



## Did the WHO recognition of snakebite as a neglected tropical disease impact national NTD master plans in 15 African countries?

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### ARTICLE INFO

Handling Editor: Dr. Denise Tambourg

#### Keywords:

Neglected tropical diseases  
Snakebite envenoming  
Africa  
Policy  
National NTD master plans

### ABSTRACT

In 2018, the World Health Organization (WHO) acknowledged Snakebite Envenoming (SBE) as a Neglected Tropical Disease (NTD). The WHO set a target for 2030 to halve the number of snakebite victims and published a roadmap to assist affected countries with drafting national SBE policies. These national SBE policies define the course of action to reach country specific and global goals. In order to review the policy environment needed to reduce the burden, we studied if SBE policy was included in national NTD programmes and if it included the four WHO SBE policy aims and a vision for the integration of NTDs. National NTD masterplans were reviewed and combined with in-depth interviews focusing on stakeholders' experience with the integration of SBE in NTD programmes, and the influence of the inclusion of SBE on the NTD list. Only 18 % (2 out of 11) of 2015–2020 NTD masterplans mentioned SBE whereas all twelve countries who published masterplans for 2020–2025 included SBE and the need for an integrated approach between NTD programmes. Information on the type of activities allowing integration or the organizational aspects of an integrated approach was often missing. The extent to which the core policy aims of the WHO SBE roadmap has been elaborated differs considerably from country to country. In the interviews, several stakeholders raised the importance of improving the quality of epidemiological data to convince policy makers of its importance, to base antivenom distribution and to facilitate overall policy making. The path of improvement that has been taken since the recognition of SBE as an NTD must be continued and benefits from a closer collaboration between policymakers, researchers and healthcare workers to reduce the evidence gap and, ultimately, to improve care.

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<https://doi.org/10.1016/j.toxicon.2025.108935>

Received 2 January 2025; Received in revised form 4 November 2025; Accepted 27 November 2025

Available online 29 November 2025

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## 1. Introduction

In 2018, the WHO recognized SBE as a Neglected Tropical Disease (NTD). This supported the inclusion of snakebite activities in national approaches to managing NTDs. SBE ranks fourth among NTDs based on the burden measured as Disability Adjusted Life Years (DALY) and current reports are likely to underestimate the real situation (Hotez et al., 2014; WHO; Berg et al., 2024). In sub-Saharan Africa, the estimated number of annual deaths is 7000–20 000 (Kasturiratne et al., 2008), but one study estimated 3557–5450 deaths each year alone in West Africa (Habib et al., 2015).

Formal WHO recognition led to the formation of an SBE working group in 2017. This group set the goal of reducing the victims of SBE by 50 % and designed a roadmap to achieve this goal. (WHO) This roadmap provides guidelines on how to approach SBE and emphasizes the importance of incorporating SBE into national and regional health policies. The roadmap describes that effective policies should include the following core policy aims.

1. Ensuring that safe and effective treatment is accessible and affordable for all;
2. Empowering regional, national, and local communities to take proactive action;
3. Strengthening health systems to deliver better outcomes;
4. Building a strong global coalition of partners to build advocacy, mobilize resources, coordinate action, and ensure that implementation of the roadmap is successful (Williams et al., 2019).

WHO Regional Office for Africa encouraged member states to develop national master plans on NTDs endemic in their country. These plans are country-owned, multi-year documents that align with global targets and WHO guidelines. The Expanded Special Project for Elimination of NTDs (ESPEN) was launched to support countries in developing their master plans (Hopkins, 2015). Six years after inclusion on the NTD list, we wanted to gain insight into the progress of the inclusion of SBE policies. Reflection on progress will provide insight into the elaboration of the WHO strategy, where countries currently stand and what the barriers and facilitators are. For 15 African countries, known to us to be active in snakebite envenoming research, management and policy making, we studied if SBE policy was included in the national NTD programme and if it included the four WHO SBE policy aims and a vision for the integration of NTDs. SBE stakeholders were interviewed for their views on national SBE policy making and SBE programme development.

