting snakebite and deaths. Besides, diversion of efforts and resources to affected areas also affect implementation as per plan elsewhere.	• Buffer stock is incorporated into the procurement of AV. Deployment of reserve antivenom to Upazila Health Complex during monsoon and post-monsoon months, which also coincides with peak snakebite season especially in hard-to-reach areas. • CG and community level health workers/ volunteers will promote the preventive measures of snakebite in the population.	Ongoing
Programmatic risk	Access to timely interventions remain critical risk in view of remoteness of some areas that is often compounded by poor physical infrastructure and lack of trained staff. Community, rights and gender barriers, and inequities, although waning over time, also pose risks for timely access to AV.	• Community level health workers/volunteers would ensure that affected population is served effectively. Deployment reserve of AV at UzHC. • Coordination and linkages with community systems, networks as well as local governments would continue to be strengthened. Local knowledge, experience, and community-based presence of health workers/volunteers would facilitate learning to deal with such situation. • Intense ACSM (advocacy, communication, and social mobilization) activities will be emphasised. "Snakebite matchbox tool" when developed will be used periodically to update understanding of community, rights and gender issues and addressing those through inclusion, equity, equality, and gender sensitive approaches.	Ongoing

Risk category	Key risk	Mitigating actions	Timeline
Programmatic risk	Inherent weaknesses of the health systems often limit the quality of services.	• While overall improvements in health systems will be emphasized by the MoHFW, the NCDC (snakebite programme) will also advocate for capacity building/strengthening. Further emphasis on prevention of snakebite by capacitated CCs will be a key measure. Capacity building of multi-purpose health volunteers will also help. Use of volunteer networks of NGOs and collaboration with different stakeholders for snakebite services in less accessible communities with health system weaknesses will attempt to solve some of the issues associated with access and reduce the burden on overstretched health workers, particularly in the periphery. • Other potential mitigation actions are: - Regular health system review including but not limited to, performance audit of staff involved in snakebite programme - Strengthening supportive supervision and monitoring ('hub and spoke model'). - Ensuring ownership of the programme by the district health authorities and empowering them to improve the quality of services - Improving collaboration between UH&FPO and other local stakeholders - Analysis and use of community and hospital surveillance data - Development and implementation of mentoring system to develop specific skills / expertise	Ongoing
Programmatic risk	Non-compliance of national guidelines and reporting by government and Non-government sector.	• Training/retraining for adherence to the SB guidelines. Coordination with relevant sectors and Ministries, NGO sector involvement will be initiated. Non-government sector engagement guidelines will be developed.	From 2023 onwards
Programmatic risk	Timeliness and completeness of reporting. Variable quality of data undermines programme management and implementation	• Data collection, collation, sharing will be strengthened. With nationwide rollout of DHIS2 based MIS, the timeliness, completeness will be further streamlined. Snakebite focal persons- PM, DPM, evaluators, will carry out on site data verification, supervision at service delivery points regularly and send prompt feedback to the local levels.	From 2023 onwards

Risk category	Key risk	Mitigating actions	Timeline
Programmatic risk	Supervision and monitoring for measuring progress and impact may miss out regular risk assessments and mitigation.	• Supervisory visits would be comprehensive with risk-aware focus. Trainings/re-trainings would also enhance requisite comprehension and skills.	Ongoing
	MPHVs are not recruited	Existing HCWs & volunteers of Government and other stakeholders will be utilized	
	AV not available in Bangladesh	Country Office WHO will be requested to support availability of AV. Measures for local production of AV will be initiated.	
	Snake data is not available due to regulations	Coordination with Forest Department, Zoological Society/wildlife biologists/academia will be made and support will be requested. Snakes brought by patients in hospitals will also be used for snake mapping. Volunteers will be used for GPS; assistance from Govt. Zoo and Safari will be sought.	

9. GOVERNANCE, (PROPOSED COMMITTEES) BANGLADESH SNAKEBITE STRATEGY FOR PREVENTION AND CONTROL

9.1 National Steering Committee

(Bangladesh Multi-sectoral Coordination Committee for Neglected Tropical Diseases, including snakebite prevention and control)

Chairperson: Honorable Minister, Ministry of Health & Family Welfare

Member secretary: Secretary, Health Services Division, Ministry of Health & Family Welfare

Members

1. Secretary, Ministry of Local Government, Rural Development and Cooperatives
2. Secretary, Medical Education and Family Planning Division, Ministry of Health and Family Welfare
3. Director General, Directorate General of Health Services
4. Director General of Medical Services (Armed Forces)
5. Director General, Directorate General of Drug Administration
6. Director General, Department of Environment
7. Chief Conservator of Forest
8. MD, Community Based Health Care Trust
9. Country Representative, World Health Organization (WHO)
10. Principal Information Officer, Press Information Department
11. Country Representative, Food & Agriculture Organization (FAO)
12. Country Representative, UNICEF
13. Chair/Representative from Chair of the Development Partners (DP)
14. President/Secretary General, Bangladesh Medical Association
15. Director CDC, DGHS
16. Line Director, NCDC, DGHS
17. One snakebite expert

TOR

i. Approve the Bangladesh Snakebite Envenoming Strategy for Prevention, Control and Management

ii. Decision on proposals sent by National Technical Committee (NTC).

iii. Monitoring and evaluation of the implementation status of strategy
iv. Resource Mobilization for NTD and Snakebite
v. Meet every six months and shorter when necessary

9.2 National Technical Committee

Chairperson: Director General of Health Services

Co-Chairperson: Additional Director General Planning and Development, DGHS

Member Secretary: Line Director NCDC, DGHS and Focal Point

Members (Not according to warrant of precedence)

1. Director, Administration, DGHS
2. Line Director, Hospitals Services and Management, DGHS
3. Line Director, Upazila Health Care
4. Line Director, CBHC
5. Director, NIPSOM
6. Director, BITID
7. Director, IEDCR
8. Managing Director/Representative, PKSF
9. Joint Chief planning/Representative, MOHFW
10. Representative of DGDA
11. President/Secretary General, Bangladesh Society of Medicine
12. President/Secretary General of Toxicology Society of Bangladesh
13. Chair/Representative from Chair of the Development Partners (DP)
14. Representative from Country Office, WHO
15. Representative from Food and Agricultural Organization
16. Head of Medicine, Dhaka Medical College, Dhaka
17. Professor M A Faiz, Professor of Medicine and Snakebite Expert
18. Conservator of Forest Wildlife
19. Programme Manager, Injury and Snakebite, NCDC, DGHS
20. Dr. Md. Abdul Wahed Chowdhury, Department of Zoology, (Wildlife Biologist), Chittagong University.

TOR

i. Development and periodic review of the Bangladesh Snakebite Envenoming Strategy, Approval of the Action Plan and Guidelines for Prevention, Control and management (for consideration developed by Core Group). First Strategy will be approved by NTC.
ii. Monitor and evaluate implementation status of strategy, Action Plans and Guidelines.
iii. Develop and Proposed budgets for the different activities outline in action plan.
iv. Coordinate with directors/directorates and sectors involved in the action plan.
v. Identify best practice(s) for prevention, first aid and management of SB for scale out through national Technical Committee.
vi. Meet every four months and when necessary.

9.3 Bangladesh snakebite envenoming working group (Working Group)

Chief Coordinator: Line Director, NCDC, DGHS

Coordinator: Programme Manager, Injury and Snakebite NCDC, DGHS.

