Snakebite remains a major public health challenge in many parts of rural Africa, Asia and South America.\textsuperscript{1} Available estimates suggest that there are about 94,000 deaths across the world annually due to snakebites;\textsuperscript{2} a conservative estimate as many deaths in low and middle-income countries are not reported.\textsuperscript{3} The burden on health systems due to snakebite is much higher than what is indicated by the mortality, because even non-venomous snakebite victims visit healthcare facilities for assessment and the morbidity due to snakebite has been scarcely documented.\textsuperscript{4} The social and economic consequences of snakebite are known to be high in communities with high prevalence.\textsuperscript{5,7}

Despite its consequences, snakebite has largely been neglected in global health. The WHO readded snakebite to the list of neglected tropical diseases in 2017—potentially implying more attention and funding for disease control programmes and treatment access initiatives.\textsuperscript{9} Such initiatives and programme planning are informed by recommendations in practice guidelines. WHO guidelines are highly influential in South Asia, South-East Asia and sub-Saharan Africa (countries with high burden of snakebite) where the lack of in-country capacity for guideline development means WHO guidelines are used as it is or are being adapted.\textsuperscript{9}

It is, therefore, essential to evaluate the quality of WHO guidelines on snakebite. We identified the latest version of the WHO South East Asia Regional Office (SEARO) guideline (2016)\textsuperscript{10} and the WHO Africa Regional Office (AFRO) guideline (2010) by searching the WHO website.\textsuperscript{11} Three authors independently appraised the quality of these guidelines using the Appraisal of Guidelines, Research and Evaluation (AGREE) II, a validated tool for assessing quality of guidelines\textsuperscript{12} via the online data management system available in the AGREE TRUST website (http://www.agreetrust.org/) which blinds the appraisers from each other. The AGREE II has 23 items categorised into six domains and two overall assessment items and is widely used for assessing the quality of guidelines including by the WHO.\textsuperscript{13}

The quality scores for overall and several key domains of both the WHO guidelines were low (table 1). Scores in the stakeholder development domain were poor (52% for the WHO-SEARO 2016 guideline and 31% for the WHO-AFRO 2010 guideline) due to non-involvement of all categories of health workers, snakebite survivors and their carers in guideline panels. The domain of rigour of development got the lowest scores (15% for the WHO-SEARO 2016 guideline and 16% for the WHO-AFRO 2010 guideline) as the guidelines were not based on systematic search, appraisal and grading of evidence. While the WHO-SEARO 2016 guideline has mentioned levels of evidence, these are based on study designs (with no consideration of quality of evidence), with most recommendations are expert opinions. Information on the methodology for formulation of recommendations was also not reported in either of the guidelines. Lack of explicitly reported conflict of interests meant scores in the domain for editorial independence were also poor, and industry representatives were involved in the guideline development process. For the domains of scope and purpose, clarity of presentation and applicability the WHO-SEARO 2016 guideline had better scores than the WHO-AFRO 2010 guideline; however, the scores in both the guidelines...
were in the moderate range. Overall, both guidelines were rated poorly.

About a decade ago, the WHO initiated a mechanism to oversee quality assurance through the formation of the Guideline Review Committee in response to public outcry over guidelines being based on expert opinion. These changes have led to improvements in guideline quality. However, it appears that these mechanisms are not being implemented or are being bypassed for snakebite guidelines as recently as 2016. We therefore call on the WHO to strictly implement its own policies for guideline development on snakebite envenoming. Guidelines provide the crucial pivot for action to decrease mortality and morbidity and we call upon the WHO to ensure development of evidence-based snakebite guidelines, involving representative of categories of healthcare workers and snakebite survivors in a transparent manner as is being done for other diseases.

**Contributors** SB conceptualised the study and searched for guidelines and wrote the first draft of the manuscript. All authors conducted AGREE II appraisals. ZL and SB conceptualised the study and searched for guidelines and wrote the final version.

