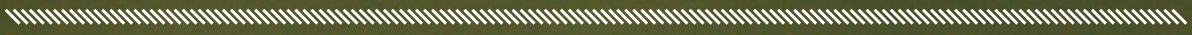


Preventing and Treating Snakebite in Resource-Poor Settings



An Action Plan for Change



Health Action
International

PREVENTING AND TREATING SNAKEBITE IN RESOURCE-POOR SETTINGS AN ACTION PLAN FOR CHANGE

THE DEVASTATING IMPACT OF SNAKEBITE

Snakebite is a grossly neglected tropical health issue that causes death, disability, disfigurement, deprivation and destitution across continents. Primarily, snakebite envenoming affects poor people living in rural settings, particularly in South and Southeast Asia, Sub-Saharan Africa and South and Latin America. According to conservative estimates, more than 5 million people are bitten by venomous snakes annually, with up to 1,841,000 serious envenomings. Envenoming results in 125,000 deaths and 400,000 victims left with serious disability a year.¹²

Snakebites can cause paralysis and suffocation; bleeding disorders that may lead to a fatal haemorrhage; irreversible kidney failure, blindness, and severe tissue damage (necrosis) that requires amputation and causes permanent disability. Indeed, many who survive snakebite envenoming will have ongoing disfigurement, disability and paralysis³, resulting in high levels of psychological damage and socioeconomic inequality.

Reliable indicators of the scale of the snakebite health burden are scarce, mainly due to underreporting and, until now, have resulted in a reluctance of the global health community to recognise the depth of the problem. Even conservative figures indicate that snakebite is deadlier than any of the recognised neglected tropical diseases (NTDs) on the World Health Organization's (WHO) priority list.⁴

One reason for the lack of hard data on incidence, death and disability is that the most affected populations are poor rural communities, agricultural workers, herders and children who live in areas with failing health systems and where snakebite incidents simply pass unreported.⁵ Local studies confirm this assumption. For example, a study in Nepal showed that whilst the Ministry of Health reported country-wide figures of 480 snakebites resulting in 22 deaths for the year 2000, a later community-based study of only one region in Nepal showed 4,078 bites and 396 deaths.⁶

¹ Gutiérrez, J. M., Burnouf, T., Harrison, R., Calvete, J. J., Kuch, U., Warrell, D. A. and Williams, D. J. (2014) A multicomponent strategy to improve the availability of antivenom for treating Snakebite envenoming. *Bulletin of the World Health Organization*. 2014; 92: 526-532.

² Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena, NK, Pathmeswaran A, Premaratna R, Savioli L, Lalloo DG, de Silva HJ. The global burden of snake bite: a literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Medicine*, November 2008, Vol. 5, Issue 11, e218.

³ WHO Snake Antivenoms Fact sheet N° 337 Reviewed February 2015

⁴ http://www.who.int/neglected_diseases/diseases/en/

⁵ Robert A. Harrison, Adam Hargreaves, Simon C. Wagstaff, Brian Faragher, David G. Lalloo *Snake Envenoming: A Disease of Poverty* PLoS 2009

⁶ Sharma SK. *Snake bites and dog bites in Nepal: community based studies on snake bites and dog bites*, Department of Medicine, B P Koirala Institute of Health Sciences, presentation made at the WHO first Consultative Meeting on Rabies and Envenomings, Geneva, 10 January 2007

FACTORS CONTRIBUTING TO THE SNAKEBITE BURDEN

Socio-cultural factors, such as the lifestyles and livelihoods of people in poor rural communities, make them particularly vulnerable to snakebite. In short, it is an occupational hazard and disproportionate burden on the poor. Knowledge transfer of measures to prevent snakes from entering dwellings is often lacking, and even when known, difficult to implement in poor housing conditions. Agricultural workers and children, in particular, underuse snake-proof footwear, and poor knowledge of how to prevent snakebite and what to do when it strikes only adds to the problem. The result is people, particularly children, being bitten at night whilst sleeping and farm workers being bitten during the course of employment. Interventions should include the use of bed nets and wearing proper footwear when working or playing in the fields, but the limited attention paid to snakebite hinders persuasive intervention.

In the absence of knowledge, first aid and proven treatment, cultural practices that are either unhelpful or cause even greater injury, fill the knowledge gap and substitute for evidence-based medicine in appropriately equipped facilities. Thus, non-evidence based practice often causes greater harm than good.⁷ Anecdotal data collected by Health Action International (HAI) in 2015 shows that general awareness of managing snakebite is very low and that uninformed

interventions can range from the insertion of foreign bodies into an opened wound, drinking cow dung or petrol, and electrocuting the victim. None of these remedies has any therapeutic value.