Members

1. Representative from Director General Medical Education
2. Representative from CDC
3. Representative from CBHC
4. Representative from Upazila Health Care
5. Representative from Hospital Services Management (HSM)
6. Representative from Bangladesh Institute of Tropical and Infectious Diseases (BITID)
7. NPO Epidemiology, WHO
8. Representative of Toxicology Society of Bangladesh (TSB)
9. Representative of Bangladesh Society of Infectious and Tropical Diseases (BSITD).
10. Principal Investigator, Venom Research Centre, Chittagong Medical College, Chattogram.
11. Head, Epidemiology, NIPSOM
12. Head of Medicine, Shaheed Suhrawardy Medical College, Dhaka
13. Deputy Programme Manager, Injury and Snakebite, NCDC, DGHS

TOR

i. Periodic review of the Bangladesh Snakebite Envenoming Strategy, Action Plan and Guidelines for Prevention, Control, and management (for consideration to NTC)
ii. Monitor and evaluate implementation status of strategy, Action Plans and Guidelines
iii. Coordinate with directors/directorates and sectors involved in the action plan

iv. Identify best practice (s) for prevention, first aid, and management of SB for scale out through National Technical Committee
v. Meet every two months and when necessary
vi. Secretariat support to the National Technical committee
vii. Develop all the Relevant Draft Documents
viii. Co-opt member (s) if necessary

9.4 Snakebite envenoming committee at Medical College Hospital and BITID

Convener: Director/superintendent

Advisor at MCH at 08 Divisional Level: Director Health, of the division

Member Secretary: Resident Physician (RP)

Members

1. Head of Medicine
2. Head of Paediatrics
3. Head ICU
4. Tropical Medicine Specialist if available.
5. In-charge: Emergency Department
6. Representative of Civil Surgeon of District
7. Matron (Nurse)
8. Social Welfare Officer of the Hospital
9. Co-opted member(s)

TOR:

i. Ensure antivenom and logistics for management of Snakebite cases
ii. Ensure and coordinated management of Snakebite cases, adults and children, providing critical care if needed. Medical College Hospital will act as referral hospital ('Hub') for District Hospital/Upazila Health Complex ('Spoke').
iii. Arranging training for the healthcare professionals and HCP students.
iv. Community engagement for prevention, appropriate first aid, and early treatment seeking at hospital.

9.5 District Hospital Snakebite Committee

Convenor: Superintendent/Director, District Hospital

Advisor(s): Civil Surgeon of District;

Member Secretary: RMO

Members

1. Consultant, Medicine
2. Consultant, Paediatrics
3. Consultant, Anesthesiology/ICU
4. Matron
5. Senior Health Education Officer
6. Social Welfare Officer
7. District Health Superintendent
8. Representative from Forestry and Environment
9. Co-opted member(s)

TOR

i. Ensure management of Snakebite cases. District hospital will act as referral hospital ('Hub') for Upazila Health Complex ('Spoke').
ii. Ensure logistics for management of Snakebite cases.
iii. Arranging training for the healthcare professionals.
iv. Community engagement for prevention, appropriate first aid, and early treatment seeking at hospital.

District Health coordination committee with Civil Surgeon as chair will discuss snakebite in monthly meeting with agenda. Civil Surgeon will coordinate with district coordination committee with Deputy Commissioner as chair to discuss snakebite periodically in the monthly meeting with agenda.

9.6 Upazila Snakebite Committee (Multi-sectoral)

Chair: UH&FPO

Advisor: UNO

Chief Patron: Chairman, Upazila Parishad

Member secretary: RMO

Members

1. Consultant Medicine
2. Consultant Paediatrics
3. MO DC
4. Upazila Forest Officer
5. Upazila, Agricultural Officer
6. Upazila Education Officer
7. Upazila Social Welfare Officer
8. Health Inspector
9. Matron/Sr. Nurse
10. President, Local Press Club
11. Co-opted member

TOR

i. Ensure management of Snakebite cases (and necessary referral)
ii. Ensure antivenom and logistics for management of Snakebite cases
iii. Recording of Snakebite morbidity and mortality data of Upazila
iv. Community engagement for prevention, appropriate first aid and early treatment seeking at hospital
v. To hold periodic community awareness activities/meeting for prevention and first aid involving local government including all union parishad chairman

Union Parishad and Community Clinic Group/Support Group will discuss snakebite prevention and control during routine meetings as a separate agenda item.

10. COST OF NATIONAL SNAKEBITE STRATEGY PLAN (NSSP)

With technical support from WHO the government has developed the detail costed plan of action of the National Snakebite Strategy (2023-2024 to 2027-2028). It will be implemented under the MOHFW programme HPNSP.

Activity-based costing methodology was applied to estimate the tentative budget for the national action plan (NAP). The NAP for SB has a total of 4 objectives where 27 Strategies have been proposed to be implemented through 76 Key Action/Activities many of which are then broken down into several sub-activities. An EXCEL based template was prepared to estimate the budget of the major activities identified for the NAP. Stakeholder mapping, bilateral and multilateral meeting and consultative workshop take place to complete and finalize the costing.

It will cost approximately 156.98 Crore BDT (equivalent to USD18.47 million) to implement the NAP for SB (2023-2028). Objective wise distribution of total budget reveals that increase partnerships, coordination and resources (Objectives 4) would require around 17.49 Crore BDT(equivalent to USD 2.06 million) in total, in 5 years. While 60.20% of the budget is required for providing treatment including antivenom/ensure safe and effective treatment (Objectives 2). Specifically, it has been estimated that this objective would require approximately 94.50 Crore BDT (equivalent to USD 11.25 million). Followed by, Empowering and Engaging Communities (Objective 1) would require around 39.91 Crore BDT (equivalent to USD 4.75 million). Strengthen/stronger health systems and increase partnerships (Objectives 3) needs 5.07 Crore BDT (equivalent to USD 0.60 million).The distribution of estimated cost against objective for snakebite plan is presented in Table 11.

Table 11: Distribution of Estimated Cost against Objectives for Snakebite Plan

Objectives	Short Term				Medium Term						Total (Objective Wise)	
	Year 1 (July 2023 - June 2024)		Year 2 (July 2024 - June 2025)		Year 3 (July 2025 - June 2026)		Year 4 (July 2026 - June 2027)		Year 5 (July 2027 - June 2028)			
	Crore BDT	Lac USD	Crore BDT	Lac USD	Crore BDT	Lac USD	Crore BDT	Lac USD	Crore BDT	Lac USD	Crore BDT	Lac USD
Objective 1: Empowering and Engaging Communities	4.58	5.45	2.77	3.30	11.79	14.03	9.89	11.77	10.89	12.96	39.91	47.51
Objective 2: Providing Treatment	20.12	23.95	15.85	18.87	21.13	25.15	18.76	22.34	18.65	22.20	94.50	112.51

Objective 3: Strengthen Health Systems	1.79	2.13	0.86	1.02	0.90	1.07	1.16	1.38	0.36	0.43	5.07	6.04
Objective 4: Increase partnerships and coordination	4.86	5.79	3.02	3.59	3.43	4.08	3.02	3.59	3.17	3.77	17.49	20.82
Total (Year Wise)	**31.35**	**37.32**	**22.49**	**26.78**	**37.24**	**44.34**	**32.83**	**39.08**	**33.06**	**39.36**	**156.98**	**186.88**

The activity wise estimation of cost for snakebite plan is depicted in Table 12. The particular resource analysis shows "Treatment" and "Workshop" would require 39.66 Crore BDT (equivalent to USD 4.66 million) and 30.94 Crore BDT (equivalent to USD 3.64 million) respectively. Followed by, 14.80 Crore BDT (equivalent to USD 1.74 million) would require for research related activities, while for program it would need another 11.97 Crore BDT (equivalent to USD 1.40 million). Surveillance of SB, meeting and consultative activities estimated would respectively require 9.46 Crore BDT (equivalent to USD 1.11 million), 5.05 Crore BDT (equivalent to USD 0.59 million) and 4.90 Crore BDT (equivalent to USD 0.57 million).

With the ultimate aim of providing scientific guidance and high quality biological primary materials for the production of safe, effective, affordable and locally appropriate antivenom a Venom Research Centre (VRC) was established at Chittagong Medical College Hospital (CMCH). With a view to make the VRC activities sustainable and transferring the institution into an effectively functioning one snakebite strategy proposed the expansion of current facility of VRC and hence estimated the cost accordingly. In 5 years the recurrent cost for the VRC (with 45 people as workforce headed by a director) would be 15.21 Crore BDT (equivalent to USD 1.79 million). The estimation reveals that it would require another 25.51 Crore BDT (equivalent to USD 3 million) to complete the infrastructure and facility development for VRC. Thus, for the expansion of VRC and its maintenance from July 2023 to June 2028, it requires a total of 40.72 Crore BDT (equivalent to USD 4.79 million) (Table 2).