**Disclaimer** Opinions expressed are those of the authors and not necessarily of their employing organisations.

**Competing interests** SB and ZL have conducted systematic reviews for informing WHO guidelines for other diseases.

**Patient consent** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Open Access** This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

© Author(s) (or their employer(s) unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

**REFERENCES**

1. Williams DJ. Snake bite: a global failure to act costs thousands of lives each year. *BMJ* 2015;351:h5378.
2. Kasturiratne A, Wickremasinghe AR, de Silva N, et al. The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Med* 2008;5:e218.
3. Bhaumik S, Snakebite: a forgotten problem. *BMJ* 2013;346:f628.
4. Gutierrez JM, Burnouf T, Harrison RA, et al. A call for incorporating social research in the global struggle against snakebite. *PLoS Negl Trop Dis* 2015;9:e0003980.
5. Hasan SM, Basher A, Molla AA, et al. The impact of snake bite on household economy in Bangladesh. *Trop Doc* 2012;42:41–3.
6. Vaiyapuri S, Vaiyapuri R, Ashokan R, et al. Snakebite and its socio-economic impact on the rural population of Tamil Nadu, India. *PLoS One* 2013;8:e80090.
7. Kularatne AM, Silva A, Maduwage K, et al. Victims’ response to snakebite and socio-epidemiological factors of 1018 snakebites in a tertiary care hospital in Sri Lanka. *Wilderness Environ Med* 2014;25:35–40.
8. Gulland A. Sixty seconds on … snakebite. *BMJ* 2017;357:j3065.
9. Bhaumik S. Use of evidence for clinical practice guideline development. *Trop Parasitol* 2017;7:65–71.
10. WHO. Guidelines for the management of snake-bites, second edition: World Health Organization, Regional Office for South-East Asia: New Delhi 2016. http://apps.who.int/iris/bitstream/handle/10665/258609/9789241565316-eng.pdf?ua=1 (accessed on 30th Dec 2017).
11. WHO Regional Office for Africa. Guidelines for the prevention and clinical management of snakebite in Africa: Mauritius 2010. http://apps.who.int/iris/bitstream/handle/10665/71810en/71810en.pdf?ua=1 (accessed on 30th Dec 2017).
12. Brouwers MC, Kho ME, Browman GP, et al. Development of the AGREE II, part 2: assessment of validity of items and tools to support application. *CA MAU* 2010;182:E472–8.
13. WHO. WHO handbook for guideline development. Geneva: World Health Organization, 2014.
14. Oxman AD, Davis DE, Freeth AM, et al. Use of evidence in WHO recommendations. *Lancet* 2007;369:1883–9.
15. Sinclair D, Isba R, Kredo T, et al. World Health Organization guideline development: an evaluation. *PLoS One* 2013;8:e63715.

---

**Table 1** Quality of WHO guidelines on snakebite using AGREE II

| Guideline | Domain 1 | Domain 2 | Domain 3 | Domain 4 | Domain 5 | Domain 6 |
|-----------|----------|----------|----------|----------|----------|----------|
|           | Scope and purpose (items 1–3) | Stakeholder involvement (items 4–6) | Rigour of development (items 7–14) | Clarity of presentation (items 15–17) | Applicability (items 18–21) | Editorial independence (items 22–23) | Overall assessment 1 | Overall assessment 2 |
| Guidelines for the management of snakebites, second edition, 2016 | 67% | 52% | 15% | 70% | 65% | 3% | 44% | Yes—0; Yes with modifications—3; No—0 |
| Guidelines for the prevention and clinical management of snakebite in Africa, 2010 | 54% | 31% | 16% | 50% | 29% | 22% | 33% | Yes—0; Yes with modifications—0; No—3 |

Each of the 23 AGREE II items within each of the six domains and the quantitative overall assessment item are rated on a 7-point Likert scale (from 1—strongly disagree to 7—strongly agree). The standardised domain quality score is calculated by summing up the scores of all appraisers and standardising by scaling the total as a percentage of the maximum possible score for that domain. The scaled domain score was calculated as: [(sum of obtained score − minimum possible score) / (maximum possible score − minimum possible score)]×100. The quantitative overall assessment item, which provides the rating of the overall quality of the guideline, is not an aggregate of individual domain scores but an independent item. The qualitative overall assessment item requires the appraiser to judge—whether the guideline might be recommended for use as it is, with modifications or not recommended for use. More details about AGREE II are available at: www.agreetrust.org. AGREE, Appraisal of Guidelines, Research and Evaluation.