A young Nigerian girl with permanent disfigurement and disability following a bite from a black-necked spitting Cobra. (Photo: Global Snakebite Initiative)

Fundamentally, however, the root cause of the perpetual high burden of untreated suffering, is a lack of funding for robust research, community awareness, health system programming and scale-up of scientific innovation in snakebite commodities and supplies.

HEALTH SYSTEMS AND POLICY-MAKING CHALLENGES

In countries where snakebite mortality and morbidity is high, the health system is generally underfunded and poorly equipped to deal with snakebite victims.⁸ Challenges include long distances between snakebite incidence and appropriately equipped health facilities. This is compounded a lack of transport and poor transport infrastructure; a dearth of healthcare providers who are adequately trained to manage snakebites; and unavailability of appropriate, quality-assured antivenoms and other essential commodities and supplies.

Indeed, by mid-2016, Sub-Saharan Africa will run out of the antivenom of choice for West African snakes because the

manufacturer will cease production.⁹ Alternatives are available, but much of the alternative antivenom is of poor quality and may not be specific to African snake species. Because healthcare providers are often unaware that antivenom is snake-specific, improper treatment and its consequences is likely to engender further distrust in the system. In addition, the emerging issue of climate change and agricultural land appropriation is affecting the distributional range of venomous snakes, which requires ongoing monitoring of domestic policy for the prevention and treatment of snakebite, if it is to be evidence-based and provide a lasting solution to the snakebite health burden.¹⁰

⁷ Sarkar, N. *Status of Traditional Healers (Ozhas) in snake bite in India-present status and their knowledge regarding the primary management of snake bite and attitude of people towards them* Conference paper, APICON, 2014

⁸ Robert A. Harrison, Adam Hargreaves, Simon C. Wagstaff, Brian Faragher, David G. Lalloo *Snake Envenoming: A Disease of Poverty* PLoS 2009

⁹ The Lancet Editorial *Snake bite—the neglected tropical disease* Vol 386 September 19, 2015

¹⁰ Javier, N. Carrasco, P. Leynaud, G. *Venomous snakes and climate change: Ophidism as a dynamic problem* Climatic Change (Impact Factor: 3.43). 12/2013; 122(1-2). DOI: 10.1007/s10584-013-1019-6

National regulations for snakebite prevention and treatment are often absent or ignored. Hence, poor prioritisation is both symptomatic and contributes to a scarcity of epidemiological data that would inform a solution. As a result, national governments do not adequately fund snakebite prevention and treatment programmes and WHO guidelines for snakebites are not implemented by national health authorities.¹¹ The lack of national prioritisation of snakebite also results in a lack of funding from international institutions and the global donor community, which in turn reinforces national neglect of the issue. Although the WHO did recognise snakebite as an NTD in 2009, snakebite is again falling from the global health agenda, and was not included in Resolution WHA66.12 (2013), which calls upon Member States to intensify efforts on 13 other selected NTDs.¹²

SCIENTIFIC INNOVATION

The leading public research institutes¹⁴ and researchers are connected through the *Global Snakebite Initiative* (GSI). However, whilst bound by science working for the common good, interconnected research and shared findings can be improved within the research community. In addition, it remains a challenge to move from science to practice, due to limited resources, information asymmetry and communication gaps.

Innovations in the area of **prevention** can help to protect people from being bitten in the first place. Prevention can consist of *protective footwear*, *repellents* and other measures to keep snakes from entering the house.

The development of **rapid diagnostic tests** will help to quickly identify the species of snake that bit the victim and plan for appropriate **treatment**. Innovative *antinecrotics* to handle tissue damage, and developing and testing *emergency response kits* could improve health outcomes.

The lack of prioritisation and financial investments at international and national levels directly affects the production of antivenom for developing countries, leading to shortages. Production costs of antivenom can be high and therefore only of interest to manufacturers in the context of a functional system and market. Inconsistent market demand, unpredictable financial investment and inadequate quality control discourage production and threaten the viability of the antivenom industry.¹³ In addition, monopoly pricing, as a result of TRIPS regulations, makes high-end patented antivenom unaffordable to poor rural communities and can lead to catastrophic expenditure by victims and their families, resulting in destitution. However, scale-up of publicly-funded innovative interventions, including polyvalent antivenoms (see below), show extraordinary promise, and will be affordably priced once they reach the market.



