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How and why snakebite became a global health priority: a policy analysis

Soumyadeep Bhaumik ,[1,2] Anthony B Zwi,[3] Robyn Norton,[1,4] Jagnoor Jagnoor[1]

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[1]Injury Division, The George Institute for Global Health, Faculty of Medicine, UNSW, Sydney, New South Wales, Australia
[2]Meta-research and Evidence Synthesis Unit, The George Institute for Global Health, New Delhi, India
[3]School of Social Sciences, UNSW, Sydney, New South Wales, Australia
[4]The George Institute for Global Health, Imperial College, London, UK

Correspondence to
Dr Soumyadeep Bhaumik; sbhaumik@georgeinstitute.org.in

ABSTRACT

Background Snakebite was added to the WHO neglected tropical disease (NTD) list in 2017, followed by a World Health Assembly resolution in 2018, and an explicit global target being set to reduce the burden in 2019. We aimed to understand how and why snakebite became a global health priority.

Methods We conducted a policy case study, using in-depth interviews, and documents (peer-reviewed and grey literature) as data sources. We drew on Shiffman *et al*'s framework on global health network to guide the analysis.

Results We conducted 20 interviews and examined 91 documents. The prioritisation of snakebite occurred in four phases: pre-crescendo, crescendo, de-crescendo and re-crescendo. The core snakebite network consisted of academics, which expanded during the re-crescendo phase to include civil society organisations and state actors. The involvement of diverse stakeholders led to better understanding of WHO processes. The use of intersecting and layered issue framing, framing solutions around snake antivenoms, in a background of cross-cultural fascination and fear of snakes enabled prioritisation in the re-crescendo phase. Ebbs and flows in legitimacy of the network and reluctant acceptance of snakebite within the NTD community are challenges.

Conclusion Our analyses imply a fragile placement of snakebite in the global agenda. We identify two challenges, which needs to be overcome. The study highlights the need to review the WHO criteria for classifying diseases as NTD. We propose that future prioritisation analysis should consider identifying temporal patterns, as well as integrating legitimacy dimensions, as in our study.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Snakebite has attracted attention in the WHO: the World Health Assembly resolution on snakebite (71st World Health Assembly resolution) in 2018, followed by development of a global strategy in 2019, which sets an explicit global target to reduce snakebite burden by 50% by 2030.

WHAT THIS STUDY ADDS

⇒ We document and analyse the fluctuating priority accorded to snakebite in WHO over time and describe the pre-crescendo, crescendo, de-crescendo and re-crescendo pattern of prioritisation.
⇒ We identify ebbs and flows in establishing legitimacy of the snakebite network and reluctant acceptance of snakebite within the neglected tropical disease (NTD) community as unaddressed challenges.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Inclusion of wider base of proponents, with leadership from endemic nations, and reorienting investments towards community-based programmes and health systems strengthening, might enhance the legitimacy of network and promote acceptance of snakebite within the NTD community.
⇒ There is a need for revisiting the WHO criteria for designating an NTD, which reinforces existing biomedical discourse on conditions.
⇒ Future policy analyses on global health priorities should explicitly consider discerning temporal patterns (like the four crescendos, in our case) and incorporating the three intersecting but distinct (of issue, of actors and of network) aspects of legitimacy.

BACKGROUND

Snakebite is a global public health problem with high incidence in several countries. The WHO mentions that there are 81 000–138 000 000 global deaths due to snakebite, annually.[1] Most deaths occur in South Asia and Africa.[2–4] In 2017, the WHO added snakebite to its list of neglected tropical diseases (NTD).[5 6] This was followed by the 2018, 71st World Health Assembly (WHA) resolution (WHA 71.5) on snakebite, and the subsequent launch, in 2019, of the associated WHO strategy to halve its burden by 2030.[2 7–9]

This study aims to understand how and why snakebite became a global health priority, as witnessed by WHO enlistment as NTD, a resolution, and a strategy for addressing its burden. Understanding the process of prioritisation is important because WHO sets the normative boundaries within which global health actors act, and influences issue conceptualisation.[10 11] We conducted this study with a view of understanding the enablers and

barriers for sustained placement of snakebite on the global health agenda. The study is also of relevance to advocates of other neglected and emerging public health problems, seeking to find a place in the contested global health space.

METHODS

Study design and approach

We conducted a policy case-study[12] and employed the process-tracing (outcome-explaining) methodology.[13] Outcome-explaining process tracing is a case-centric approach, which aims to craft sufficient explanation of a historical process.[13] Broadly, we qualitatively analysed data from in-depth interviews of stakeholders and documents (summarised in figure 1). We used Shiffman *et al*'s framework on the emergence and effectiveness of global health networks (GHN)[14] for this purpose. The framework defines a GHN as a 'web of individuals and organisations linked by a shared concern to address a sizeable portion of the world's population'.[14] It identifies three categories of factors (issue characteristics; network and actor features and policy environment), which influence