Table 12: Activity wise cost Estimation for Snakebite Plan

Component	Short Term		Medium Term			Total (In Crore BDT)
	Year 1 (July 2023 - June 2024)	Year 2 (July 2024 - June 2025)	Year 3 (July 2025 - June 2026)	Year 4 (July 2026 - June 2027)	Year 5 (July 2027 - June 2028)	
Program	1.72	1.14	3.09	2.94	3.09	**11.97**
Consultant	0.92	0.46	1.20	1.20	1.20	**4.98**
Workshop	5.54	2.63	10.10	6.36	6.39	**31.01**

Meeting	1.06	0.85	0.83	0.82	0.82	**4.37**
Treatment	8.88	7.19	7.52	7.86	8.21	**39.66**
Surveillance	2.21	1.21	2.18	2.18	1.68	**9.46**
VRC	8.15	8.15	8.15	8.15	8.15	**40.73**
Research	3.85	2.70	3.25	2.40	2.60	**14.80**
Total (In Crore BDT)	**32.33**	**22.45**	**36.25**	**31.80**	**32.10**	**156.98**

Table 13 contains the breakdown of estimated cost by strategies and year for each of the four objectives. Except VRC establishment and activities, Strategy 2.4 (Make safe, effective treatments (AV) available, accessible and affordable to all) is the most resource intensive requiring 34.73 Crore BDT (equivalent to USD 4.08 million) in 5 years. The second most resource intensive task is Strategy 1.3 (Improve the prevention, reduce risk and increase avoidance of snakebite Strategy). It needs a total of 27.88 Crore BDT (equivalent to USD 3.28 million) in 5 years. Strategy 2.1 - Integrate health care professional training and education requires 12.14 Crore BDT, equivalent to USD 1.42 million, while Strategy 4.1 - Support governance and leadership needs 8.46 Crore BDT (equivalent to USD 0.99 million). Strategy 4.3 - Enhance integration, coordination, and cooperation and Strategy 1.1 - Identify high risk communities: Targeted interventions in high-risk groups requires 8.46 Crore BDT (equivalent to USD 0.99 million) and 4.3 Crore BDT respectively.

Table 13: Strategy wise Estimated Resource Requirement for Snakebite Plan

Objective	Strategy	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Total	
		BDT	US$	BDT	US$	BDT	US$	BDT	US$	BDT	US$	BDT	US$
Objective 1	Strategy 1.1	71.45	0.85	12.50	0.15	106.50	1.27	106.50	1.27	106.50	1.27	403.45	4.80
	Strategy 1.2	1.40	0.02	0.70	0.01	0.70	0.01	0.70	0.01	0.70	0.01	4.20	0.05
	Strategy 1.3	260.33	3.10	33.68	0.40	831.38	9.90	831.38	9.90	831.38	9.90	2788.15	33.19
	Strategy 1.4	0.70	0.01	-	-	-	-	-	-	-	-	0.70	0.01
	Strategy 1.5	-	-	-	-	150.00	1.79	-	-	-	-	150.00	1.79
	Strategy 1.6	40.00	0.48	-	-	40.00	0.48	-	-	100.00	1.19	180.00	2.14
	Strategy 1.7	32.75	0.39	180.00	2.14	-	-	-	-	-	-	212.75	2.53
	Strategy 1.8	50.70	0.60	50.00	0.60	50.00	0.60	50.00	0.60	50.00	0.60	250.70	2.98
	Strategy 1.9	0.70	0.01	-	-	-	-	-	-	-	-	0.70	0.01
Total budget requested for Objective 1		**458.03**	**5.45**	**276.88**	**3.30**	**1178.58**	**14.03**	**988.58**	**11.77**	**1088.58**	**12.96**	**3990.65**	**47.51**
In Crore BDT		**4.58**		**2.77**		**11.79**		**9.89**		**10.89**		**39.91**	
Objective 2	Strategy 2.1	400.60	4.77	52.00	0.62	469.85	5.59	144.50	1.72	147.25	1.75	1214.20	14.45

Objective	Strategy	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Total	
		BDT	US$	BDT	US$	BDT	US$	BDT	US$	BDT	US$	BDT	US$
	Strategy 2.2	6.20	0.07	-	-	50.00	0.60	100.00	1.19	100.00	1.19	256.20	3.05
	Strategy 2.3	866.00	10.31	814.60	9.70	814.60	9.70	814.60	9.70	814.60	9.70	4124.40	49.10
	Strategy 2.4	650.71	7.75	668.45	7.96	683.17	8.13	717.26	8.54	753.06	8.97	3472.65	41.34
	Strategy 2.5	88.00	1.05	50.00	0.60	95.00	1.13	50.00	0.60	-	-	283.00	3.37
	Strategy 2.6	-	-	-	-	-	-	50.00	0.60	50.00	0.60	100.00	1.19
Total budget requested for Objective 2		**2011.51**	**23.95**	**1585.05**	**18.87**	**2112.62**	**25.15**	**1876.36**	**22.34**	**1864.91**	**22.20**	**9450.45**	**112.51**
In Crore BDT		**20.12**		**15.85**		**21.13**		**18.76**		**18.65**		**94.50**	
Objective 3	**Strategy 3.1**	8.90	0.11	-	-	30.45	0.36	30.45	0.36	30.45	0.36	100.25	1.19
	Strategy 3.2	53.45	0.64	50.00	0.60	50.00	0.60	50.00	0.60	-	-	203.45	2.42
	Strategy 3.3	1.40	0.02	-	-	-	-	-	-	-	-	1.40	0.02
	Strategy 3.4	-	-	-	-	-	-	-	-	-	-	-	-
	Strategy 3.5	102.80	1.22	0.70	0.01	0.70	0.01	0.70	0.01	0.70	0.01	105.60	1.26
	Strategy 3.6	12.60	0.15	35.00	0.42	9.00	0.11	35.00	0.42	5.00	0.06	96.60	1.15
Total budget requested for Objective 3		**179.15**	**2.13**	**85.70**	**1.02**	**90.15**	**1.07**	**116.15**	**1.38**	**36.15**	**0.43**	**507.30**	**6.04**
In Crore BDT		**1.79**		**0.86**		**0.90**		**1.16**		**0.36**		**5.07**	
Objective 4	**Strategy 4.1**	249.22	2.97	149.22	1.78	149.22	1.78	149.22	1.78	149.22	1.78	846.10	10.07
	Strategy 4.2	25.85	0.31	25.15	0.30	25.15	0.30	25.15	0.30	25.15	0.30	126.45	1.51
	Strategy 4.3	125.65	1.50	122.20	1.45	122.90	1.46	122.20	1.45	122.20	1.45	615.15	7.32
	Strategy 4.4	80.70	0.96	-	-	40.70	0.48	-	-	15.00	0.18	136.40	1.62
	Strategy 4.5	5.00	0.06	5.00	0.06	5.00	0.06	5.00	0.06	5.00	0.06	25.00	0.30
	Strategy 4.6	-	-	-	-	-	-	-	-	-	-	-	-
Total budget requested for Objective 4		**486.42**	**5.79**	**301.57**	**3.59**	**342.97**	**4.08**	**301.57**	**3.59**	**316.57**	**3.77**	**1749.10**	**20.82**
In Crore BDT		**4.86**		**3.02**		**3.43**		**3.02**		**3.17**		**17.49**	
Total budget requested for snakebite program		**3135.11**	**37.32**	**2249.20**	**26.78**	**3724.32**	**44.34**	**3282.66**	**39.08**	**3306.21**	**39.36**	**15697.50**	**186.88**
In Crore BDT		**31.35**		**22.49**		**37.24**		**32.83**		**33.06**		**156.98**	