## 2. Methods

This protocol was reviewed and approved by the Liverpool School of Tropical Medicine Research Ethics Committee (reference: 21–068). All participating stakeholders provided electronic informed consent based on the information received on the objectives, importance and ethical provisions of the study.

### 2.1. National NTD masterplans and WHO policy documents

This study combined a qualitative analysis of NTD masterplans with in-depth interviews. Data were collected from 15 countries in the WHO African region: Benin, Burkina Faso, Burundi, Cameroon, Chad, Eswatini, Ethiopia, Ghana, Kenya, Nigeria, Rwanda, South Sudan, Tanzania, Togo, Uganda.

National NTD master programmes were obtained through an internet search and via stakeholders. The internet search was done in a structured manner to identify the national NTD masterplans for each country.

National NTD masterplans available or published between January 1, 2017 and July 15, 2025 were included. Language was not a limitation for the inclusion of documents. News reports, progress reports, general

policy papers and clinical guidelines were excluded from the selection of documents. Draft national NTD master plans documents were included if published via the WHO ESPEN website.

#### 2.1.1. Search

The identification of the documents was done by following the same search protocol for each country. This meant performing a search on WHO ESPEN (Expanded Special Project for Elimination of Neglected Tropical Diseases) for national NTD masterplans and searching national NTD masterplans on the Ministry of Health websites and on Google. The Google search was performed in the Chrome browser using the setting ‘Google Depersonalized’. The complete search strategy can be found in the *Supplementary document* showing both the English and the French search strategy.

#### 2.1.2. Selection and data identification

Data identification in the National NTD masterplans was done by two authors (YC and SK) who consulted a third author (YS) in case of ambiguities. The text search terms were used to identify the relevant sections on SBE following the terms described in the *Supplementary document*.

### 2.2. In-depth interview (Stienstra et al., 2023)

SBE stakeholders were asked to participate in an in-depth interview. These stakeholders were approached for this specific research question based on the rich data on policy making they provided in an earlier study exploring the barriers in SBE research in Africa (Stienstra et al., 2023). The interviews were conducted following an Interview Guide focusing on exploring the stakeholders’ role in SBE, the current national SBE policies, the integration of SBE in NTD programmes, and the influence of the inclusion of SBE on the NTD list. The stakeholders were asked about the impact of the recognition of SBE by the WHO on SBE policy making and SBE programme development. In-depth interviews were conducted via Google Teams and lasted between 45 and 75 min. The interviews were held in English which was spoken by all in-depth interview participants.

### 2.3. Data extraction and data analysis

Framework analysis was used to extract and analyse data from the documents to assess the content of the documents. The framework covered two themes linked to the research questions: (1) the integration of SBE policy in national NTD programmes; and (2) the inclusion of the four WHO core policy aims for SBE. Information per country was processed in a narrative table.

Framework analysis was also used for the data extraction of the in-depth interviews. For this data source, the framework contained three themes, namely: (1) the policy consequences of including SBE on the NTD list; (2) experiences with the management of SBE; and (3) the integration of SBE in the NTD programme. Labelling the data was done using ATLAS.ti software.

## 3. Results

### 3.1. The publications of national NTD masterplans and their content

Twenty-four documents from the fifteen countries were included (Table 1). Eleven masterplans on NTDs were found for the period 2015–2020 and thirteen masterplans from twelve countries for the period 2020–2025. Uganda published two plans in these five years. In the 2015–2020 period, two of the eleven (18 %) NTD masterplans (Kenya and Burkina Faso) included SBE. Bénin, Burundi, Eswatini, Ethiopia, Ghana, Kenya, Nigeria, Rwanda, South Sudan, Tanzania, Togo (2022–2023) and Uganda published masterplans in the period 2020–2025 masterplans, all of which included SBE. Three countries had

**Table 1**

National SBE policy documents. Document assessment on SBE inclusion, SBE integration in national NTD programme, and the inclusion of the WHO policy aims for SBE.