Harvesting venom for antivenom production at the Liverpool School of Tropical Medicine. (Photo: Bobbi Klettke, Health Action International)

Although *polyvalent antivenoms* have been in existence for some time, there is ample opportunity to improve the effectiveness of current antivenoms and the treatment of snakebite victims through scientific innovations in commodities, supplies and evidence-based practice.

¹¹ Scheske, Ruitenbergh, Bissumbhar *Needs and availability of snake antivenoms: relevance and application of international guidelines* [JHPM ePublished: 4 April 2015]

¹² http://www.who.int/neglected_diseases/mediacentre/WHA_66.12_Eng.pdf

¹³ Nicholas I. Brown *Consequences of Neglect: Analysis of the Sub-Saharan African Snake Antivenom Market and the Global Context* PLoS 2012

¹⁴ Consejo Superior de Investigaciones Científicas (Spain); Liverpool School of Tropical Medicine (UK); Australian Venom Research Unit (Australia); Instituto Clodomiro Picado (Costa Rica); Madras Crocodile Bank Trust, Centre for Herpetology (India); Micropharm (UK); Charles Campbell Toxinology Centre (Papua New Guinea)

Antivenom must be tailored to an array of toxins across different regional snake species. Deficiencies in the quality, quantity, specificity, distribution and application of antivenoms are responsible for the unnecessary deaths or permanent mutilation of tens of thousands of people each year. No universal antidote exists.

Publicly-funded scientific research to improve antivenoms to make them more effective and to implement their

practical application looks promising. Recent research has found that a complex combination of genetic and non-genetic factors result in major medically important differences in snake venom composition - even between very similar snake species.¹⁵ However, funding is needed for further research and to ensure that findings are continuously adopted and contribute to improved health outcomes.¹⁶



A father ventilates his son in a fight for survival following a snakebite envenoming. (Photo: Global Snakebite Initiative)

ADDRESSING THE SNAKEBITE ISSUE

HAJ is proposing an audacious international programme that brings together science, society and state to tackle the burden of snakebite envenoming on the poor. The **scientific community** is, and will continue, refining and innovating therapeutic commodities, such as antivenoms, first response regimes, standard treatment guidelines and medical training. **Civil society** will conduct research in disease burden, traditional healing practice and capacitate communities and domestic civil society in snakebite awareness and treatment seeking behaviour. Together, the scientific community and civil society will work with **governments** to ensure robust and implementable policy frameworks that strengthen health

systems, including healthcare provider training, snakebite facility accessibility and a reliable supply chain of commodities, including affordable antivenom.

This programme will improve the prevention and treatment of snakebite through a combination of community action, scientific innovation, health system strengthening and policy change. The impact of the proposed programme is an overall **reduction in snakebite morbidity and mortality**.

¹⁵ Castoe, T.A et al. *The Burmese python genome reveals the molecular basis for extreme adaptation in snakes* PNAS, December 2013

¹⁶ Jeremy Hsu *Snakebite antivenom development is stuck in the 19th century: what's next?* Scientific American December 2015

HAI & GSI PARTNERSHIP

HAI, an international Non-Governmental Organisation (NGO) based in Amsterdam, has a 35-year track record of success in influencing medicines policy to improve access to medicines and their rational use. It is the only NGO that is entirely dedicated to strengthening medicines policy to improve public health. In low- and middle-income countries, HAI builds capacity within local civil society organisations to enable them to collect data and engage in evidence-based advocacy.

Over the years, HAI has successfully facilitated dialogue amongst civil society, government and pharmaceutical industry stakeholders to improve transparency on access to medicines. With the WHO, HAI has also developed an international gold standard methodology to collect evidence on the price, availability, affordability and price components in medicines supply chain¹⁷ in over 120 low- and middle-income (LMICs). This data, and HAI's subsequent advocacy activities based on this evidence, have helped to inform WHO recommendations and national health policies.

Snakebite is a health topic that fits particularly well with HAI's passion and experience. It mainly affects the poorest communities and is neglected by policy makers at all levels, as well as donors. Antivenom is currently largely unavailable in resource poor settings and for the most part, and even if it is, it is largely unaffordable, forcing victims into catastrophic treatment expenditure and destitution. Improving health outcomes for snakebite victims is a challenge that HAI is passionate to address.

