**Editorial Title:** Outlining progress since the 1st International Snakebite Awareness Day, and some key challenges for next year

**Authors:** RA Harrison1 and DJ Williams2

1 Centre for Snakebite Research & Interventions, Liverpool School of Tropical Medicine, Liverpool L3 5QA, UK

2 Australia Venom Research Unit, University of Melbourne, Australia

**Editorial:**

The Royal Society of Tropical Medicine and Hygiene instituted the 19th September International Snakebite Awareness Day in 2018 as an advocacy platform to raise awareness of the global medical and socioeconomic burden posed by snakebite. There has been significant progress in this domain in the past year:

1. The World Health Organisation launched its strategy to halve the global mortality (83-138,000 deaths pa) and morbidity (400,000 disabilities pa) of snakebite by 20301,2. The strategy comprises four primary objectives (see box), each with immediate, short term and long term objectives and funding requirements. The strategy clarifies that achieving this ambitious target requires the engagement, support and investment of key stakeholders, ranging from affected communities and civil society groups, antivenom manufacturers, science groups and their funding bodies to Tropical Governments and International Health Agencies. The WHO is best placed to establish the framework needed to coordinate these varied activities and harmonise their outputs.
2. As a direct consequence of the WHO’s strategy, a number of Tropical Country Governments have already assigned snakebite as the responsibility of the Ministry of Health (MoH) Neglected Tropical Disease (NTD) Departments. For example, The Kenya MoH NTD Department is currently tasking each county to report all hospital admissions of snakebite patients, and has established a National Snakebite Taskforce to (i) collate, analyse and report that data to central government and (ii) identify gaps and design evidence-based interventions to reduce mortality and morbidity. Several African Governments (eg, Burkina Faso, Cameroon, Ghana) have adopted the model used by many Latin American and Asian governments to supply antivenoms at minimal cost to patients – high treatment costs ($50-1,500) is a common cause of victims not seeking hospital care.
3. Coincident with WHO’s Strategy launch, Wellcome announced3 its 7 year, £80m investment in snakebite research. While we await details of this largest-ever research investment in snakebite, it’s clear that it represents a transformation of a domain that had suffered decades of research neglect. Wellcome’s investment has been designed so that the research outputs align with WHO’s strategic objectives. It can be anticipated that it will galvanise investment from other agencies with like-minded tropical disease-amelioration philosophies. This will be necessary to deliver WHO’s stated ambitions.
4. This is already happening - with investment from bodies new to the snakebite domain. Thus, the seven figure support by the Hamish Ogston Foundation for clinical research in several Asian countries represents the first private/philanthropic investment in snakebite research. Furthermore, the UK Government Department for International Development announced its 3 year, £9.6m support for the Scientific Research Partnership for Neglected Tropical Snakebite, a Product Development Partnership of several USA, UK, India, Nigeria and Kenya research groups dedicated to the design, development, efficacy-testing and delivery of monoclonal antibody-based Next Generation of Snakebite Therapies4. These snakebite funding initiatives join that of the recent German, Swiss and Danish Governments and the European Research Commission. These, together with the Africa-centric focus on clinical and public health research funded by Médecins Sans Frontières5] and the UK Government National Institutes of Health Research6, and explain the prevailing optimism that WHO’s strategic objectives can be achieved.

Notwithstanding these recent, highly encouraging developments, the scale of the global challenge must not however be underestimated, nor the need for further investment be ignored. The paucity of effective, affordable antivenoms to treat snakebite in the majority of the most affected tropical countries spotlights the urgent need to (i) preclinically and clinically identify effective products and (ii) establish a more fiscally-secure environment for their sustained manufacture. Their delivery to the most at risk populations will require transformed logistic and health systems in these countries.

There exists understandable enthusiasm within tropical national and private concerns for in-country antivenom manufacture to address this problem. The political and health gains of local antivenom manufacturing need to be carefully balanced against the fiscal risk, and be informed by the (i) history of market failure of some of Africa’s most effective products7 and (ii) prevailing fragile demand for these medicines. Perhaps it might be prudent for interested national agencies to first consider forming Public Private Partnerships with reputable antivenom manufacturers (informed by WHO’s antivenom pre-qualification programme) to establish in-country Good Manufacturing Practice-compliant bottling facilities. These would import antivenom immunoglobulin in bulk and output vials of antivenom for local delivery over a 2-3 year pilot period. This would enable Governments to assess demand and make evidence-informed, cost-benefit assessments of the fiscal and logistic costs against the medical benefits BEFORE multi-million pound investments (circa £6-8m) are made in full antivenom-manufacturing facilities. This staged approach to in-country antivenom supply will reduce the risk of failure, which would bring severe and lasting political and fiscal reputational risks to all the individuals and agencies involved.