Work title document	Publication (Year)	SBE inclusion	SBE Integration	Policy aims			
				1 Safe & effective treatment	2 Empowering & Engaging communities	3 Stronger health system	4 Partnership, coordination & resources
<b>Benin</b>							
Plan Directeur National de Lutte Contre Les NTD 16-20	2016	No	–	–	–	–	–
Plan Directeur MTN 2023–2027	2024	Yes	Yes*	Yes	Yes	Yes	Yes
<b>Burkina Faso</b>							
Plan Stratégique de Lutte Contre Les MTN 16-20	2016	Yes	Yes*	Yes	Yes	Yes	Yes
<b>Burundi</b>							
Plan Directeur de Lutte Contre Les MTN 16-20	2016	No	–	–	–	–	–
Burundi Masterplan 2022–2027	2024	Yes	No	–	–	Yes	–
<b>Cameroon</b>							
–	–	–	–	–	–	–	–
<b>Chad</b>							
Plan Directeur de Lutte Contre Les NTD 16-20	2016	No	–	–	–	–	–
<b>Eswatini</b>							
Masterplan towards the elimination of NTD 15-20	2015	No	–	–	–	–	–
Neglected Tropical Diseases Master Plan 2024–2028	2025	Yes	No	Yes	Yes	–	–
<b>Ethiopia</b>							
Second Edition of National NTD Master Plan 16-20	2016	No	–	–	–	–	–
The third National NTD Strategic Plan 2021–2025	2022	Yes	Yes	Gen NTD	Gen NTD	Gen NTD	Gen NTD
<b>Ghana</b>							
Master plan for NTD programme 16-20	2016	No	–	–	–	–	–
NTD Master Plan 21-25	2021	Yes	Yes	Yes	Gen NTD	Yes	Gen NTD
<b>Kenya</b>							
Second National Strategic Plan for control of NTD 16-20	2016	Yes	Yes	Gen NTD	Gen NTD	Gen NTD	Yes
Kenya National Master plan for Elimination of NTDs	2023	Yes	Yes	Yes	Yes	Yes	Yes
<b>Nigeria</b>							
NTD Nigeria Multi-Year Master Plan 15-20	2015	No	–	–	–	–	–
Master plan for NTDs 2023–2027	2024	Yes	Yes	Gen NTD	Gen NTD	Gen NTD	Gen NTD
<b>Rwanda</b>							
NTD Strategic Plan 19-24	2021	Yes	Yes*	Yes	Yes	Yes	Yes
<b>South Sudan</b>							
National Master Plan For NTD 16-20	2016	No	–	–	–	–	–
NTD Master Plan 2023–2027	2024	Yes	Yes*	Yes	–	Yes	Yes
<b>Tanzania</b>							
Strategic Master plan for the NTD control program 21-26	2022	Yes	Yes	Gen NTD	Gen NTD	Gen NTD	Gen NTD
<b>Togo</b>							
Plan Directeur National de Lutte Intégrée contre les MTN 16-20	2015	No	–	–	–	–	–
Plan Stratégique National MTN (2022–2023)	2024	Yes	No	Gen NTD	–	Gen NTD	–
<b>Uganda</b>							
Sustainability Plan for NTD Control Program 20-25	2020	Yes	Yes	Gen NTD	Gen NTD	Gen NTD	Gen NTD
Uganda Neglected Tropical Diseases Master Plan 2023–2027	2023	Yes	Yes	Yes	Yes	–	–

SBE – Snakebite Envenoming, NTD – Neglected Tropical Diseases, MTN - Maladies Tropicales Négligées, MOH – Ministry of Health.