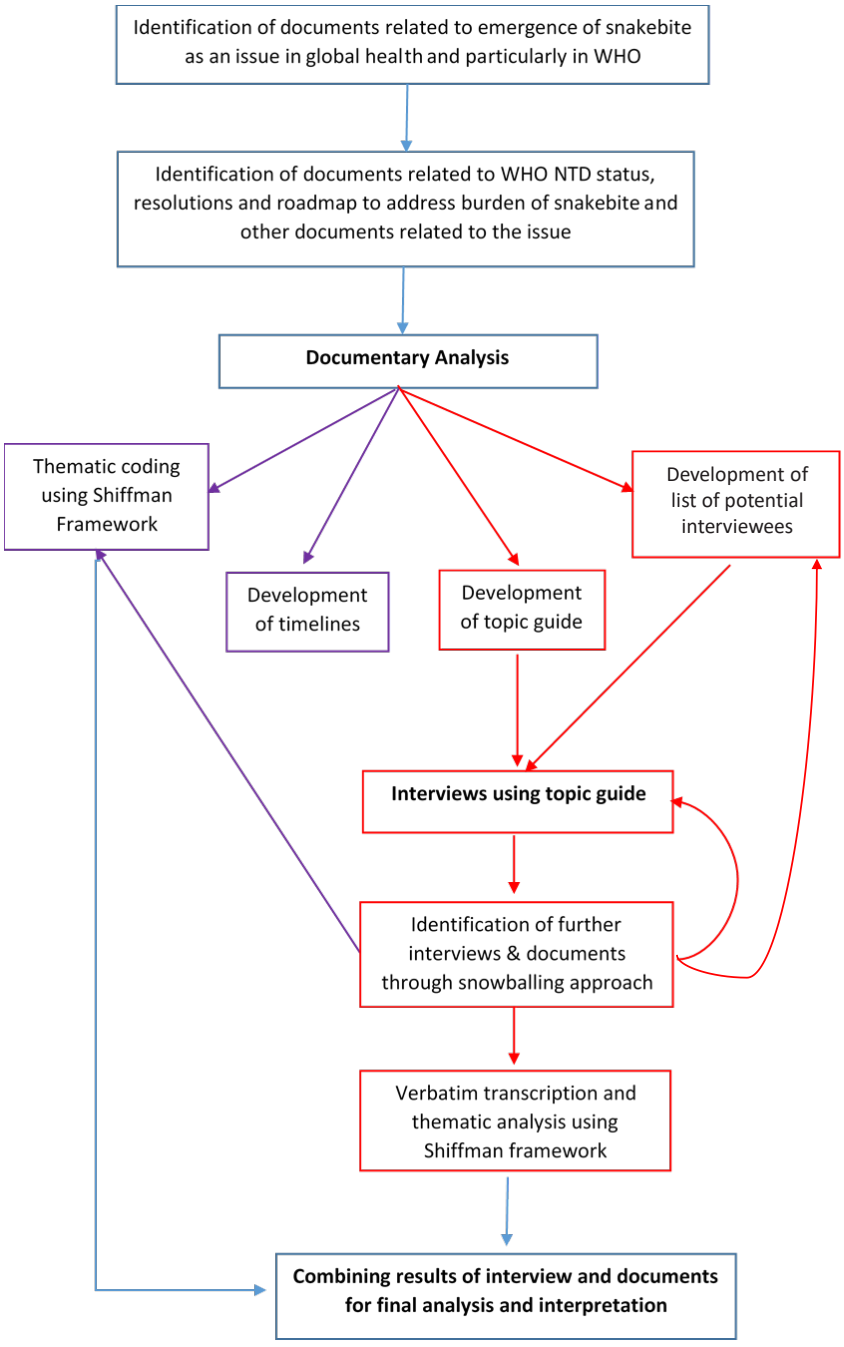

Figure 1 Schematic diagram showing methodological approach and study design. NTD, neglected tropical disease.

the emergence and effectiveness of GHNs. We drew on Shiffman's 2016 GHN framework,[14] based on our *a priori* knowledge that subsequent to the removal of snakebite from the WHO-NTD list (2015), a network of non-state actors was advocating for snakebite during 2015–2019, resulting in a WHA side-event, a WHA resolution and a WHO strategy on snakebite (2019).[2 9] Shiffman *et al*'s GHN framework is developed explicitly for this purpose, where a network influences prioritisation in the global health agenda. We set a temporal boundary of 2015–2019 but were flexible to accommodate earlier events and activities of relevance to our period of interest.

Data sources

We examined relevant documents and conducted in-depth interviews.

Document analysis

We searched for documents (reports, meeting notes, press releases, opinion pieces, academic articles, newsletters), which were issued/authored by WHO (headquarters, committees or divisions), governments, non-state actors and global health funders, related to the prioritisation of snakebite and/or were related to emergence or effectiveness of the network.

We searched electronic databases (PubMed and WHO-IRIS), and hand-searched websites of organisations identified as playing a role in the WHO prioritisation process. Details of the search strategy and websites searched are presented in online supplemental appendix 1. Additional, documents referred to, or provided by participants were also included.

In-depth interviews

In-depth interviews were conducted with key informants who met any one of the following criteria:

- WHO staff, representatives of member states, ministries who were involved in sponsoring WHO/WHA events or resolutions, in any capacity.
- Non-state actors involved in the WHO process, in any capacity.

We employed a purposive sampling strategy. Based on document review, we first sent interview requests to people who were involved in multiple aspects of prioritisation. We purposively invited key individuals to reflect diversity of roles, organisations and countries. As more information was obtained, or interview requests were declined (or not responded to), we continued inviting other key potential informants of interest. We also did snowball sampling. This was continued till saturation was reached. Out of the initial set of people we invited, and were thought to play a key role, we did not get interviews from four people (also see penultimate paragraph of discussion on study strengths and limitations). All interviews were conducted online in English by the lead investigator (SB) using a topic guide, which consisted of mapping questions, broad open-ended questions and specific probes. An iterative and inductive approach was adopted with the initial topic guide modified, as additional aspects and issues emerged. We drew on the evolving understanding of the issue from documents and other in-depth interviews, to add, remove or modify probes, thus customising questions for a particular participant. No fixed order of questioning was followed. We did not aim to resolve disagreements among different participants, but rather attempted to understand the diversity of views and the rationale for these differences.

Analysis

All interviews were transcribed. Where relevant, we sought clarifications by e-mail, postinterview. For large documents or documents where snakebite was only mentioned in a segment, we coded the relevant section or the executive summary. We sought to minimise bias by triangulating across multiple data sources and informants. Unless specifically mentioned (to be from a single source), all presented findings are triangulated. An iterative modality was used, with the lead researcher (SB) initially coding data based on Shiffman *et al*'s framework,[14] pausing, reflecting, discussing with other authors and making reflective notes, to ensure consistency and prevent bias. The process involved frequent cross-checking codes and (particularly with JJ) as well as discussions to reflect on interpretations. JJ reviewed transcripts and debriefing meetings were conducted. We also took particular care to identify codes, and aspects which did not fit into the framework.

Research team reflexivity

Our multinational, research team comprises of outsiders to the process studied and as such there was no positionality bias. The disciplinary background of team members includes medicine, international public health, social science, global development and injury research. All researchers have experience in qualitative research, including policy research and practice.

Patient and public involvement

Patients and members of the public were not involved in any aspect of the study.

RESULTS

Documents and in-depth interviews

We initially retrieved 924 documents, of which 91 were included in the final analysis (flowchart showing selection of articles and full list of documents included is available in online supplemental appendix 2). We also coded the documentary screened at the WHA side-event.[15]

We conducted in-depth interviews with 20 people, for an average duration of 65 min (36–104 min). One other person did not give an interview but provided multiple documents. Summary characteristics of the participants are presented in table 1.