The Global Snakebite Initiative (GSI) is an internationally-active non-profit organisation, registered in Australia, led by snakebite experts who are dedicated to improving access to good quality, robustly tested, safe, effective antivenoms in the world's poorest communities. They work to improve the prevention, first aid and treatment of snakebites, and in bringing recognition to the rehabilitation needs of snakebite victims around the world.

HAI's eagerness to improve access to treatment of snakebite victims has resulted in active engagement to revive and support GSI, bring new members on board, and provide communications and advocacy expertise to what has hitherto been a primarily scientific endeavour.

Because snakebite is a massively neglected and severely underfunded healthcare problem, it is necessary to first (re) build a global snakebite community of key stakeholders in the public, private and civil society sectors to advocate for snakebite initiatives at the highest levels.

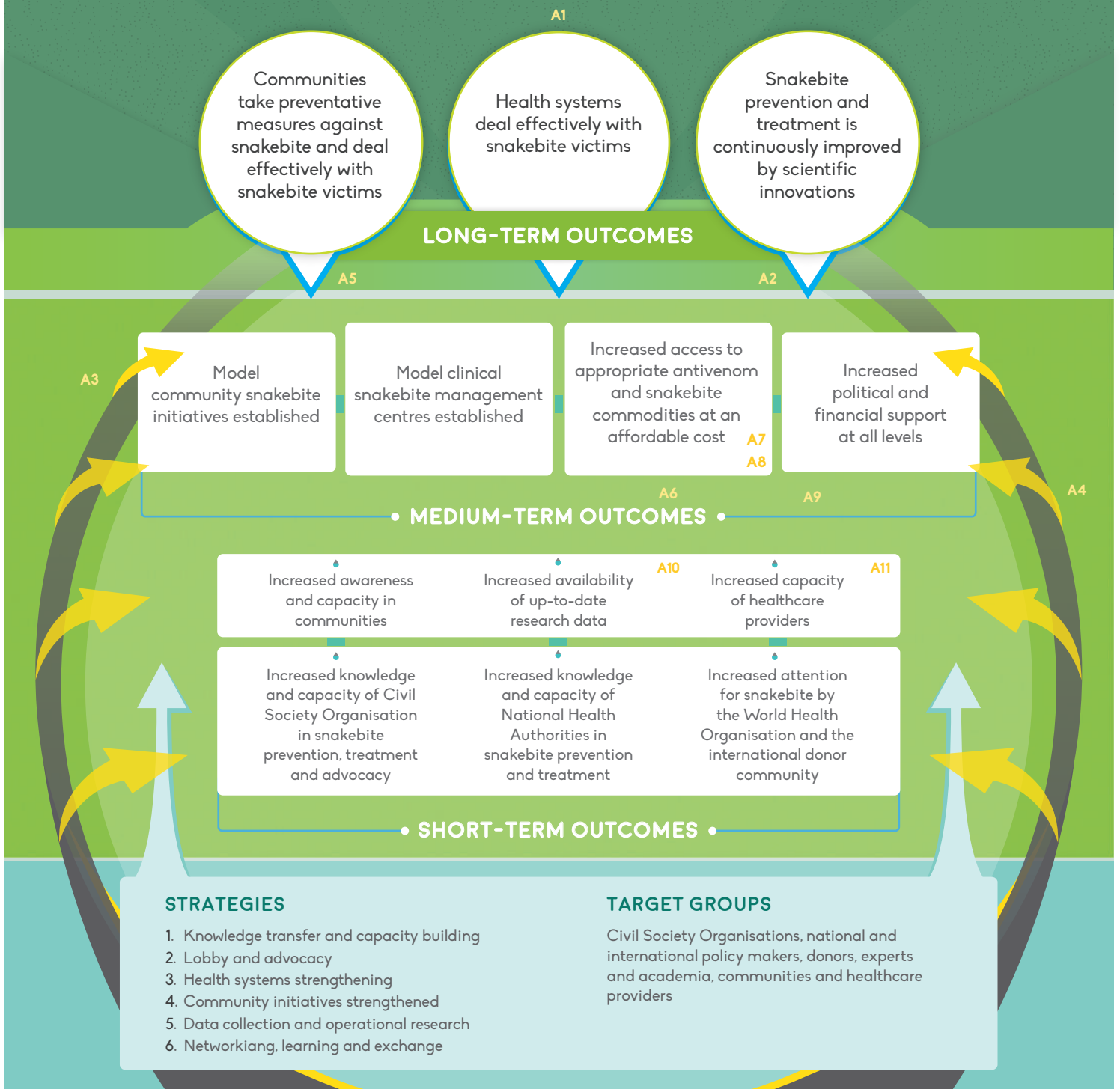
In November 2015, the HAI/GSI partnership took the initiative to promote a Member State side-event on snakebite at the World Health Assembly in May 2016, aiming to raise awareness of the global snakebite burden, amplify existing, but underused health systems and scientific innovation. HAI and GSI aim to have snakebite formally reinstated as a recognised Neglected Tropical Disease (NTD) by the WHO.