**SBE inclusion:** Yes – SBE policy in document | No – No SBE policy in document.**SBE integration:** No – No integrated NTD approach for SBE | Yes – Integrated NTD approach mentioned for SBE | Yes\* – Integrated NTD approach and activities specified for SBE.**Policy Aims:** Yes – SBE policy entails the policy aim | Gen NTD – the policy aim is presented in the general NTD policy, with an indication this policy applies to SBE | No – SBE policy does not entail the policy aim.Website WHO masterplans: <https://espen.afro.who.int/tools-resources/documents/country-ntd-master-plans>.

not published a masterplan for the period 2020–2025.

### 3.1.1. SBE integration

The need for an integrated approach between NTD programmes was mentioned in all masterplans. However, further information on the type of activities allowing integration or the organizational aspects of an integrated approach was often missing.

*Each programme will maintain its disease-specific objectives, strategies, targets and milestones in its integrated package, on the understanding that achieving its goals will contribute to achievement of the national goal. (Masterplan, 2020–2025, Ethiopia)*

Only masterplans of Burkina Faso, Kenya, Nigeria and Rwanda included descriptions of activities that specified how to integrate SBE in the NTD programme. The Rwanda masterplan displayed a table with opportunities for integration. These included examples to improve management of SBE and a selection of other NTDs by e-learning, capacity building for basic skills at the district and referral level, clinical mentorship, and communication with referral facilities. The Kenya masterplan emphasized the need to collect better data on burden by integrating snakebite surveys in mass drug administration NTD programmes. This integrated approach to data collection started in 2022. The Nigeria masterplan incorporated integrated training and case-finding initiatives. Additionally, it highlighted the necessity of establishing integrated peer support groups at the community level.

### 3.1.2. Policy aims

The thirteen masterplans 2020–2025 which included SBE addressed the four policy aims. Policy aims were described for NTDs in general. Nine documents provided SBE specific policy aims.

**3.1.2.1. Safe and effective treatment.** The first WHO policy aim is defined as ‘Ensuring that safe and effective treatment is accessible and affordable for all’, including the accessibility and affordability of safe and effective antivenoms, training and education of health workers and investment in innovative research on new therapeutics. All masterplans gave descriptions of how to improve NTD treatment in general. This example came from the masterplan of Ethiopia:

*Strengthen a timely, effective NTD logistics supply chain management system (quantification, request, stock monitoring and reporting of commodities). (Masterplan, 2021–2025, Ethiopia)*

The masterplans from Rwanda, Kenya, Ghana, Nigeria and Burkina Faso described in further detail how to improve the management of snakebites.

*Develop integrated training manuals, conduct integrated training for health workers on the diagnosis and management (Masterplan, 2023–2027, Nigeria)*

*Training of health personnel in the diagnosis and management of envenoming. (Masterplan, 2016–2020, Burkina Faso)*

The Rwanda masterplan covered multiple topics at the SBE specific level including the improvement of the antivenom supply chain. This masterplan contained a control strategy for SBE with concrete interventions, in which the following was written:

**PROGRAMME STRATEGIES/INTERVENTIONS.**

1. Rapid evaluation of Snakebites envenoming in Rwanda
2. Disseminate guideline for proper case management
3. Training of health care providers
4. Improve supply chain of antivenom products (SBE); fast delivery where possible
5. Include SBE in Human Resource Management Information System

6. Raise awareness of diseases in community and among health care providers and Community Health Workers. (Masterplan, 2019–2024, Rwanda)

The masterplan of Kenya included objectives for the upcoming years to improve access to antivenom, for example the following:

*Conduct two efficacy tests of antivenoms available in the market Assess capacity of the 16 SBE endemic counties to purchase antivenoms*

**3.1.2.2. Empowering and engaging communities.** The second policy aim is formulated as ‘Empowering regional, national, and local communities to take proactive action’, which includes activities such as improvement of health care-seeking behaviour, SBE prevention, and community engagement and participation. The attention documents gave to this aim varied.