Key findings: timeline of events

Though our study emphasis was on 2015–2019, we constructed a timeline of key events (figure 2) over a

Table 1 Summary characteristics of study participants

Country	► Snakebite endemic: 7 – Asia: 4 – South America: 1 – Africa: 1 – Oceania: 1 ► Snakebite non-endemic: 13 – United Kingdom and Europe: 9 – North America: 4
Gender	► Male:14 ► Female: 6
Constituency	► Academics: 11 ► Non-academics: 9
Affiliations	► NTD and other WHO departments (names redacted to prevent deductive disclosure): 3 ► *Funders: 2 ► *University/academic institutes (names redacted to prevent deductive disclosure) in four non-endemic nations and four endemic nations: 11 ► *Non-profits (names redacted to prevent deductive disclosure) endemic countries: 2 ► *Global advocacy and non-profit organisation: (civil society actors): 4 Some persons moved between organisations.

*Participated in key events, formally engaged held positions at Global Snakebite Initiative representative and/or played key role in WHO process (development of technical dossiers for WHO, WHA resolution, WHO strategy) or advocacy on the issue).
NTD, neglected tropical disease; WHA, World Health Assembly.

longer period to understand earlier events that may have influenced or affected those in our period of interest. A more detailed timeline of events is available in an online dashboard (link). We divide the entire process into four heuristic phases, based on landmark events (policy outcomes) in the WHO. We label these phases as 'four crescendos', which are:

- *Pre-crescendo phase* (prior to April 2009): events prior to snakebite being added as a NTD in the WHO-NTD list in April 2009.[6 16]
- *Crescendo phase* (April 2009–2013): from April 2009 to the 'demotion' of snakebite as a 'neglected condition' (from NTD) in 2013.[6 17]
- *De-crescendo phase* (2013 to mid-2015): from 2013 to being removed altogether from the WHO-NTD list.[6 17]
- *Re-crescendo phase* (mid-2015–May 2019): From mid-2015 to the WHO releasing the snakebite strategy. Key events in this phase were:
  - World Health Assembly side event: May 2016.[18 19]
  - Snakebite added to WHO-NTD list as a Category A NTD: June 2017.[6 20]
  - Adoption of WHA resolution: May 2018.[9]
  - Release of WHO strategy on snakebite: May 2019.[2]

Key findings: the how and why of prioritisation

The findings, drawing on the GHN framework,[14] within the four crescendos are summarised in table 2 and are detailed subsequently.

Issue characteristics

Affected groups

Snakebite primarily affects the rural people, those having low socioeconomic status and agricultural

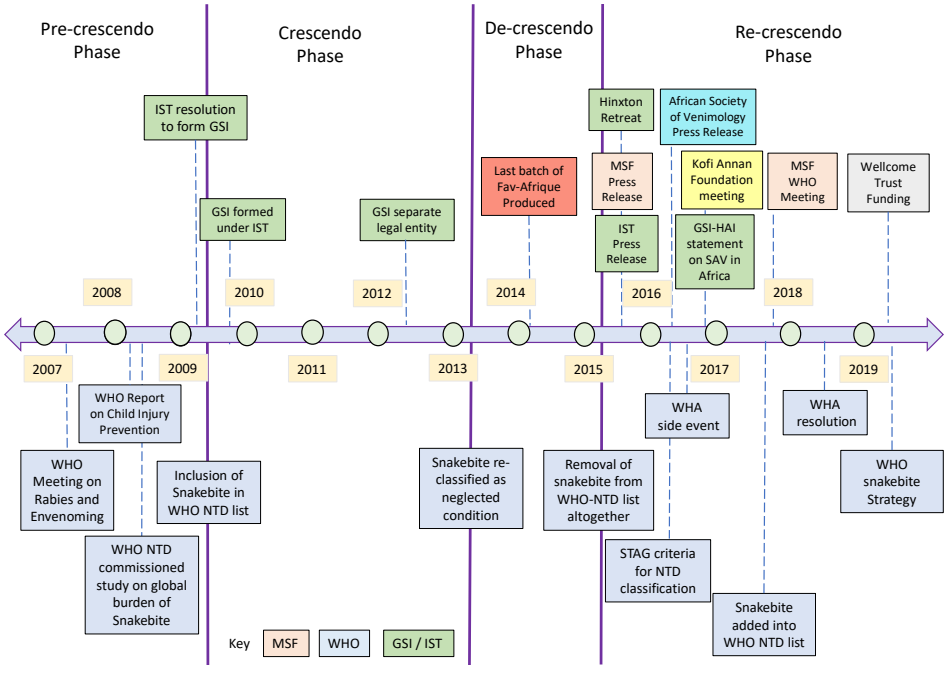

Figure 2 Key events in prioritisation of snakebite across four crescendos. GSI, Global Snakebite Initiative; HAI, Health Action International; IST, International Society of Toxinology; MSF, Médecins Sans Frontières; WHA, World Health Assembly; WHO-NTD, WHO neglected tropical disease.

Table 2 Summary of study results mapped in the four crescendos

Domains		Pre-crescendo (prior to April 2009)	Crescendo (April 2009 to 2013)	De-crescendo (2013 to mid-2015)	Re-crescendo (mid-2015 to May 2019)
Issue characteristics	Affected groups	Implicit understanding that snakebite affects those with low socio-economic status, including children			
	Severity of snakebite	Global burden estimates	No new global estimate		Burden data used consistently with acknowledgement of data gaps
	Unique issue characteristic	Cross-cultural fascination and fear of snakes			
	Tractability	Multi-faceted solution			Framing solutions primarily around research, production, and logistics of snake anti-venom
Network and actor features	Leadership and governance	Academics			Academics and leadership of MSF and HAI
	Network composition	Academics under aegis of International Society of Toxinology	Academics under aegis of International Society of Toxinology and Global Snakebite Initiative		Academics under IST and GSI, with civil society actors and state actors
	Framing strategies	-	Technification		Intersecting and layered framing (moralisation, securitisation and technification)
Policy environment	Acceptance within neglected tropical disease community	-	Concerned	Denied	Reluctant
	Legitimacy	Legitimacy of individual actors. Issue seen as legitimate.			Ebbs and flows in legitimacy of network intersecting with legitimacy of individual actors and legitimacy of issue.
	Funding	WHO-NTD Division	Commonwealth Serum Laboratory, and Norton Rose, Australia (pro-bono legal aid)	None	Wellcome Trust, Lillian Lincoln Foundation, Dutch Government, Hennecke Family Foundation & Kofi Annan Foundation.