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তারিখ: ০৫ শ্রাবণ ১৪৩২ / ২০ জুলাই ২০২৫

বিষয়: "National Snakebite Strategy and Action Plan (2023-2028)" এর প্রশাসনিক অনুমোদন।

সূত্র: স্বাস্থ্য অধিদপ্তরের নন কমিউনিকেবল ডিজিজ কন্ট্রোল প্রোগ্রাম এর ০৮ ডিসেম্বর ২০২৪ তারিখের ২১২৭ সংখ্যক পত্র।

উপর্যুক্ত বিষয় ও সূত্রোক্ত পত্রের প্রেক্ষিতে, গত ২৪ এপ্রিল ২০২৫ তারিখে অনুষ্ঠিত কর্মশালার সিদ্ধান্ত, পূর্বাপর সংশ্লিষ্ট অংশীজন এবং স্বাস্থ্য অধিদপ্তরের মতামতের আলোকে "National Snakebite Strategy and Action Plan (2023-2028)" এর প্রশাসনিক অনুমোদন নির্দেশক্রমে প্রদান করা হলো। এতে স্বাস্থ্য সেবা বিভাগ, স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়ের যথাযথ কর্তৃপক্ষের সম্মতি গ্রহণ করা হয়েছে।

সংযুক্তি: বর্ণনা মোতাবেক।

20/07/2025
(মো. মহিউদ্দিন আল হেলাল)
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বিতরণ (জ্যেষ্ঠতার ক্রমানুসারে নয়):

১. সিনিয়র সচিব, জননিরাপত্তা বিভাগ, স্বরাষ্ট্র মন্ত্রণালয়
২. সিনিয়র সচিব, সড়ক পরিবহন ও মহাসড়ক বিভাগ, সড়ক পরিবহন ও সেতু মন্ত্রণালয়
৩. সচিব, স্থানীয় সরকার বিভাগ, স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
৪. সচিব, পরিবেশ, বন ও জলবায়ু পরিবর্তন মন্ত্রণালয়
৫. সচিব, তথ্য ও সমপ্রচার মন্ত্রণালয়
৬. মহাপরিচালক, স্বাস্থ্য অধিদপ্তর (National Snakebite Strategy and Action Plan টি ওয়েবসাইটে প্রকাশের জন্য অনুরোধ করা হলো।
৭. মহাপরিচালক, স্বাস্থ্য শিক্ষা অধিদপ্তর
৮. মহাপরিচালক, পরিবেশ অধিদপ্তর
৯. মহাপরিচালক, ঔষধ প্রশাসন অধিদপ্তর
১০. প্রধান বন সংরক্ষক, বন অধিদপ্তর
১১. প্রধান তথ্য কর্মকর্তা, তথ্য অধিদপ্তর (পিআইডি)
১২. পরিচালক, রোগ নিয়ন্ত্রণ, স্বাস্থ্য অধিদপ্তর
১৩. লাইন ডাইরেক্টর (এনসিডিসি), স্বাস্থ্য অধিদপ্তর, মহাখালী, ঢাকা (Action plan টি বই আকারে মুদ্রণপূর্বক সকল অংশীজনের নিকট বিতরণের ও সংরক্ষণের জন্য অনুরোধ করা হলো)
১৪. অধ্যাপক ডা. এম এ ফয়েজ, প্রাক্তন মহাপরিচালক, স্বাস্থ্য অধিদপ্তর
১৫. বিশ্বস্বাস্থ্য সংস্থার বাংলাদেশস্থ প্রতিনিধি

অনুলিপি:

১. ডেপুটি প্রোগ্রাম ম্যানেজার, এনসিডিসি-৫, স্বাস্থ্য অধিদপ্তর, মহখালী, ঢাকা
২. অতিরিক্ত সচিব (বিশ্বস্বাস্থ্য অনুবিভাগ) এর ব্যক্তিগত কর্মকর্তা, স্বাস্থ্য সেবা বিভাগ

Annex

ANNEX 01

SWOT Analysis of Snakebite Control Programme, Bangladesh

Strengths (helpful), organization (s), capabilities, attitudes (improved performance)

- Nationwide good network of health facilities with strong primary health care system
- Existing documents, some resources- national guidelines are available, learning and community awareness materials exists
- Snakebite is considered as a national priority public health problem for some time
- Support from professional societies: Toxicology Society of Bangladesh (TSB), Bangladesh Society of Infectious and Tropical Diseases (BSITD): lots of regular professional meetings
- Experienced persons and organizations. Interested health professionals on snakebite are available, long experienced and highly skilled national level professors were involved for long
- Initiated devolvement of strategic plan
- Motivated and highly encouraging mentors
- Enthusiastic initiative by NCDC

Weakness (harmful), organizational, programmatic, limitations, and reasons for past failures negatively affected the programme)

- No formal structured snakebite programme both prevention & treatment is available so limited budget for snakebite mitigation
- Sometime negative attitude of health provider
- Inadequate/lack of skilled human resources for management of snakebite
- Poor counselling technique by health providers on snakebite
- Poor antivenom /supply delivery system, no country AV- no local anti-venom is developed
- Inadequate provision of respiratory support and logistics at UzHC (ALS) and poor knowledge about basic life support (BLS) at the community and community health workers (CHWs)
- Very little community engagement for snakebite, lack of awareness among general people.
- Community empowerment and engagement is poor
- Primary HCWs are not proactive, accountability of health care workers is low
- Unavailable logistics in periphery
- Political commitment is not strong, high-level commitment is lacking
- 'Ozha's involvement is more visible

- Poor/No reporting of snakebite cases
- No plan for those who play crucial role in management ('Ozha'), a gap between govt. service provider and those people ('Ozha'),
- No fixed focal person for snakebite in Upazila level,
- Though guideline on snakebite management and prevention are prepared but not implemented in a planned way/approach,
- Snakebite programme is not correlated with health care system,
- Misconception of people and visit to traditional healer,
- Avoidance of proper first aid before referred,
- Geographical distribution of different snakes is not known,
- No national strategy and action plan, weak national programme,
- Lack of motivation and commitment of local health care providers (including physician),
- No/lack of information to community people for modern management,
- Poor referral linkage, lack of information to community people- where to go,
- Fear of local HCPs for managing snakebite.