There is also a need for governments in snakebite-endemic countries, and international donor agencies, to recognise the health benefits of investing in in-country facilities capable of (i) pre-clinical testing of antivenom efficacy to ensure that only effective products are approved for human use and (ii) undertaking clinical trials (or minimally more affordable but necessarily robust clinical observation studies) of existing and new treatments. This new capacity building investment will, for example, address the fact that we have very little evidence that the antivenoms currently used in Africa are in fact effective8. We already know that some antivenoms in Africa are alarming ineffective9,10.

In conclusion, we hope we have described the many, transformative changes leading to realistic optimism that WHO’s strategic plan is achievable, and that these need to be balanced with an honest assessment of the many fiscal, medicinal, logistic and research challenges that lie ahead. We sincerely hope being able to report a continued upward trajectory of the global activity to reduce the disease burden of snakebite for the 2nd anniversary of the International Snakebite Awareness Day in 2020.

**References:**

1 World Health Organization (2019) “WHO launches global strategy for prevention and control of snakebite envenoming”. <https://www.who.int/news-room/detail/23-05-2019-who-launches-global-strategy-for-prevention-and-control-of-snanebite-envenoming>. Accessed 30 July 2019.

2 Williams DJ, Faiz MA, Abela-Ridder B, Ainsworth S, Bulfone TC, Nickerson AD, et al. (2019) Strategy for a globally coordinated response to a priority neglected tropical disease: Snakebite envenoming. PLoS Negl Trop Dis 13(2): e0007059. https://doi.org/10.1371/journal. pntd.0007059

3 Wellcome Trust. (2019) “Snakebites – it’s time to solve the world’s biggest hidden health crisis” <https://wellcome.ac.uk/press-release/snakebites-–-its-time-solve-worlds-biggest-hidden-health-crisis>. Accessed 30 July 2019.

4 see reports published by the Guardian https://www.theguardian.com/global-development/2019/may/24/scientists-pursue-universal-snakebite-cure-using-hiv-antibody- techniques and Telegraph <https://www.telegraph.co.uk/news/snakebite-and-antivenom/> newspapers – both accessed 02/08/2019

5 Médecins Sans Frontières <https://www.msf.org/first-ten-minutes-are-critical-treating-snakebite-ethiopia> Accessed 02/08/2019

6 Liverpool School of Tropical Medicine <https://www.lstmed.ac.uk/the-centre-for-snakebite-research-interventions> Accessed 02/08/2019

7 Citation: Harrison RA, Oluoch GO, Ainsworth S, Alsolaiss J, Bolton F, Arias A-S, et al. (2017) Preclinical antivenom-efficacy testing reveals potentially disturbing deficiencies of snakebite treatment capability in East Africa. PLoS Negl Trop Dis 11(10): e0005969. https://doi.org/10.1371/ journal.pntd.0005969

8 Potet J, Smith J, McIver L (2019) Reviewing evidence of the clinical effectiveness of commercially available antivenoms in sub-Saharan Africa identifies the need for a multi-centre, multiantivenom clinical trial. PLoS Negl Trop Dis 13(6): e0007551. https://doi.org/10.1371/journal. pntd.0007551

9 Visser LE., Kyei-Faried S., Belcher DW., et al. (2008), Failure of a new antivenom to treat Echis ocellatus snake bite in rural Ghana: the importance of quality surveillance. Transactions of the Royal Society of Tropical Medicine and Hygiene. Vol. 102 (5): 445–50. https://doi.org/10.1016/j.trstmh.2007.11.006 PMID: 18190937

10 Alirol E., Lechevalier P., Zamatto F., et al. (2015), Antivenoms for snakebite envenoming: what is in the research pipeline? PLoS Neglected Tropical Diseases. Vol. 9 (9): e0003896. https://doi.org/10.1371/ journal.pntd.0003896 PMID: 26355744

Box: The key elements and costs of the World Health Organisation strategy to halve the global mortality and morbidity of snakebite by 2030 (see <https://apps.who.int/iris/bitstream/handle/10665/324838/9789241515641-eng.pdf?ua=1>for full details)