GSI, Global Snakebite Initiative; HAI, Health Action International; IST, International Society of Toxinology; MSF, Médecins Sans Frontières; WHO-NTD, WHO neglected tropical disease.

workers.[4 18 20–25] Most snakebite deaths occur in South Asia and Africa.[4 26 27] Snakebite is also common in Indigenous people (including in some high income nations) and has been described as a condition, which has 'long been oppressive for Indigenous people'.[28] Snakebite was also recognised as an important cause of death in children.[29] Broadly, across all crescendo phases, there was an implicit understanding among stakeholders of the condition affecting those with low socio-economic status and an importance cause of death in children.

Severity of snakebite

In the pre-crescendo phase, researchers in Sri Lanka (commissioned by the WHO-NTD department) provided a global estimate of the burden of snakebite.[26] Participants believed that the evidence from this paper provided justification for addition of snakebite as an NTD in 2009.

> …at the time, the person who led the NTD program, I believe, identified that the burden (of snakebite) is needed to be better understood… pretty soon after the Kasturiratne paper came out, snakebite was included on the WHO NTD priority list…—IDI 017

Around the same time, the WHO Child Injury Report[29] noted 1 00 000–2 00 000 deaths and 400 000 amputations each year due to snakebite. The report used the relative, instead of the absolute burden in children. Data from this report were used by many actors in further advocacy.

There were no new global estimates available in the crescendo, de-crescendo or re-crescendo phases. The lack of availability of new burden data might have contributed to the decrescendo. This was overcome in the re-crescendo phase, by the members of snakebite network demonstrating consistency in the use of data on bites and deaths, with simultaneously acknowledgement of data gaps, including for disability and socioeconomic burden, due to the occurrence of snakebite in areas with weak health systems.

Fascination and fear of snakes

Multiple respondents highlighted that the cross-cultural association of snakes, be it fear or fascination, led to inherent recognition of the issue by stakeholders, media and the public alike. This was one key factor that remained constant across time.

> …in every culture, it's got this sort of sexual kind of you know, superpower…everybody understands the snake…So that was one of the best things about it is that you didn't have to explain what is the snake? … a lot of NTDs, like Mycetoma, no one had ever heard of it. Nobody knew what it was!—IDI 019.

Participants who spearheaded media and advocacy efforts acknowledged that a 'media-friendly campaign' was created through the strategic visual use of snakes, to garner attention on the issue.

Complexities in defining tractability

The multifaceted and complex nature of strategies required to address snakebite, and divergent viewpoints on it, led to challenges in defining tractability (quality of being easily dealt with). The recognition among stakeholders of the burden being primarily driven by social determinants, and the problems being common in areas with weak health systems, meant the need for multisectoral solutions. This added to snakebite being seen as not tractable.

> …living in remote, rural areas and the shortage of health staff, and the fact of health worker crisis in Africa; the fact that we have poor transport and communication systems, and, in some places, roads are impossible in rains—IDI 011.

In the re-crescendo phase, the network identified addressing issues around research, production and logistics of snake antivenom (referred to only as anti-venom in subsequent text) and improved clinical management as priority domains of action. Participants recognised that because snakebite affected those who had little ability to pay, there was no market incentive for investments in research or production of antivenoms. The issue is further complicated due to the fragmented nature of the antivenom market (it is relevant to only a specific geography), which restricts market size. Multiple participants identified framing tractability around antivenom, in the re-crescendo phase, as a factor, which helped push snakebite in the global agenda.

> Pushing the antivenom side, managed to get it onto the agenda at the WHO… was clearly the correct strategy to push it up higher, there were people that could push snakebite, uh, from the treatment side rather than from the prevention side—IDI 012.

Network and actor features

Leadership group, governance structures and clarity of roles

In the crescendo phase, a small group of academics took the lead in forming the Global Snakebite Initiative (GSI), as a special project under the aegis of the International Society of Toxinology (IST). During this time, the leadership engaged in deliberative communication through the IST newsletter (including on legal advice sought and funding considerations). Subsequently GSI became a separate legal entity from 2012 to gain more financial and operational autonomy.

As soon as snakebite was dropped from the WHO NTD list, it was the GSI and IST networks (same group of individuals), which sprang into action. The core inner group of this network initially comprised academics from Australia, Costa Rica and UK. In the re-crescendo phase expanded to include the leadership of Médecins Sans Frontières (MSF) and Health Action International (HAI), two well-respected international civil society organisations. Internally, there was clarity in roles: MSF leading media and public advocacy efforts, HAI leading policy advocacy with WHO and academics offering technical insights and evidence. The Permanent Delegation to the United Nations of Costa Rica acted as focal point for engaging with other state actors. This relationship with the Costa Rican government was fostered by a Costa Rican academic through the then Minister of Health of Costa Rica.

> The role of the diplomatic mission of Costa Rica was very important because they know how to present a document like that for an organization like the United Nations, because this it's not like a technical or scientific document. It's a diplomatic document…they invited representative of different embassies to attend a meeting where this document is presented, is discussed, and is modified—IDI 006.

Multiple participants identified a WHO-NTD division staffer, as an effective leader who championed snakebite within WHO.

> WHO does [have) a lot of people … I don't find very good managers and administrators, but it means that when you do find one who is, they stand out from the crowd. XXX [name redacted] is absolutely one of them … Every large organization you need the external facing people, but you'll also need the champions behind the scenes who go and make it work—IDI 020.

Network composition

In the crescendo and de-crescendo phases, the GSI-IST network evolved, but it was restricted primarily to academics and clinicians. When snakebite was removed from the WHO NTD list, the need for coalition-building by engaging with a more diverse set of actors was recognised by the core inner group of the network. An academic from UK and another from Costa Rica took the lead in organising the Hinxton Retreat[18] in 2015 (after removal of snakebite from WHO-NTD list altogether), to develop a strategy for a 'more globally coordinated, multifaceted approach' for snakebite.[18] Coalition building was achieved by involving non-academic organisations in the Hinxton retreat, which includes but is not limited to MSF, HAI, different WHO departments, The Lancet and the Wellcome Trust (which funded the meeting).