Opportunity (External origin), unfulfilled niches, helpful- positive influence

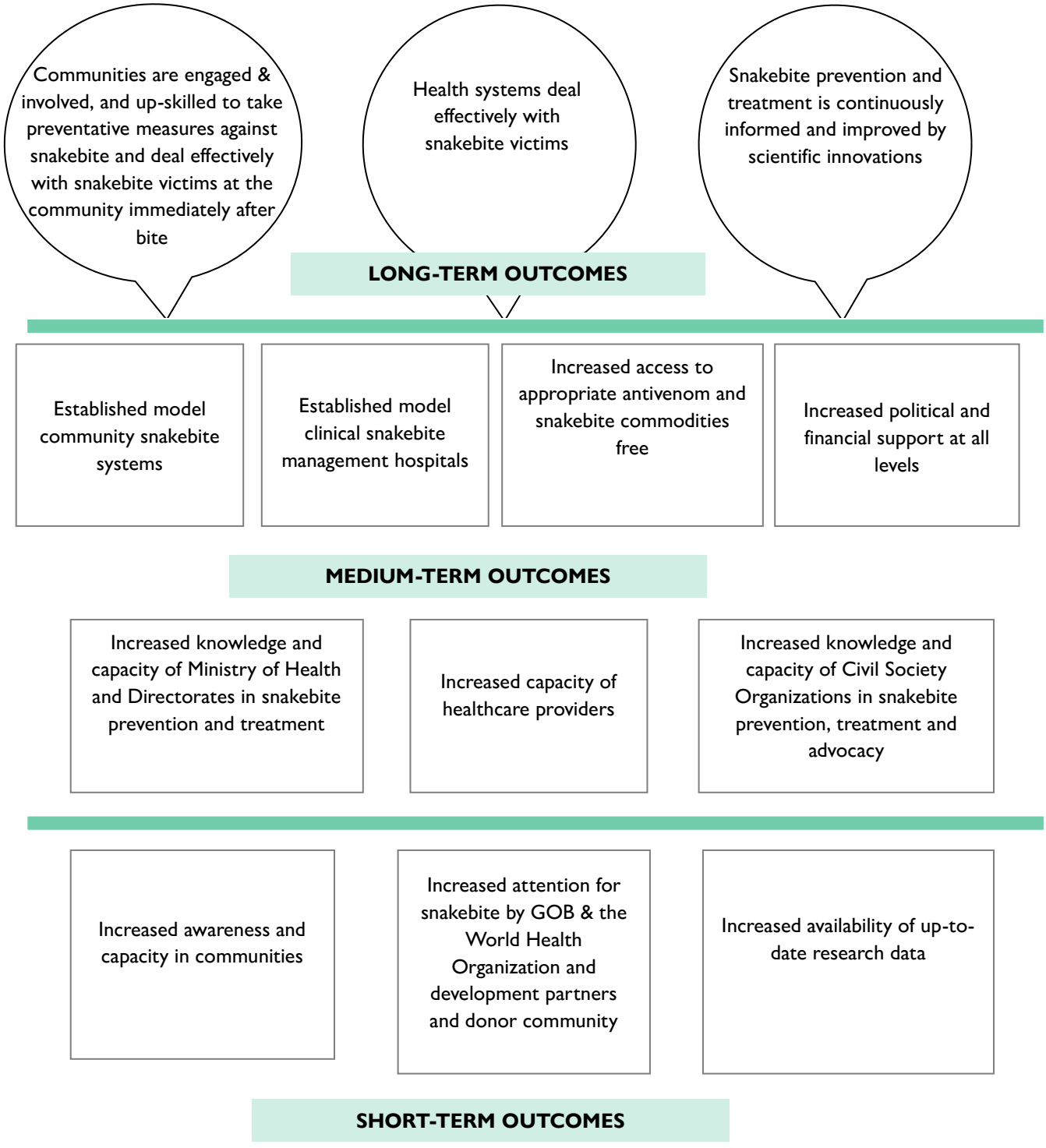
- Strong political interest/support, good leadership, strong commitment of the programme (NCD), willingness to make change
- Essential Service Package (ESP) as a way to achieve UHC; has a sector focused agenda on snakebite within NCD
- Available technology- example mobile phone, digital and telecommunication, feasible Apps; Nation wide digital platform for online awareness, Media (FB, WhatsApp)
- Global commitment, Support from WHO, Global target for NTD (snakebite) are identified, WHO strategy is available, WHO/SEAR involvement
- Has venom research centre (VRC,B) at CMC set up by assistance from NCDC, Collaboration
- Alliance, Not-for profit organizations have good track record in public health - BRAC, PKSF, mission & charity hospitals
- Existing PPP- community clinics with CG & CSG and others,
- Anti-venom also available, free of cost from NCDC
- Awareness of local community though insufficient
- Snakebite management programme already included in NCDC programme,

Threat (harmful), unsupportive environmental, culture and norms, competing programmes

- Community trust on 'traditional healers'
- Strong myths and taboos related to snakes and snakebite, false belief: wrong concept
- No interest from an existing big non-government sector exception is there (Kumudini Hospital, 'Jhal Chatra' hospital)
- No social support for snakebite victims- for travel and treatment, disability, death
- Antivenom supply chain is not guaranteed
- 'Carelessness of HCW'
- Multi-sectoral involvement is not available
- Risk of physical assault, if any side effect happens while treating patients with antivenom
- Communities are more interested to take services from 'Ozha'
- 'Ozha' practice, 'Ozhas'/traditional healer take more time to treat snakebite by traditional methods
- Resistant stakeholders (may be difficult to change)
- Involvement of multi sectoral personnel is required
- Lack of enthusiasm of primary health care workers
- People's perception about snakebite are not friendly
- Misconception of general people about snake and snakebite
- Quality of antivenom currently used
- Inadequate funding
- Sustainability of the programme
- Behavioural change of community is difficult
- Competitive health issues

ANNEX 02

Impact: Reduction in Snakebite Morbidity and Mortality



Assumptions

- An effective programme to reduce snakebite mortality and morbidity needs to combine community action with health system and policy changes, both of which are constantly improved through research and scientific innovations
- Governments will invest in sustainable snakebite programming
- More snakebite victims will access formal health services when services are improved and trained community health workers quickly refer patients
- Increased knowledge among health authorities that poor quality antivenom is not effective, will raise demand for quality assured antivenom
- The newly developed and tested medicines and supplies are more likely to become widely available in the context of increased political will and financial resources
- Innovations will lead to efficiency gains in antivenom production, contributing to lower prices and increased affordability
- Ultimately antivenom costs will be reimbursed
- Political and financial support is further enhanced by realizing effective community and clinical models
- Data on snakebite incidents and socio-cultural practices is essential to develop context-specific interventions and effectively influence policies and practices.

ANNEX 03

Resource Matrix: Elements essential for the emergency management of snakebite victims (Adapted from Draft Snakebite Strategy WHO SEA Region)

Introduction

The resource matrix for elements essential for the emergency management of snakebite victims contains brief descriptions of infrastructural facilities and resources required for the effective provision of specific categories of acute care at different healthcare system levels. Six categories of care identified as essential for the effective emergency management and resuscitation of snakebite victims, have been outlined. These include airway, respiratory stabilization in neurotoxic envenoming, circulation, acute kidney injury, local envenoming management and essential medicines. A specific matrix has been designed for each of the six categories.

Resource matrix design

Similar to the resource matrix for essential trauma care, each matrix consists of a vertical axis listing the specific elements of emergency care required. These elements are divided into two categories: (1) knowledge skills and (2) equipment and supplies. Knowledge and skills indicate that healthcare workers (medical, nursing, others) have the basic minimum training (acquired not only through graduate courses but also through continuing education) to perform such diagnostic and therapeutic activities deemed necessary and appropriate at a given health care level safely, effectively and successfully. Equipment and supplies refer to those items that are available to all, without consideration of ability to pay, especially in critical and life-threatening emergency situations. This implies not only the physical presence of these facilities but their ready availability in a functioning state 24 hours a day, 7 days a week (24/7). For this to occur, organizational and administrative mechanisms must be in place to immediately replace depleted or expired antivenom and medication stocks and repair or replace non-functioning equipment. The horizontal axis of the matrix lists the specific level of the healthcare system. This attribution is based on the following categories.

Primary healthcare facilities

Community Clinic/Union Health Facility

This category consists of a wide range of healthcare capabilities ranging from minimally equipped rural facilities that mainly function as out-patient clinics staffed by community health providers at

CC and staffed by SACMO/MO at union level. These are usually the first level of contact between the population and healthcare system in Bangladesh.

Upazila Health Complex (31-50 bed)

Secondary healthcare facilities/District Hospital

This includes hospitals that act as the first referral units. They are usually staffed by full time specialist doctors.

Tertiary healthcare facilities/Medical Colleges Hospital

These are the final referral centers for the primary and secondary levels of the healthcare system. They consist of a broad range of sub specialties and usually represent the highest level of care ina country.

Designation of priorities

For each cell within the matrix, the authors recommend those resources (vertical axis) that should be available at a specific level of the health care system (horizontal axis). The priority of each item was given a designation according to the following criteria:

Essential resources (E)

The E designation indicates "life-saving" equipment and items, vital for resuscitation. These represent the "least common denominator" of emergency care in snakebite victims. Their availability must be ensured at the stated level of healthcare, even in regions where access to resources is most severely constrained.

Desirable resources (D)

These items represent items that may increase the probability of a positive outcome but are unlikely to be cost-effective and universally available at all facilities of a given level in regions with the poorest access to resources. They are therefore not listed as essential.