Some masterplans described specific targets in community engagement SBE. For example:

*Proportion of people in endemic districts with knowledge on snakebite and management: 50 % in 2027*

*(Masterplan, 2023–2027, Uganda)*

*Provide incentives for community members who refer suspected NTD cases (Masterplan, 2023–2027, Nigeria)*

**3.1.2.3. Stronger health systems.** ‘Strengthening health systems to deliver better outcomes’ is the third WHO policy aim, covering activities such as improving infrastructure, health facilities, research, monitoring, and surveillance. Six documents provided SBE specific descriptions. Disease monitoring was addressed in all documents. The Eswatini Masterplan incorporated the designation of snakebite as a notifiable condition in 2022.

The Ghana 2020–2025 Masterplan stated on disease monitoring:

*Monitoring and evaluation of some of the NTD is already being done within the national health information management system (HMIS). The NTD programme will therefore take urgent steps to ensure that all diseases are inbuilt into the HMIS of the Ministry of Health as a strategic priority. (Masterplan, 2020–2025, Ghana)*

Improving infrastructure was mentioned in documents from Burkina Faso, Kenya, South Sudan and Tanzania.

*Support infrastructure, equipment and other necessary items for the NTD programme management at all levels. (Masterplan, 2021–2026, Tanzania)*

*Rehabilitation to optimize the functioning of the individual in the community LF, leprosy and snakebites (Masterplan, 2023–2027, South Sudan)*

**3.1.2.4. Partnership, coordination and resources.** The fourth policy aim, ‘Building a strong global coalition of partners to build advocacy, mobilize resources, coordinate action, and ensure that implementation of the roadmap is successful’, contains themes such as promoting governance, leadership, advocacy, effective communication, and coordinated data management. Masterplans included these aims and described them for NTDs in general.

*It (masterplan) also forms the basis for harmonizing the joint support of all partners working in NTD, in terms of resource mobilization, information sharing, monitoring and evaluation and periodic reviews. (Masterplan, 2021–2025, Ghana)*

Kenya and Rwanda described aims which were SBE specific in their masterplans 2020–2025.

*These include working with WHO to advocate for inclusion of snakebites as priority NTDs, ..., membership and participation in the SBE Technical Advisory Group, recruiting Trainers of Trainees (TOTs) from the MOH to aid in dissemination of information and community education (Master-plan, 2023–2027, Kenya)*

### 3.2. SBE stakeholders' view on national SBE policy making

Qualitative data was derived from in-depth interviews with eight SBE stakeholders active in 10 of the 15 countries. Four worked for the Ministry, one worked as a medical doctor, and three worked for international NGOs. The interviews provided additional information about three topics: the policy consequences of including SBE on the NTD list; experiences with the management of SBE; and the integration of SBE in national NTD programmes.

#### 3.2.1. Impact of NTD designation on the position of SBE in the Ministry of Health and NTD programme

Seven participants gave specific information on the position of SBE in the national NTD programme of eight countries. For seven countries, the stakeholders acknowledged changes in the organization of SBE management after the inclusion of SBE on the NTD list. In one country, according to the snakebite stakeholder, SBE was already part of the NTD programme before the official recognition as an NTD.

The interviews contained examples of changes in SBE policy making. Some countries were reported to have started from scratch. A common first step was appointing a focal person for SBE:

*Yes, so in both countries also, with support from snakebite being a Neglected Tropical Disease in both countries, there is a snakebite focal person, focal point, which is within the NTD department and recognizes that snakebite is part of the NTD framework and seeks to develop resources and capacity for snakebite within that department. (Member of NGO active in snakebites, F)*

Stakeholders from different countries emphasized the importance of the authority gained by divisions or focal persons to coordinate SBE as a result of policies. The following two quotes provided insight into the improvements that have been made since the appointment of authority to divisions or individuals in the field of SBE:

*Because of the legitimacy of the programme level to work with partners, go out to there, conduct health education and behaviour change, communication and to get people going back to the hospitals where now we have stocked antivenom. So just by bringing the programme into the NTD, it has helped a lot. (medical doctor, C)*

*Number one, it gave us the authority to be able to coordinate issues around snakebite management in (country censored). You know, before that, there was no authority, I can tell you this is very important, because even after officially getting the authority and officially being the coordinator of snakebite envenoming activities, I still encountered a lot of difficulties from stakeholders. (National NTD programme manager, H)*

Another perspective on the consequences of including SBE on the NTD list was described by a stakeholder who mainly expected advantages in the availability of funding from international parties.