Academics in the snakebite network had the ability to advocate in high-impact journals.[5 18 30–32] As the snakebite network expanded to include a more diverse set of actors (MSF and HAI being the most prominent) during the re-crescendo phase, they could overcome some of their limitations. Involvement of HAI and MSF led to (1) understanding of the processes and motivations of WHO (recognition of state power and funding needs of WHO) and (2) identification of the need for media and advocacy efforts.

> We do what our states would like us to do. We don't just, you know, out of the blue sky just take out something

and put on our work plan. It has to come from our countries supported by other partners—IDI 008.

Snakebite was an NTD. But it was, removed from its status… this time there was really, an appetite to see a wider net of stakeholders, including civil society(organizations)—IDI 004 (quote edited for clarity).

HAI came aboard, and they took a lot of the policy work, … achieving the right steps in policy at WHO—IDI 009.

During the latter part of the re-crescendo phase, there was more engagement with state actors, and national level actors, but the core inner group remained constant. Involvement of countries in supporting WHO-related activities in the re-crescendo phase is detailed in online supplemental appendix 3. The involvement of Wellcome Trust and Kofi Annan and his foundation also crucial. There was wider stakeholder involvement from high-burden endemic nations during development of the WHO strategy of 2019.

Use of intersecting and layered framing strategies

Framing refers to the process by which proponents (and detractors) create and portray issues—reflecting the politics of assigning meaning and significance to public issue through social interactions.[33] During the crescendo and de-crescendo phase, the snakebite network predominantly used a technification frame (ie, depiction of an issue as one that can be detected and solved by experts through science and technology). During the re-crescendo phase, a dynamically evolving, intersecting and layered framing strategy, beyond technification, was used. Soon after snakebite was dropped from the WHO list in 2015, GSI-IST used a predominant moralisation frame: addressing snakebite as an ethical imperative. Fresh from the de-crescendo, the network's primary source of power was normative. Those affected by snakebite were framed as 'politically voiceless'.[2 34] GSI-IST claimed moral authority to counter social injustice, arising from their technical understanding and long-standing commitment on the issue as academics. The moralisation frame was supported by evidence on the burden of snakebite, relative to other NTDs, and was enabled through cross-cultural fear and fascination about snakes.

We humans and our primate cousins have an innate fear of snakes and other venomous animals—so our instinct is to run away. Unfortunately, this revulsion for snakes has clouded the judgement of Ministers, donors and WHO leadership to the point where they are ashamed to admit and do anything about the public health burden of snakebite—said Prof David Warrell. Co-President of IST Congress 2015 (extract from press release issued by IST)[35]

The powerlessness of those affected, also meant that support from state actors for the WHO resolutions was comparatively easier. Snakebite was seen as a non-political issue, unlike other global issues, which were often tied to interest group motivations.

MSF supplemented the framing of moralisation by intersecting it with a securitisation frame (depiction of an issue as a threat which needs emergency response). MSF brought the securitisation frame by putting a timeline for action. It brought forth the crisis that would emerge as the last batch Fav-Afrique, 'the only antivenom that has been proven safe and effective to treat envenoming from different types of snakes across Sub-Saharan Africa'[36] would expire in June 2016. Few participants felt that the source of power for MSF was due to its reputation as a humanitarian organisation with global media and advocacy capabilities; their power, at that time, was further enhanced through its important role in addressing Ebola and in critiquing WHO and advocating for a more strenuous response to Ebola outbreaks.[37]

The 'Minutes to Die'[38] documentary (produced by Lillian Lincoln Foundation) played a pivotal role in framing snakebite in moralisation and securitisation frames, to garner traction. A shorter version of the documentary[15] was shown in the WHA side event (2016), which had attendance from senior WHO leaders. The documentary used strong imagery and narratives to highlight the 'helpless' condition of people and communities affected by snakebite. During the re-crescendo phase, it was screened 114 times (first in May 2017), mostly in universities and conferences across the globe. One participant who attended the 2016 WHA side event was not overly positive about the documentary but still acknowledged its contribution to gaining traction.

…to be honest, it's, it's a bit of, um… development porn. It's, it's, you know, it's about, oh, these poor people being bitten, and then they haven't got anywhere to go… the film was, was dangerously exploitative…—IDI 001 (while talking about the value of advocacy and the role of the documentary in the process).

We could triangulate the comment of this participant (about 'white saviours' and 'development porn') through our coding of audio (narrator voice-over and some stakeholder interviews used language which evoke pity not empathy) and the imagery (eg, camera movements and depiction of communities affected by snakebite as helpless), in the version of the documentary version shown in the 2016 side event.[15]

Post the 2016 WHA side event, the network enhanced the use of technification. This was driven by the need to demonstrate the alignment of snakebite with the formal criteria of NTD, which the WHO STAG-NTD committee set for the first time in 2016, and to recognise solutions which were perceived to be feasible by more diverse stakeholders. The moralisation narrative was interweaved with the technification one, by mentioning that the broad process by which an antivenom is manufactured (involving injecting venom to a horse, 'bleeding' to acquire serum and develop

antivenom) had not changed over time, despite progress in biotechnology.

Policy environment

Ebbs and flows in legitimacy

Legitimacy (by what authority does one exert power) is known to be a challenge for GHNs.[39] We identified three distinct but intersecting dimensions of legitimacy: legitimacy of the issue, legitimacy of individual actors and legitimacy of the network.