Summary resource matrices for elements of essential emergency care in snakebite victims

Table 14.1: Airway management

	Health care facility level		
	Primary (UzHC)	**Secondary (DH)**	**Tertiary (MCH)**
General			
Sterile vials	-	E	E
Dry test tube	E	E	E
Sterile test tube	-	E	E
Gloves	E	E	E
Water and soap	E	E	E
Gauze and cotton, micropore	E	E	E
Battery	E	E	E
Breathing: knowledge & skills			
Assessment of airway compromise	E	E	E
Manual manoeuvres (chin lift, jaw thrust, recovery position)	E	E	E
Insertion of oral or nasal airway	E	E	E
Assisted ventilation using bag-valve-mask (Ambo bag)	E	E	E
Use of suction	E	E	E
Endotracheal intubation	D	E	E
Airway: Equipment and supplies			
Oral or nasal airway tube	E	E	E
Bag-valve -mask (e.g Ambo)	E	E	E
Suction device (electrical/pneumatic)	E	E	E
Suction tubing	E	E	E
Yankauer suction tip	E	E	E
Laryngoscope	D	E	E
Endotracheal tube	D	E	E

Table 14.2: Breathing: management of respiratory failure in neurotoxic envenoming

	Health care facility level		
	Primary	**Secondary**	**Tertiary**
Breathing: knowledge & skills			
Assessment of respiratory distress and adequacy of ventilation	E	E	E
Administration of oxygen	E	E	E
Breathing: Equipment and supplies			
* Stethoscope BP machine	E	E	E
* Oxygen supply (cylinder/concentrator/other source)	E	E	E
* Nasal prongs/face mask/associated tubing	E	E	E
* Bag-valve-mask	E	E	E
* Pulse oximetry	E	E	E
Arterial blood gas (ABG) measurement	-	E	E
Mechanical ventilator	-	E	E
Hexisol solution	E	E	E
Endotracheal tube	E	E	E
Ambo bag	E	E	E
Suction tubing	E	E	E
Suction device (electrical)	E	E	E

Table 14.3: Circulation: management of hemotoxic envenoming and shock

Table 14.3A: Circulation (knowledge & skills)

	Health care facility level		
	Primary	**Secondary**	**Tertiary**
Assessment & external control of haemorrhage			
Assessment of shock	E	E	E
Compression for control of haemorrhage	E	E	E
Fluid resuscitation			
Knowledge of fluid resuscitation	E	E	E
Peripheral percutaneous intravenous access	E	E	E
Central venous access for fluid administration	-	E	E
Intra-osseous access for children < 5years	-	E	E
Transfusion knowledge and skills	-	E	E
Urethral catheter insertion	E	E	E
Monitoring			
Knowledge of resuscitation parameters	E	E	E
Advanced monitoring (central venous pressure)	-	E	E
Other			
Differential diagnosis of causes of shock	D	E	E
Use of pressor agents	E	E	E
Dopamine	D	E	E
Use of fluids and antibiotics for septic shock	-	E	E

Table 14.3B: Circulation (equipment and supplies)

	Health care facility level		
	Primary	**Secondary**	**Tertiary**
Assessment & external control of haemorrhage			
Clock or watch with second hand	E	E	E
Stethoscope	E	E	E
Blood pressure apparatus	E	E	E
Gauze and bandages	E	E	E
Fluid resuscitation			
Crystalloid	E	E	E
Needle and syringe	E	E	E
* Intravenous infusion sets (lines and cannula)	E	E	E
Intra-osseous needle	-	E	E
* Blood transfusion capabilities (set)	-	E	E
Central venous lines	-	E	E
Monitoring			
Stethoscope	E	E	E
Blood pressure apparatus	E	E	E
Urinary catheter	E	E	E
Electronic cardiac monitoring	-	E	E
Monitoring of central venous pressure	-	D	E
Facilities for whole blood clotting test (WBCT)	E	E	E
Facilities for PT/INR, aPTT and D-Dimer	-	E	E
Facilities for haemoglobin or haematocrit	E	E	E
Facilities for complete blood count	E	E	E

Facilities for creatinine and electrolytes	D	E	E
Other			
Vasopressors	-	D	E
Thermometer	E	E	E
Weighing scale for children	E	E	E

Table 14.4: Management of acute kidney injury (AKI)

	Health care facility level		
	Primary	**Secondary**	**Tertiary**
Management of AKI: knowledge & skills			
Assess for oliguria	E	E	E
Assess fluid status: volume depletion/over load	D	E	E
Peripheral percutaneous intravenous access	E	E	E
Urethral catheter insertion	E	E	E
Central venous access	-	E	E
Management of AKI: equipment			
Stethoscope	E	E	E
Blood pressure apparatus	E	E	E
* Intravenous infusion sets (lines and cannula)	E	E	E
Intraosseous needle	D	E	E
Normal saline	E	E	E
Crystalloid	E	E	E
* Needle and syringe	E	E	E
Intravenous infusion sets (lines and cannula)	E	E	E
* Urethral catheter foley catheter	E	E	E
Urinary meter bag	E	E	E

Central venous lines	-	E	E
Monitoring of central venous pressure	-	E	E
Serum creatinine, urea and electrolytes	-	E	E
Laboratory facilities for urine microscopy	D	E	E
ECG	E	E	E
Nebuliser	E	E	E
Renal replacement therapy (Dialysis)	-	D	E

Table 14.5: Management of local envenoming

	Health care facility level		
	Primary	**Secondary**	**Tertiary**
Management of local envenoming: knowledge & skills			
Assess for potential disability	E	E	E
Recognition of compartment syndrome	D	E	E
Measurement of intercompartmental pressure	-	-	E
Non-surgical management: clean and dress	E	E	E
Surgical management: debridement/fasciotomy	-	D	E
Management of local envenoming: equipment			
Gauze and bandages	E	E	E
Sterile dressings	E	E	E
Topical antibiotic dressings	E	E	E
Intra-compartmental pressure monitor	-	-	E
Thermometer	E	E	E
Torch	E	E	E
Gram stain	D	E	E
Bacterial cultures	-	D	E