*Well in Africa it is, well, there are some changes now, after the decision, the WHO decision, about the list of neglected tropical diseases and the snakebites in this list. But the changes are not very, very important. The most important is that now we can have access to funds from international organizations. I mean, Wellcome Trust and eventually Bill Gates Foundation and so on. (Member of NGO active in snakebites, G)*

#### 3.2.2. The integration of SBE in national NTD programmes

The integration of SBE in the national government structure and the integration of specific SBE activities were explored in the interviews. For

six countries, the interviews provided detailed information about the SBE focal persons in the national NTD programme. The interviews revealed that focal persons were all responsible for multiple NTDs.

NTD programme managers explained future plans for the integration of SBE in the NTD programme as follows:

*It is very simple to integrate snakebites in research to establish with other activities, because some are overlapping with snakebite, maybe overlapping with other NTDs. So, if we are conducting an MDA in the communities and the schools, the person can conduct domestic controls as well and make awareness to communities. (National NTD programme manager, D)*

*We are trying to integrate everything and also this NTD, snakebite, is really simple to integrate, with the list in mind of using available resources to achieve more in health not only in NTD but also in other diseases. (National NTD programme manager, D)*

*So even when it is something that is cross cutting, they can go and go implement. They can support each other. I am the focal point person for lymphatic filariasis and you are the focal point person for snakebites, but as I am going to implement my interventions, we actually work on it with you, because it is going to have an impact on snakebites as well. (National NTD programme manager, H)*

A few interviewees gave examples of activities on how SBE is integrated already. One of the examples was a stakeholder who explained how they aim to increase community engagement for several NTDs combined:

*It's a behaviour change communication technical working group. It has social scientists, it has even very well-known media personalities in (country censored), you know we brought them into the programme. You know, the ones who anchor news on television national television, so we have that group of people who work very closely with the programme so that they can help us to develop messages. They come up with ideas on how we can get the messages out to people. So this one does not just work for snakebites, it works for all the NTDs. (National NTD programme manager, H)*

Stakeholders not working at the ministry more often demonstrated uncertainty about the structure of SBE within the NTD programme and the activities of the focal points for snakebites.

*(Name censored), who's the focal point for all NTDs and communicable diseases and he's been specifically in charge of snakebite. But I don't know if it's snakebite as a dossier or snakebite within all the other NTDs. So I haven't seen any integration of snakebite with other NTDs.*

...

*I know it's (SBE in the NTD programme) supposed to be there, but I'm not sure if it has started or not started, or if it's a bit virtual still. (Member of NGO active in snakebite, B)*

#### 3.2.3. Snakebite stakeholders' perspectives on SBE management

Stakeholders described the barriers in policy making they had experienced. All eight emphasized the importance of improving data on the burden or explained how this had been a crucial step in the process. Some stakeholders explained underreporting of SBE to be a consequence of not being looked at as a disease but as an accident and potentially provoked by supernatural beings.

*But when you ask, okay how many snakebites do you have each year in your country? They don't know. Because they don't take this problem as a regular problem of health. You see what I mean? (Member of NGO active in snakebite, G)*

*The snakebite is not normal or natural situation. For many people, even in government, it is not a natural accident. I mean, there's something very confused in the mind of many people on the origin of snakebite, why a*

*snake bites a man, woman or child. (Member of NGO active in snakebite, G)*

Stakeholders considered knowledge on the burden of snakebites crucial for two reasons. The first reason given by stakeholders was that knowledge of the burden is necessary to convince influential parties of the seriousness of this health problem.