In general, and throughout all phases, there was inherent recognition of snakebite as a legitimate public health problem due to its issue characteristics. Early documents of IST during the pre-crescendo phase (2009) mention that the formation of GSI was based on positive and informal discussions with key individuals from the medical toxinology field, primarily from non-endemic nations. This formed the inner core group of the snakebite network. There was universal recognition that individuals in the inner core were accomplished researchers who contributed their professional lives to the cause of snakebite-this legitimacy of individual actors persisted throughout the prioritisation process. The individual credibility and the efforts and action they undertook, translated to the legitimacy of the snakebite network and strengthened legitimacy of snakebite as an issue. However, in the re-crescendo phase and as snakebite gained traction in the global agenda, there was an ebb in the legitimacy of the power which network exerted. The leadership of the snakebite network was perceived by some to be lacking legitimate actors from high-burden nations, particularly from Africa. The moralisation and securitisation frame meant Africa was the focal point for advocacy, but stakeholders from this region were not engaged optimally. In May 2016, prior to the WHA side event, the African Society of Venimology (ASV) issued a press release titled 'African Experts, Ignored Again on Snakebite, Move Forward Alone'.[40] Such an event happened despite GSI having representation of an African expert in its leadership. The ASV was established in 2012, after a pan-African survey revealing its need,[28] making them legitimate actors with whom the WHO should have engaged extensively.

> Once again, with the notable exception of the 4th Conference in Dakar, in which the World Health Organization (WHO) was represented, international agencies, albeit invited, did not attend— minutes of 6th International Conference on Envenomation by Snakebites and Scorpion Stings in Africa organised by ASV[41]

The GSI in the IST newsletter mentioned the issue (arising from the ASV press release) as disappointing and called it an attempt to 'create controversy' which 'did not prevent the success'.[42] As a remedy they mentioned they would be 'engaging directly with all of the ASV members as we move forward'.[42] The ebb in legitimacy was overcome by such engagement and the parallel involvement of Kofi Annan (former secretary-general of the United Nations, and a Noble Laureate from Ghana). The involvement of Kofi Annan (and the Kofi Annan Foundation) enhanced legitimacy of snakebite as a global health issue and ensured support from state actors, particularly from Africa. Kofi Annan's interest on snakebite was based on its impact in Ghana, an issue brought to his personal attention by Akshay Rath,[34] a UN physician from India.

Despite the success of the network in getting snakebite in the global health agenda, multiple participants expressed concerns about the legitimacy of the snakebite network (lead by GSI and IST) exerted by framing solutions and consequent resourcing around antivenoms.

> Global Snakebite Initiative, scientists…its brilliant science, but these scientists and they're all men—just to say that again. They want to go to Africa and start injecting people with 'their antivenom'. So, they become service delivery and they know how to deliver their own antivenom and many are medical doctors, but they, they sort of in a very white saviour kind of way, they go striding into rural Kenya to deliver antivenom to the poor—IDI 001

Participants also mentioned that the WHA resolutions and strategy left out issues of concern to endemic nations, like intellectual property. The WHO strategy development in 2019 involved people from endemic nations as a part of the expert group. Despite that multiple participants perceived that the research interests of non-endemic nations were primarily driving the agenda of the development of the WHO strategy on snakebite.

> Many of the participants or associated researchers (were) from UK and other European countries had the focus little bit tilted towards Sub-Saharan Africa and Africa in general…there was no recognition (in terms of proportionate representation and relevance of agenda) that most of the burden is in South Asia—IDI 002.

One interview participant mentioned about the linguistic divide (between English-speaking and French-speaking researchers) as a factor preventing coalition. We could not triangulate this aspect (also see discussion).

Acceptance within the NTD community

In the pre-crescendo phase, there were two key WHO initiatives outside the NTD division:

- Meeting on 'Rabies and envenoming: a neglected public health issue'[43] in 2007 by the WHO Quality Assurance and Safety Cluster leading to the first WHO guidelines on quality control of antivenom.[44]
- Release of the 'World report on child injury prevention' in 2008 by the WHO Injury and Violence Prevention Department with a section on snakebite.[29]

Multiple participants believed that, in 2009, the then head of the WHO-NTD department was instrumental in the inclusion of snakebite in the WHO NTD list. However, other than the 2008 meeting minutes of the Strategic and Technical Advisory Group for NTD (STAG-NTD) (The STAG-NTD is the principal advisory group with respect to NTDs on WHO, with the mandate to advise on policies & strategies, which reports directly to the WHO Director

General), which mentions the need for understanding direct and indirect costs of 'NTDs including snake bites', there is no documented discussion on snakebite in the STAG-NTD in the crescendo or decrescendo phase. Participants believed that the 'demotion' and subsequent removal of snakebite from the WHO-NTD list was because snakebite was not a 'disease' nor was it amenable to elimination or eradication, unlike other diseases in the WHO-NTD list. To align with and enhance acceptance within the NTD community, the formal technical dossier (submitted by member states to the STAG-NTD) for inclusion in the WHO-NTD list was for snakebite envenoming (the clinical condition due to 'venoms of toxins in the bite of a venomous snake') rather than for snakebite.[4] Multiple participants believed that the WHO STAG-NTD developing a criteria and process for a disease condition to be designated as an NTD,[45] enabled the designation of snakebite envenoming in the WHO NTD list. However, despite the framing around snakebite envenoming, the STAG-NTD expressed concerns about its listing as an NTD. The STAG-NTD finally recommended that:

> It is unsure that the programmatic aspects of this (snakebite envenoming) would be best handled by the NTD Department. It was decided therefore to defer this decision to WHO's senior management… STAG also notes the following caveat: that any additional responsibilities associated with snakebite being included in the NTD portfolio should come with additional resources.

Despite the STAG-NTD recommendation, the then Director General, WHO, endorsed snakebite envenoming as a Category A NTD (a category A NTD meets all four criteria set by NTD-STAG: (1) disproportionately affects the poor causing significant morbidity and mortality, (2) endemic in tropical and subtropical areas, (3), amenable to broad control elimination or eradication and (4) research on it is relatively neglected. The categorisation implies commitment for large-scale programme by WHO-NTD department. A category B NTD meets any three of the four criteria and does not come with any explicit programme commitment from WHO-NTD department, leading to its inclusion in WHO-NTD list) in June 2017.

The acceptance of snakebite envenoming within the NTD community, however, continues to be a challenge. Even in the 2019 STAG-NTD meeting concerns were expressed about how the inclusion of snakebite envenoming 'opened the NTD categories to non-infectious diseases'.[46]

Funding

Participants who were part of the inner core of the network, mentioned that in the crescendo phase, they operated with an impression that the WHO-NTD status would ensure funding. In re-crescendo, the understanding of funding needs of WHO, led them to engage actively with funders and wider group of stakeholders. Support from Wellcome Trust was key to the success, and the relationship was fostered vide professional relationships with UK-based researchers in the inner core. Wellcome Trust's influence as a funder is not only due to having the largest funding portfolio on snakebite but also because of strategic engagement, to influence the 2019 snakebite strategy. Multiple participants stated that major funders for NTDs continue to be unconvinced of snakebite envenoming as an NTD despite the WHO categorisation.