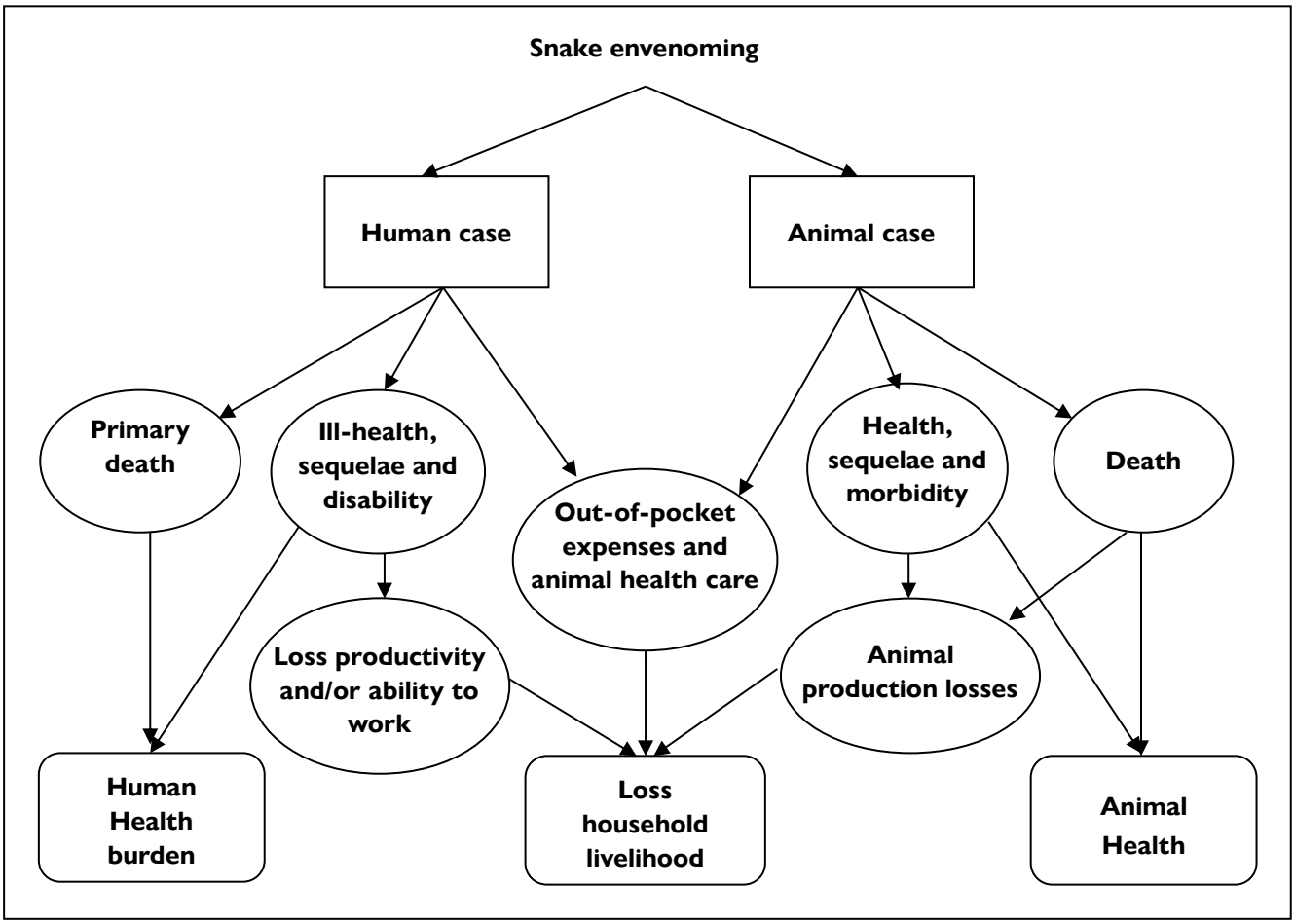
Table 14.6: Essential medications

Medications	Health care facility level		
	Primary	Secondary	Tertiary
Antidote			
* Antivenom	E	E	E
* Tetanustoxoid*	E	E	E
Pain, fever, inflammation			
* Paracetamol tablet/suppository	E	E	E
Anaphylaxis and life support medications			
* Hydrocortisone/nS	E	E	E
* Epinephrine/adrenaline	E	E	E
Chlorphenarmine	E	E	E
Inj. Famotidine	E	E	E
* Atropine & neostigmine	E	E	E
Furosemide	E	E	E
Calcium gluconate	D	E	E
Sodium bicarbonate	D	E	E
25% Glucose	E	E	E
Insulin syringe	E	E	E
Salbutamol Nebulization	E	E	E
Antibiotics			
* Amoxycillin & clavulanic acid	E	E	E
* Ceftriaxone	E	E	E
Gentamicin	D	E	E
Metronidazole	D	E	E

**Due to the fact that continuous electricity and refrigeration may not be always available at such facilities, the availability of medications for tetanus prophylaxis and liquid antivenom cannot be deemed essential. However, given their importance, tetanus prophylaxis and antivenom administration should be considered essential at any basic facility.*

ANNEX 04

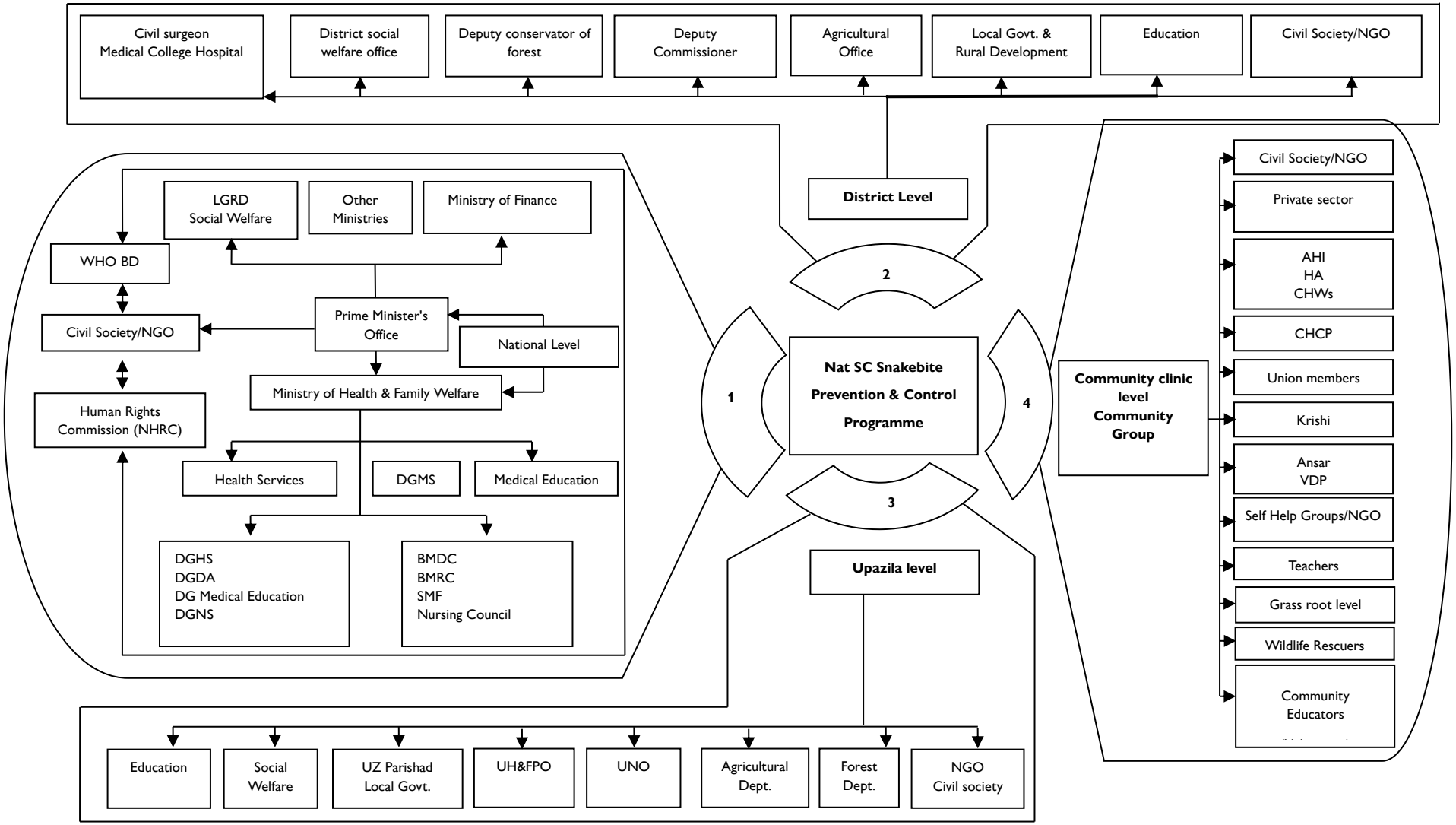
Pathways to health and livelihood losses due to snakebite in a One Health approach to the socioeconomic impact assessment of snakebite



Source: https://doi.org/10.1371/journal.pntd.0007608.g001

ANNEX 05

Flow chart outlining working model for engagement of key stakeholders at different level*



ANNEX 06

Brief Study Report: Perception of Traditional Healers, Community Groups and Service Providers

Objectives and Methods

Studies have been conducted with traditional healers, community (male, female and local opinion leaders) groups and health service providers working at Upazila Health Complex (UzHC).The first study was conducted with traditional healers including *'Ozha'*, *'Kabiraj'* and *'Gunin'* to whom people usually visit after any snakebite. The objectives of the study were to explore the knowledge on traditional treatment following snakebite, to identify the attitudes and believes of traditional treatment on snakebite among traditional healers as well to take the recommendations and any possible government support for rehabilitation of traditional healers. In total, 17 traditional healers (*'Ozha'*= 5, *'Kabiraj'*= 8 and *'Gunin'*= 4) were purposively selected as a respondent from eight divisions. Among the respondents, all were male except two, who actually allowed their time and agreed to participate in providing verbal consent.