*The most important thing is to first get enough data. That can convince the decision-makers, how big the problem is and what exactly we need? (National NTD programme manager, A)*

The second reason was that knowledge of the size of the burden was considered essential for appropriate policy design. The burden should correspond with the planning of implementation and resource allocation. In addition to national data, the importance of identifying hotspots was also explained to be able to come up with an adjusted policy for different regions. Two examples of such statements from stakeholders are listed below:

*Assessing the burden of snakebite is one of the main priorities ... The top management, also asked me, I mean the minister, the Parliament Secretaries, the Accounting Officer, they ask me, how big is the problem? Because in terms of the antivenom, then you should know exactly how big the problem is, and help how much you want to buy? (National NTD programme manager, A)*

*But I think it's also important to go around the country and identify clearly through research and evidence where those hotspots really are, where needs more resources and more allocation focused on and where is less of an issue or less of a problem, and I think that also should be supported by strengthened surveillance and better system in place, so that health care workers and hospitals are able to accurately collect information on snakebite. (Member of NGO active in snakebite, F)*

Access to epidemiological data was seen by stakeholders as an important starting point to ensure that antivenom gets to the right places once available. The statements below highlighted the challenges with antivenom availability and policy making.

*I don't know if it has really been implemented, because the main problem, I would say, is access to antivenom. And without antivenom you can't really implement guidelines. (Member of NGO active in snakebite, B)*

*The challenge is, if you mobilize the community now and you tell them that now the antivenom is at the facility and now they go and they don't find it there. What will happen? (medical doctor, C)*

#### 4. Discussion

This research showed that the acknowledgment of SBE as an NTD by WHO was a trigger to improve or develop national SBE policies in several SSA countries. SBE is now more commonly included in current national NTD programmes, but the extent to which the policy has been elaborated differs considerably from country to country. In the interviews, several stakeholders raised the importance of improving the quality of epidemiological data to convince policy makers of its importance, to base antivenom distribution and to facilitate overall policy making.

Studying pitfalls, solutions, and advice from other NTDs could contribute to an efficient process of policy making and implementation. A successful example of an integrated approach among NTDs are the Mass Drug Administration programmes targeting multiple NTDs. The burden of the MDA targeted diseases has been greatly reduced since the start of this program (Webster et al., 2014). A systematic review on integrated management of NTDs demonstrated the approach to be cost effective and to potentially increase coverage (Banda et al., 2021). Williams et al. indicated the importance of the integration of SBE into other NTD programmes (Williams et al., 2019); however, many of the

current masterplans lack detailed information on the type of activities allowing integration or the organizational aspects of an integrated approach. Nonetheless, the in-depth interviews yielded more concrete examples of integrated strategies adopted across the various countries.

Fahrion et al. (2017) demonstrates the opportunity for SBE to integrate human rabies policy implementation for bite prevention education programmes and infrastructure for the production and supply of biologics (Fahrion et al., 2017).

Despite human rabies being listed as an NTD in 2010, only 40 African countries (40/54) in 2021 included rabies control and prevention strategy in their national policy making, and 14 countries (14/54) had no specific strategy (Haselbeck et al., 2021). This shows that policy changes can take a long time. Research on policy making processes identifies the political economy of trending pandemic threats as an important external influence on decision-making processes for zoonotic disease control (Okello et al., 2015). In recent years, the process for NTDs in general has been complicated by the Covid-19 pandemic.