> Gates Foundation has a huge portfolio in NTDs. Most of the NTDs that they've been focusing on are the ones… with an elimination/eradication target…new NTD like snakebite …it is potentially a bit less appealing—IDI 015.

A summary of the key funders in different crescendo phases is integrated within table 2.

Government agencies in USA (research arm of Department of Defence, Defence Advanced Research Projects Agency, National Science Foundation and National Institutes of Health) and UK (Department for International Development and National Institute for Health Research) have funded research on snakebite, but no explicit link of these agencies being directly involved in the WHO prioritisation process. However, these funding would have indirectly contributed to the process, being funders of key actors and leaders involved in the process.

DISCUSSION

The prioritisation of snakebite occurred in a crescendo, de-crescendo, re-crescendo manner. In the re-crescendo phase, it was enabled by a diverse network composition, better understanding of the processes and funding needs of WHO, recognition of the need for engaging the media and the use of intersecting and layered framing strategies. Involvement of Costa Rica and Kofi Annan was important to overcome ebbs in establishing legitimacy and to garner support from state actors. Funding and strategic engagement by the Wellcome Trust enabled prioritisation of snakebite and shaped the agenda within the WHO. Reluctant acceptance of snakebite within the NTD community is a barrier to its sustained placement on the global health agenda.

The success of getting snakebite in the global health agenda was on account of various factors, but largely driven by the core inner group of the snakebite network—individuals who were committed to the cause of snakebite and provided leadership to build a network and enabled by civil society actors—who were equally committed. However, the fluctuating pattern of prioritisation implies a fragile placement of snakebite in the global health agenda. Despite the successes of integrating snakebite in the agenda, the network faces a challenge in sustaining its legitimacy, particularly in endemic nations. This might be due to several factors. Recent calls for decolonising global health have increased awareness and recognition of the 'foreign gaze', epistemic injustice, power asymmetries in global health initiatives and the need for structural reforms in the global health ecosystem.[47–52] Data from the snakebite envenoming medicines database show that 11 of the 13 projects funded by Wellcome Trust, a

key global health funder for antivenom research, were awarded to research institutions in non-endemic nations (UK, Europe and USA).[53] Disproportionate allocation of material resources reinforces perceptions around legitimacy. The Wellcome Trust Program on snakebite is till 2026, and it is recommended that future funding decisions look into more long-term gains (eg, existing infrastructure, capacities and capability strengthening) and with different set of recipients in endemic nations. Research on fluctuating interest of other global health funders on snakebite is warranted.

The other issue of reluctant acceptance of snakebite within the NTD community has its roots, in what might be described as epistemic injustice.[52 54 55] The epistemic injustice is primarily due to the normative WHO establishes through its criteria for classifying a condition as an NTD.[45] Third, in the list of the four mandatory criteria for a category A listing (which implies 'large-scale action in the portfolio of the NTD department') is that a disease should be 'immediately amenable to broad control, elimination or eradication'.[45] This reinforces the existing biomedical discourse on snakebite,[56] with the necessity of defining tractability narrowly around anti-venoms. The issue around NTD definition (beyond snakebite), which arises from our analysis, merits establishment of an independent commission with adequate disciplinary and 'tropical' (ie, endemic, or high burden) country representation to revisit the existing criteria for NTD designation. Such a move will ensure justice for people affected by NTDs, like snakebite. There is also lack of internal consistency in the definition owing to the need for identified tools for control, eradication, elimination or broad control, as well as research on it being neglected.

While larger ecosystem changes in global health governance are complex and might be beyond the purview of the snakebite network, several strategic changes are possible to improve legitimacy in endemic nations and to promote acceptance within the NTD community. Our study shows that the snakebite network was able to gain state support from endemic nations through legitimacy of individual actors (reputation of researchers from endemic and non-endemic nations and involvement of Kofi Annan). Between 2019 and now, the issue of legitimacy of the WHO might have been significantly improved because of development of an expert group on snakebite, which has representation of wide section of stakeholders from endemic nations. Improving legitimacy further is relevant as the WHO strategy enters the implementation phase,[57] for which national-level plans will need to be developed and implemented. Action towards protection of intellectual property rights for endemic nations might be considered by the snakebite network to enhance their legitimacy. Advocacy efforts should be directed towards national governments, encouraging them to use Trade-Related Aspects of Intellectual Property Rights flexibilities of the World Trade Organisation to issue compulsory license (using the high public health impact clause) .[58–60] The Nagoya Protocol on Access and Benefit Sharing[61] provides guidance on using biological resources and intellectual property derived from them: emphasising the need to leverage sovereign rights and institute-appropriate domestic laws to prevent non-endemic entities from owning intellectual property is crucial. Emulating the MSF Access Campaign, which prioritises people over profits, can serve as an exemplar in advocating for affordable and accessible snakebite interventions. Global funders might consider funding research institutions in countries with highest burden of snakebite directly, to enable long-term structural changes.[48] It is worthwhile to note that the Wellcome Trust, through its large portfolio of investments, has largely taken care of one of the four pillars of the WHO strategy around treatments (antivenom). There is a need for more global health funders, national governments and partners to focus on prioritising investments on strengthening health systems and empowering communities for prevention and improved care-seeking aspects of the WHO strategy.[57] We recommend existing global health funders to be reflexive about epistemic injustice, and commission independent evaluations of their funding portfolios to ensure that the scope of their programmes is not mirroring epistemic injustice set by norm-setting organisations and institutions. Ensuring that actors from endemic nations are leading snakebite initiatives might enhance legitimacy and enable inclusion of a wider base of proponents. The use of One Health as a framework for understanding and addressing snakebite might also be considered: it has successfully attracted large multicountry collaborative funding.[62 63] The joint action plan of WHO, Food and Agriculture Organization of the United Nations, World Organisation for Animal Health & United Nations Environment Program identifies snakebite as an area of work in 2022–2026.[64] The WHO, and other proponents of snakebite, might commission focused policy analysis to identify entry points for snakebite within the NTD and One Health community. The WHO might also consider developing regional status reports as has been done in drowning, another condition is recently prioritised globally.[65 66] Such reports not only stimulate action, and allow for monitoring but also creates space for dialogue.