The second study was undertaken with housewives, farmers, service holders, day labours, teachers, religious leaders, health workers, fishermen, village doctors, NGO workers, local leaders as well as healthcare providers about the perception about prevention and management regarding snakebite. To explore the frequency of snakebite incidents and their consequences in the community, to know the general practices of receiving first aid from the community and formal treatment of snakebite from the health facilities and to explore the recommendations to strengthen health services in managing snakebite at the facilities were the objectives of this study. Two upazilas were purposively selected from two districts where in total, six FGDs (female= 2, male= 2 and 2 community leaders) and 12 KIIs (6 doctors, 2 SACMOs and 4 nurses) were participated in this study.

Results

According to the respondents of traditional healers, '*Ozha*', '*Kabiraj*' and '*Gunin*' provided treatment of any illness and injury in their community, including snakebite. Some of the traditional healers inherited the knowledge from their ancestors, and some chose the position from their own interest. As per the opinions of several traditional healers, 'every four out of five snakes in Bangladesh have no venom'. Therefore, most of the time people didn't die from snakebite cases. Most snakebite patients become well or recover from the condition naturally. Patients from all socio-economic backgrounds came to seek treatment from the traditional healers. Rich-poor, educated-uneducated, everyone gets treatment from them. Usually, people get panicked when

someone is bitten by a snake. So, they can't decide what would be the best option to take treatment. Also, there's pressure from neighbours. That's why they were forced to visit '*Ozha*', '*Kabiraj*', and '*Gunin*' before doctors in most the cases. Snake bitten patients prefer to visit '*Ozha*', '*Kabiraj*', and '*Gunin*' than visiting doctors or hospitals as treatment cost is less to traditional healers.

While dealing with snakebite patients, the traditional healers have applied several techniques to confirm identifying whether the patient was bitten by a venomous or non-venomous snake. They tried to screen a snakebite patient by following way:

- 'Checked the wounded spot by touching or tapping with their hands'.
- From traditional healers' inheritance knowledge about a venomous snake, 'the poison has numbed around the wounded spot'.
- 'Patient tends to have a blurry and fuzzy vision, can't talk properly, patient's mouth continues to salivate and even unable to taste the chilli spices'.

A good number of '*Ozha*' and '*Kabiraj*' pointed out that 'the venomous snake-bitten person's blood seems black and thick, and a non-venom snake-bitten person's blood looks thin. By seeing blood condition, traditional healers realized that the snake was non-poisonous, then they began to treat the patient'. On the other hand, they refer patients to the nearest government hospital, especially district level hospital. They mentioned the reasons for referring the snakebite patients according to the condition in their interview sessions. They argued that they didn't want to take risks in providing treatment to a serious snakebite patient considering their reputation. Because their reputation might be hampered if the patient dies while the healer supposes to provide treatment. The family members also tend to get angry at them in these types of situations. When traditional healers confirm the wounded person is bitten by a non-venomous snake, they immediately pass their times with different approaches (i.e. 'uttering few words, touch with some tree roots or leaves in the wounded part'). They claimed 'patient feel mental relaxes through this type of treatment'. According to traditional healers' statements, sometimes, traditional healers have to perform this type of pretence by creating pressure from the patient end. Few traditional healers argued that, in very few cases, they have to provide treatment to the venomous snake bite patients if the health facility is not near to the community. They then 'cut the wounded place with a blade, and therefore, poisonous blood could get out from the body. As a result, patient becomes good in health condition'.

Traditional healers briefed the process of the snakebite treatment to the patients during their interview. While snakebite patients arrived at the healers, several common questions were asked to the snake-bitten patients:

- 'In which place the snake bite the patient (near house, pond, field, jungle)'
- 'What was the colour of the snakes that bitten to the patient (if the patient could see the snake)'
- 'Condition of the bitten part of the body (many teeth or 2/4 teeth)'

There is also a common belief among both traditional healers and patients that the 'wounded spot should be tied'. Because of, 'the poison is stopped from spreading to all over the body. This often causes the area to swell or turn black due to inability to circulate blood'. The patient becomes very scared that s/he might not be able to survive after a snakebite. Traditional healers often 'use this fear as an opportunity'. As the patients start to believe them the way they provide treatment. They then offered patients with 'very primary therapy for reducing pain, reducing swelling of the legs with medicines made from plants. Several traditional healers pointed that 'they cut off the wound to bring out the blood'. Usually, they knew that 'human blood is comparatively thicker. Consequently, when a venomous snake bites, blood seems stickier. Thus, to identify whether the snake was venomous or not, they examine the blood of the patient'. Several cited that they cleaned the broken teeth from the wounded place of the snakebite patients; otherwise, the injured might have a chance to have an infection. Two *Kabiraj* mentioned that 'toxin from snake-bitten person was sucked through hen and the hen died after completing sucking toxin'.

All of the traditional healers informed that medicine or injections to treat snakebites were not yet available or sufficient in all government hospitals. So, the patients didn't get immediate treatment when they went to the hospital. As a result, they have to return to them, even though they chose hospitals first. They believed that 'the life of a patient could be cured only through the treatment of the anti-venom and their plant-based medicines were literally useless. They think that people are now much more conscious than before. Nowadays, people are also getting to learn a lot more through different means. Expansion of modern medicine, traditional healers considered their profession to be much riskier than before. In addition, traditional healers said that usually, they didn't demand any money after treating wounded or snakebite patients. According to their opinions, patient would pay money as they wish. 'Ozha' perceived that they treat the services to the snakebite patients as volunteer mode.

Suggestions and thoughts have been collected from the traditional healers about integration or rehabilitation of the traditional healers' profession. They wanted to integrate themselves with formal treatment by receiving training in modern medicine, and thus they could provide first aid treatment including anti-venom to cure snakebites. Several of the traditional healers were interested to aware community to prevent snakebite. Therefore, they might counsel the patient

who comes to take treatment, and even they can also deliver awareness messages while they visit the local community for providing different treatment for any illness. Awareness campaigns about the prevention of snakebite incidents will be arranged for high school students, and then these school children could disseminate the messages to their family and the community.

Community people, including health care providers participated in the study where they shared their perceptions and views on the context of snakebite incidents. Female, male, children and different professionals had frequent snake bite experiences (venomous and non-venomous) during farming, walking, household chores etc., especially on rainy days. People have great trust on traditional healers for getting care immediately after snakebite despite the fact that it being known that they are sometimes harmful. The community have easy access to receive treatment from traditional healers. In case of ineffective treatment from them, the community visited UzHCs, though didn't receive snakebite treatment there.

Health care providers can't remember what they taught and learnt in their students' life about snakebite patient management. Almost all health providers didn't see any snake bite-related government guidelines or instructions. Several health service providers mentioned that all snakebite patients (venomous& non-venomous) should have antivenomous vials. A number of health care providers believe that the symbol of two bite marks was an indicator of venomous snake. As doctors were not confident enough, usually they didn't admit snakebite patients in their UzHCs. They referred snakebite patients to district-level hospitals. Doctors or nurses didn't communicate with anyone in a tertiary level hospital, although they referred snakebite patients there. Anti-venom vials were not available in UzHCs.

Health providers demanded hands-on training where snakebite management should be oriented for doctors, SACMOs and nurses. A dedicated emergency room for snakebite patients would be better to be established in UzHCs. Furthermore, an antivenom vial should be stored in UzHCs. Photograph of the bite site, tourniquet, important clinical findings for the record would be better to introduce where hospital management could arrange the process. Awareness programmes should be introduced to sensitize the community for taking formal treatment instead of going to traditional healers. Meeting with the community (courtyard, IPC), educational sessions in the health centre, national-level campaigns (announcement, SMS, seminar, talk show) could be introduced as means to sensitize the community. Awareness meetings with traditional healers could be arranged for not providing any harmful practice, including tourniquets for the sake of snakebite treatment and encourage the community to visit the nearest health facilities after conducting any snakebite incident.

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