Our ultimately goal is to increase global attention and funding for snakebite at the WHO and with national governments and (international) donors, to develop and implement (pilot) projects in line with our 'theory of change', described below. The HAI/GSI secretariat plays a key role in identifying and grasping advocacy opportunities, linking, learning, facilitating exchange, project development and fundraising. The secretariat will also function as a networking and knowledge hub, responsible for capturing up-to-date knowledge of scientific innovations, as well as linking research to practice.

Through our partnership, we intend to implement scientific innovations to improve snakebite prevention, treatment and care. Members of GSI are working on developing innovations, such as products that prevent snakebite (e.g., snake repellents, footwear), as well as those that diagnose and treat them (e.g., rapid diagnostic tests, emergency response kits, antinecrotics and next generation antivenom, including polyvalent antivenom). Ultimately, these next generation snakebite medicines and supplies should be available in communities and local and national health facilities. In addition, innovative approaches, such as exploring the use of drones to quickly deliver antivenom to a patient and the use of bioneedles for the administration of polyvalent antivenom, are being explored.

¹⁷ http://www.who.int/medicines/areas/access/OMS_Medicine_prices.pdf

IMPACT: REDUCTION IN SNAKEBITE MORBIDITY AND MORTALITY



ONGOING SCIENTIFIC INNOVATION: PREVENTION, EMERGENCY RESPONSE, RAPID DIAGNOSTICS, ANTINECROTICS, POLYVALENT ANTIVENOM

ASSUMPTIONS

- A1:** 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
- A2:** Governments will invest in sustainable snakebite programming
- A3:** 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
- A4:** Innovations will lead to efficiency gains in antivenom production, contributing to lower prices and increased affordability
- A5:** More snakebite victims will access formal health services when services improve and trained community health workers quickly refer patients
- A6:** Increased knowledge among health authorities that poor quality antivenom is not effective, will raise demand for quality assured antivenom, reinstating a market
- A7:** Manufacturers are willing to work with GSI on the production of snakebite commodities
- A8:** Ultimately antivenom costs will be reimbursed
- A9:** Political and financial support is further enhanced by realising effective community and clinical models
- A10:** Data on snakebite incidents and socio-cultural practices is essential to develop context-specific interventions and effectively influence policies and practices
- A11:** Healthcare providers have the capacity to be trained to manage snakebite effectively

THEORY OF CHANGE

• SHORT-TERM OUTCOMES

The immediate or short-term outcomes that we foresee exist on two levels. The most direct results of our interventions are:

1+2

INCREASED KNOWLEDGE AND CAPACITY OF CIVIL SOCIETY ORGANISATIONS IN SNAKEBITE PREVENTION, TREATMENT AND ADVOCACY AND INCREASED KNOWLEDGE AND CAPACITY OF NATIONAL HEALTH AUTHORITIES IN SNAKEBITE PREVENTION AND TREATMENT

Civil society organisations (CSOs) and National Health Authorities (NHAs) are the key actors to engage in the development of contextualised interventions and policies, data collection, networking and building the capacity of others (e.g., community members, healthcare providers). At the country level, they are our direct target group. Capacitated CSOs and NHAs are able to mobilise key stakeholders by establishing multi-stakeholder platforms

and expert groups. Multi-stakeholder platforms on snakebite bring together CSOs, academia, policy makers and the private sector to ensure information exchange and encourage a joint effort in snakebite interventions in which each group plays its own specific role under its own mandate. Expert groups will comprise a variety of carefully selected experts working on a specific task (e.g., translating WHO guidelines to the national context).

3

INCREASED ATTENTION FOR SNAKEBITE BY THE WORLD HEALTH ORGANISATION AND THE INTERNATIONAL DONOR COMMUNITY

At the same time we will directly target the WHO and the international donor community to build international

support for snakebite, which is needed to enhance action at the national level and to mobilise initial resources.