One aspect of snakebite prioritisation was the successful use of a documentary to frame and garner traction on the issue in WHA, and beyond. However, the pitfalls of such sensitisation were also noted in our study. Similar strategies might be used for agenda setting, but they should adhere to recent guidelines on the use of imagery in global health (which were not available during that time) to ensure respect for affected people, and avoid content that is insensitive, misrepresentative or leading to stigmatisation and stereotyping.[67]

Though we did not aim to develop theory, our study identifies some areas which might be explored in future policy analysis studies and theory-driven work on GHNs. While dynamicity is key, and it is understood to be part of any policy analysis, temporal variations should be more formally integrated in the GHN framework to enable

Table 3 Summary of contributions of the study to knowledge gaps on global health networks identified by Shiffman *et al* earlier[71]

Domains of future research questions on GHN	Contribution of the current study
Global agenda setting	Our study demonstrates network effectiveness in the absence of objective robust data on burden and tractability through effective use of framing strategies, good leadership, clarity in actor roles and involvement of states. As such it adds to the growing literature that the role of GHNs extends beyond producing knowledge (evidence) but also linking knowledge with normative claims, particularly by adding a moral element.
National efforts	Our study identified that owing to the structure of WHO, state actors, continue to hold considerable power in global agenda setting. However, GHNs can influence states. Our study, however, could not discern if this was on account of principled stand (because of moral principles that snakebite as a neglected disease should be addressed) by state actors, or because of material imperatives (because of the perception that snakebite is a non-political issue and it enhances diplomatic relations with other states, which can be suitably used for pursuing other material objectives).
Framework generalisability	In our study, the categories from the GHN framework were broadly useful. We suggest conduct of theory-driven work to enhance generalisability of the GHN framework, to consider: ► integrating discerning of temporality patterns, explicitly, such as 'four crescendos' in our case. ► integrating legitimacy in policy environment domain of framework. ► adding unique issue characteristic, related to characteristics and/or cultural aspects of organism involved in disease condition (and/or its interaction with humans and the environment).
Legitimacy	Our study notes three dimensions of legitimacy—legitimacy of individual actors, legitimacy of the power which the network and legitimacy of the issue. The three, though distinct, intersect with each other. Perceptions on legitimacy of power were related to not only network composition and leadership but also effects framing strategies and tractability narratives.

GHN, global health network.

more robust, rather than intuitive analysis. Discerning patterns of temporality, such as the 'four crescendos' we detected in our study, should be explicitly considered in future studies and integrated within analytical frameworks. Theory-driven work to revise the GHN framework might consider explicitly integrating legitimacy within the policy environment domain. It is recognised that global health actors use cultural, social, financial and symbolic capital(legitimacy) to not only advance ideas but also secure power.[68–70] With the recognition that global health being a field of power relations,[68] legitimacy is an important aspect to analyse, and perhaps more broad and useful than allies and opponents in the current framework. Contributions of our study to knowledge gaps with respect to research questions, earlier identified by Shiffman *et al* are summarised in table 3.[71]

The results of our analysis should be viewed considering its strengths and weakness. Our study strength lies in the use of in-depth interviews and the vast amount of documentary data. The smaller number of participants from endemic nations are reflective of the policy process where they were in minority, except in the terminal stage of WHO strategy development in 2019. We did not get interviews from many people we invited. Overall, out of the refusals (or no response), we consider four people being those who played a significant role in the process. Our extensive documentary analysis (together with information from other interviews) meant we could fill all, but two gaps, in our understanding of the prioritisation process. We acknowledge them as limitations. The gaps pertain to interest of state actors and information pertaining to specific events in the pre-crescendo and de-crescendo phase. We could not access documents or get interviews from any state actors. One key informant thought that the motivation for Costa Rica to lead a WHA resolution was to enhance its diplomatic stature globally, while another thought it was largely due to its commercial interest (public universities in Costa Rica are involved in antivenom manufacturing)—neither of which, we could triangulate. Similarly, the motivations for the Dutch government to fund advocacy for a disease not endemic in their own nation are not clear. We do not know why states supported or dropped out from different WHA-related activities (online supplemental appendix

3). We acknowledge that the lack of information on state actors and how international relation between different member states, affected agenda setting, is a weakness. Such a scenario is common in similar case studies.[66] We also acknowledge gaps in the understanding of the inner machinations of WHO during the initial listing, demotion and removal of snakebite in the NTD list. This was because of no documentation about it in the NTD-STAG meetings (we do not know whether it was not discussed at all or not documented in minutes) and because we did not get enough interviews from people involved in the pre-crescendo, crescendo and decrescendo phase. The small number of interviewees from high-burden endemic nations, reflects proportionately less involvement in global prioritisation process. The issue of linguistic divide hampering coalition building in advocacy and science needs further investigation. Research commissioned by the Wellcome Trust in 2021 found that language as a key equity issue, hampering African health research. It also notes that language intersects with the legacy of colonialism.[72] We recommend future research to specifically investigate lingo-cultural divide in global health.

The research team, being outsiders in the process, have no positionality bias. However, we cannot rule out social desirability bias from participants. Many participants were pleased to be part of the study which looked at the process 'historically'. The desire to be part of history might have led participants to overstate their own role and contributions. We mitigated against this by triangulating data from multiple sources.

CONCLUSION

Our analysis implies a fragile placement of the issue of snakebite on the global policy agenda. Implementation of the WHO strategy to achieve 2030 targets would be dependent on how successfully the snakebite network enhances legitimacy and promotes its acceptance within the NTD community. The study also merits revisiting the WHO criteria for designation as an NTD, which reinforces biomedical discourse on diseases. We suggest that future analysis of prioritisation considers discerning temporal patterns (like the four crescendos, in our case), and incorporate three intersecting but distinct dimensions of legitimacy.

Twitter Soumyadeep Bhaumik @DrSoumyadeepB and Anthony B Zwi @HEARDatUNSW

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ORCID iD

Soumyadeep Bhaumik http://orcid.org/0000-0001-9579-4453

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