It is common for NTDs to have 'implementation gaps' (Molyneux, 2014; Hotez, 2015). Krentel et al. (2018) identified implementation challenges for NTDs such as delays in delivering drugs to health centres, insufficient time and funds for promotional and educational messages, and insufficient numbers and overburdened health personnel (Krentel et al., 2018). With respect to SBE, the implementation gap appears to be an 'implementation chasm'. Our results suggest this will be hard to bridge without better data on the burden of SBE for appropriate resource allocation compared to better funded NTDs. However, action and policymaking should not be postponed while awaiting epidemiological data, as snakebite patients continue to suffer due to inadequate basic medical care and limited awareness of SBE within health systems. A scoping review demonstrated poor collaboration between research organizations and policymakers in national health policy making in Africa (Yimang et al., 2021). SBE requires such a collaborative approach as policy makers currently lack evidence to correctly prioritize SBE and to develop policies. Researchers need support from policy makers to mobilize funding and to prioritize the research questions policy makers need most to eventually have an impact on health outcomes.

##### 4.1. Limitations and further research

This study included only 15 countries, selected based on their active engagement with SBE. While this approach allowed for an exploration of the challenges involved in integrating SBE into national NTD programmes – and therefore into national masterplans – it does not represent the extent of SBE inclusion across the continent. No masterplan could be identified for three of the fifteen countries, while in several others, the available masterplans covered timeframes that differed from the intended 2020–2025 period. The delayed publication of masterplans may reflect challenges within national healthcare systems or may be linked to disruptions caused by the COVID-19 pandemic, during which numerous NTD programmes were suspended. These findings may also be interpreted as indicative of the pace at which SBE policy is developing. Eight in-depth interviews were conducted: although some stakeholders represented several countries, not all countries were represented in the in-depth interviews. This study did not include NGO documents, while NGOs are known as contributors to policy documents. Interviews with members of NGOs emphasized the role of the NGO was to support and assist the government and not to take over responsibilities such as the publication of policy documents. We did not study the role of national policy makers in the placement of snakebite envenoming on the global health agenda and if these activities served as a facilitator in national policy development.

#### 5. Conclusion

National NTD programmes have been stimulated to include SBE in their national policy by the recognition of SBE as an NTD at the global

level. However, SBE policy making as described in NTD masterplans is limited in detail or still in the pipeline. It has been seven years since SBE was included on the WHO NTD list and there are five years left to achieve the target of halving the SBE burden, which is in line with the targets related to SBE for the SDG 2030. To achieve these goals, the path of improvement that has been taken since the recognition of SBE as an NTD must be continued and benefits from a closer collaboration between policymakers, researchers and healthcare workers.

### CRedit authorship contribution statement

**Ymkje Stienstra:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ymkje Clevering:** Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Sanne Kokhuis:** Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation. **John H. Amuasi:** Writing – review & editing, Validation, Conceptualization. **Sara Padidar:** Writing – review & editing, Methodology, Conceptualization. **Janna M. Schurer:** Writing – review & editing, Methodology, Conceptualization. **Rhona Mijumbi:** Writing – review & editing, Methodology, Formal analysis. **Rachael Thomson:** Writing – review & editing, Methodology, Funding acquisition, Formal analysis, Conceptualization. **George O. Oluoch:** Writing – review & editing, Project administration, Methodology, Conceptualization. **Jean B. Mbonigaba:** Writing – review & editing, Methodology, Data curation, Conceptualization. **David G. Laloo:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

### Ethical statement

This protocol was reviewed and approved by the Liverpool School of Tropical Medicine Research Ethics Committee (reference: 21–068). All participating stakeholders provided electronic informed consent based on the information received on the objectives, importance and ethical provisions of the study. We carefully observed the privacy rights of participating stakeholders. The work is in accordance with the Code of Ethics of the World Medical Association.

### Funding

This research was funded by the Wellcome Trust (grant 227763/Z/23/Z), awarded to YS and DGL. The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. For the purpose of open access, the author has applied a CC BY public copyright license to any Author Accepted Manuscript version arising from this submission.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Acknowledgements

We thank Diogo Martins and George Phillips for their valuable

suggestions.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.toxicol.2025.108935>.

### Data availability

Data will be made available on request.

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