4

INCREASED AWARENESS AND CAPACITY IN COMMUNITIES

GSI members will provide the technical expertise to support CSOs and NHAs to establish multi-stakeholder platforms and expert groups, as well as building the technical capacity

5

INCREASED CAPACITY OF HEALTHCARE PROVIDERS

of community members and healthcare providers. Data will reflect snakebite frequency, the presence of different species, common community practices and the ability of

6

INCREASED AVAILABILITY OF UP-TO-DATE RESEARCH DATA

the health system to deal with snakebite. The availability of data is essential to feed evidence-based advocacy, as well as for the development of context-specific models. CSOs, community members, healthcare providers and NHAs will conduct data collection and research with technical support

from GSI members and financial support from (international) donors. Another key assumption here is that health-care providers have the capacity to be trained to manage snakebite effectively.

• MEDIUM-TERM OUTCOMES

In the medium-term, we foresee four mutually reinforcing outcomes that will contribute to our long-term outcomes:

1

ESTABLISHED MODEL COMMUNITY SNAKEBITE SYSTEMS

We will develop context-specific models in communities aimed at the prevention of snakebite and ensuring that snakebite victims get the treatment they need. A functional model would include awareness raising in communities, systems to identify snakes, communication systems with health facilities and improved emergency transport. Trained community healthcare providers play a central role in awareness-raising, immediate care and referral and data

collection in communities. The models are aligned to the local needs and tested for their effectiveness for scale-up. If better health outcomes become visible, communities will be more likely to opt for formal health services instead of traditional healers. Once proven, local partners, supported by GSI, will engage in lobbying, advocacy and networking to mainstream demonstrably effective interventions into regional/national policies and mobilise funding for roll out.

2

ESTABLISHED MODEL CLINICAL SNAKEBITE MANAGEMENT CENTRES

Currently, health facilities in countries where snakebite mortality is high are not adequately equipped to treat snakebite victims. Snakebite victims are unlikely to come to a health facility if it is unable to treat them. Our strategy to improve the health system is through the establishment of clinical snakebite management centres in central/regional hospitals. They will function as centres of expertise, not only responsible for treatment of severe snakebite victims, but also for research, data collection, and training and supporting healthcare providers at lower level health facilities. The centres are responsible for improving the management

and care for snakebite victims in their region as well as influencing policy development. We assume here that more snakebite victims will access formal health services if the services improve and trained community healthcare providers quickly refer patients.

As with community systems, we will ensure that effective models become part of national snakebite policy and are scaled-up nation-wide. Effective models can also feed into further strengthening of international WHO guidelines.

3

INCREASED ACCESS TO APPROPRIATE ANTIVENOM AND SNAKEBITE COMMODITIES AT AN AFFORDABLE COST

Currently, regionally effective antivenom is often not available at health facilities. Availability, accessibility and affordability of antivenom is an important prerequisite to ensure snakebite victims are treated and to build trust in the health system within communities. Lobbying and advocacy at international and national levels is needed to mobilise resources and ensure antivenom production. Capacity building of national health authorities is needed to improve procurement, distribution and forecasting.

In addition to ensuring access to the currently available most appropriate polyvalent antivenom, we also aim to ensure that newly developed and improved antivenom

becomes available and is affordable, safe and used properly. Lobbying, advocacy and capacity building at all levels are the required strategies to ensure this.

Our assumptions are that in African countries, increased knowledge amongst health authorities that poor quality antivenom is not effective will raise demand for appropriate antivenom, reinstating a market for manufacturers. Moreover, when necessary, manufacturers will be willing to work with GSI on the production of affordable and quality assured snakebite commodities. In the short term, governments and donors will reimburse some or all of the costs of antivenom to large-scale and small scale manufacturers.

4

INCREASED POLITICAL AND FINANCIAL SUPPORT AT ALL LEVELS

Increased political and financial support at all levels is a prerequisite for the realisation of the long-term outcomes as well as for the other three medium-term outcomes. At the same time, political and financial support is enhanced when community and clinical models begin to show results and impact. At first, lobbying and advocacy is needed to

build initial political and financial support for the development of model interventions. Later, proven, effective models at community and health systems level will generate the evidence and data to mobilise more political and financial support.

• LONG-TERM OUTCOMES

We foresee three long-term outcomes that will contribute to the impact of a *reduction in snakebite morbidity and mortality*:

1

COMMUNITIES ARE ENGAGED AND UP-SKILLED TO TAKE PREVENTATIVE MEASURES AGAINST SNAKEBITE AND DEAL EFFECTIVELY WITH SNAKEBITE VICTIMS

Preventative measures include, for instance, protective footwear or using bed nets or repellents in the house. In case a community member is bitten, our aim is for communities to have the tools to identify the snake (e.g., through a mobile app) and ensure the victim is quickly transported to the

nearest, or most specialised, health facility for treatment. In the future, it may be possible to treat a victims nearer to the point of envenoming, depending on the development of safe and easy to use polyvalent antivenom or antinecrotics and healthcare provider capacity. In this case, antivenoms

held at a central distribution centre of snakebite excellence may be sent to district hospitals by drone (last mile technologies). Communities should be equipped with reliable mechanisms to report snakebite incidence (e.g., number

and type of snakes seen, number of bite incidents) to feed into **a national snakebite database**, possibly directly, using mHealth technologies.

2

HEALTH SYSTEMS DEAL EFFECTIVELY WITH SNAKEBITE VICTIMS

At a health systems level, HAI will ensure that snakebite is fully integrated into health policies, healthcare providers are trained on snakebite during and after their medical training, and health facilities are fully equipped to treat snakebite victims or have referral systems in place. In addition, we aim to ensure that there are communication systems in place between formal and informal healthcare providers in

communities. Data on incidence and health outcomes is captured in a **national snakebite database** and will be used for policy development. We assume that governments will ultimately invest in snakebite to ensure the sustainability of the intervention. This financial investment is most likely to happen if effectiveness of interventions is proven.

3

SNAKEBITE PREVENTION AND TREATMENT IS CONTINUOUSLY INFORMED AND IMPROVED BY SCIENTIFIC INNOVATIONS WHICH MUST BE AMPLIFIED AND SCALED-UP

Scientific research and innovations aim to contribute to enhanced prevention of snakebites as well as further improving health outcomes for snakebite victims, which can result from improved identification systems of the species of the snake, improved transport systems or improvements in antinecrotics or polyvalent antivenom. Every sign is that that science will deliver useful innovations and our aim is to ensure that these innovations are effectively translated into policy and programmes. We foresee a central role for the GSI secretariat to keep track of research and innovations taking place worldwide and the facilitation of linking,

learning and exchange for scale-up of promising innovations.

We make the assumption that newly developed and tested medicines and supplies are more likely to become widely available in the context of increased political will and financial resources (mid-term outcome 4). In addition, we assume that innovations will lead to efficiency gains in antivenom production, contributing to lower prices and increased affordability (mid-term outcome 3).

STRATEGIES TO ACHIEVE OUTCOMES

- **Knowledge transfer and capacity building at all levels in the area of prevention and treatment of snakebites:**

Knowledge transfer and capacity building will be done on a broad range of topics and for a broad range of stakeholders. Topics include knowledge on venomous snake species,

prevention measures, clinical treatment, side effects, procurement and forecasting of medicines and supplies, research and data collection, lobbying and advocacy, project development, and monitoring and evaluation. Target groups are CSOs, community members, community healthcare providers,

(formal) healthcare providers, researchers, health authorities and policy makers. Capacity building can consist of training, as well as coaching and mentoring.

- **Advocacy for policy change and budget allocation: Advocacy will be evidence-based and informed by research data.**

We expect the GSI secretariat to take leadership in international advocacy and support CSOs and multi-stakeholder platforms in country in their advocacy efforts.

- **Health systems strengthening to improve management and treatment of snakebites:** Health systems strengthening includes setting up referral systems, health management information systems, forecasting and procurement, and ongoing training of healthcare providers.

- **Community systems strengthening to enhance prevention and effective and efficient treatment for snakebite victims:**

Community systems strengthening includes the on-going training of community healthcare providers, community-based health management information systems, systems to

improve snake identification, transport systems and communication systems with the formal health system.

- **Data collection and operational research to explore the most efficient and effective interventions in a given context:**

Data collection and research is essential to gain better insight in the current extent of the problem, which is essential to mobilise policy makers and donors. In addition, data and research is needed to continuously improve interventions and policies, aiming at realising the best results.

- **Networking, learning and exchange to enhance expertise and collaboration between different actors:**

At the international level, the GSI secretariat is responsible for networking, learning and exchange by keeping oversight over the different activities of individual members and other relevant actors. The secretariat will share relevant knowledge and expertise and take a leading role in linking different actors to each other. At the national level, we foresee a large role for national multi-stakeholder platforms in ensuring knowledge exchange and joint policy development.

Strengthening health systems: Healthcare workers learn how to intubate a snakebite victim, a skill that will stay with them throughout their careers. (Photo: Global Snakebite Initiative)



“Snakebite has never received the attention it deserves by the global health community. With collective action, we now have a significant opportunity to create tangible change in the lives of millions of people around the world who are suffering from a malady that is both preventable and treatable.”

Dr. Tim Reed

Executive Director Health Action International

OUTCOME	INDICATORS
1. Increased knowledge and capacity of CSOs in snakebite prevention, treatment and advocacy	<ul style="list-style-type: none"> • Number of CSOs with increased knowledge and capacity in snakebite prevention and treatment • Number of CSOs with increased knowledge and capacity in data collection and advocacy • Multi-stakeholder platforms / expert groups established at country level
2. Increased knowledge and capacity of NHAs in snakebite prevention and treatment	<ul style="list-style-type: none"> • Number of NHA staff members with increased knowledge and capacity in snakebite prevention and treatment • Expert group on implementing WHO guidelines on snakebite established
3. Increased attention for snakebite by the WHO and the international donor community	<ul style="list-style-type: none"> • Snakebite is reinstated as neglected tropical disease by the WHO • Number of donors that include snakebite in their priority areas
4. Increased awareness and capacity in communities	<ul style="list-style-type: none"> • Number of community members with increased knowledge on snakebite
5. Increased capacity of healthcare providers	<ul style="list-style-type: none"> • Number of healthcare providers with increased knowledge and skills on snakebite
6. Increased availability of up-to-date research data	<ul style="list-style-type: none"> • Increased availability of research data on different aspects of snakebite (e.g., incidence, common species, community practices, current health system response / gaps)

OUTCOME	INDICATORS	COMMENT
1. Model community snakebite systems established	<ul style="list-style-type: none"> • Number and quality of context-specific community models established • Increased availability of community data on snakebite 	Indicators are mainly qualitative to measure the quality and completeness of community systems. This includes knowledge and awareness, communication systems with health facilities and transport
2. Model clinical snakebite management centres established	<ul style="list-style-type: none"> • Number and quality of clinical snakebite management centers established • Increased availability of clinical data on snakebite 	Indicators are mainly qualitative to measure the quality and completeness of clinical systems. This includes capacity of healthcare providers, referral systems and availability of commodities and supplies
3. Increased access to appropriate antivenom and snakebite commodities at an affordable cost	<ul style="list-style-type: none"> • Number of health facilities where appropriate antivenom and snakebite commodities are available and affordable • Decrease in stockouts for antivenom and other snakebite commodities 	
4. Increased political and financial support at all levels	<ul style="list-style-type: none"> • Increased number of health policies include specific policies on snakebite • WHO guidelines on snakebite translated to local context • Increased financial resources for snakebite available (donors, governments and international agencies) 	

OUTCOME	INDICATORS	COMMENT
Impact: Reduction in snakebite mortality and morbidity	<ul style="list-style-type: none"> • Reduced snakebite incidence rate • Reduced snakebite mortality rate • Improved health outcomes of snakebite victims (disability-adjusted life years, DALYs) 	This data will be acquired from the <i>national snakebite database</i>
Communities take preventative measures against snakebite and deal effectively with snakebite victims	<ul style="list-style-type: none"> • Increased use of preventative measures in communities • Increased percentage of snakebite victims are transported quickly to a health facility where they can be treated • Communities collect snakebite data which feeds into a national snakebite database 	<p>The kind of preventative measures is context-specific. Data is both quantitative and qualitative.</p> <p>Community data on snakebite should become part of the (community-based) health management information system (HMIS)</p>
Health systems deal effectively with snakebite victims	<ul style="list-style-type: none"> • Increased percentage of snakebite victims correctly diagnosed and timely treated' • (Evidence-based) snakebite prevention and treatment policies are fully integrated into national health policies • Training on snakebite is part of the national curriculum of healthcare providers • Increased percentage of health facilities are fully equipped to deal effectively with snakebite victims • Health facility data on snakebite is collected and feeds into a national snakebite database 	This indicator is a result of both community and health system action
Snakebite prevention and treatment is continuously improved by scientific innovations	<ul style="list-style-type: none"> • Scientific innovations are part of community interventions, health policy and/or treatment practices 	We envisage a situation, under the leadership of the GSI secretariat, in which innovations and promising research is visible and shared among the GSI members and beyond so that interventions are constantly improving.

PREVENTING AND TREATING SNAKEBITE IN RESOURCE-POOR SETTINGS: AN ACTION PLAN FOR CHANGE

Theory of Change

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