Assessing the burden of snakebite in Nepal applying a One Health approach

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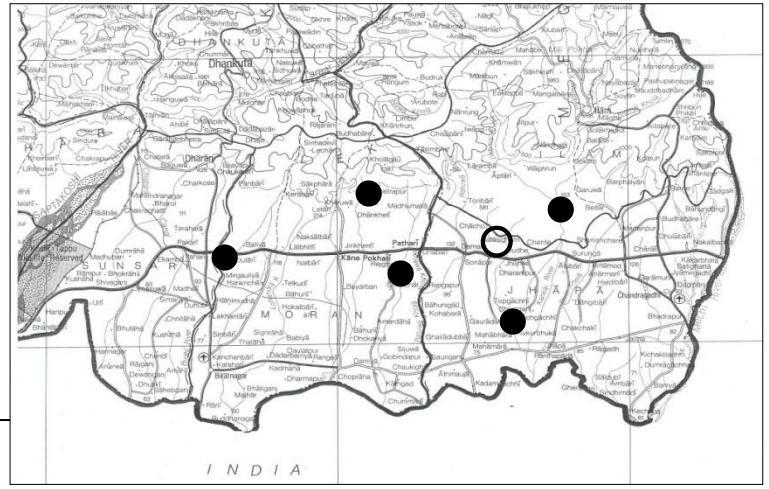
Snakebite affects the disavantaged people in the world

- **Economically disadvantaged rural communities (farmers, cattle herders agricultural workers etc.)**

- **SBE also impacts the health of livestock animals on which rural people depend upon**

Source: Shutterstock

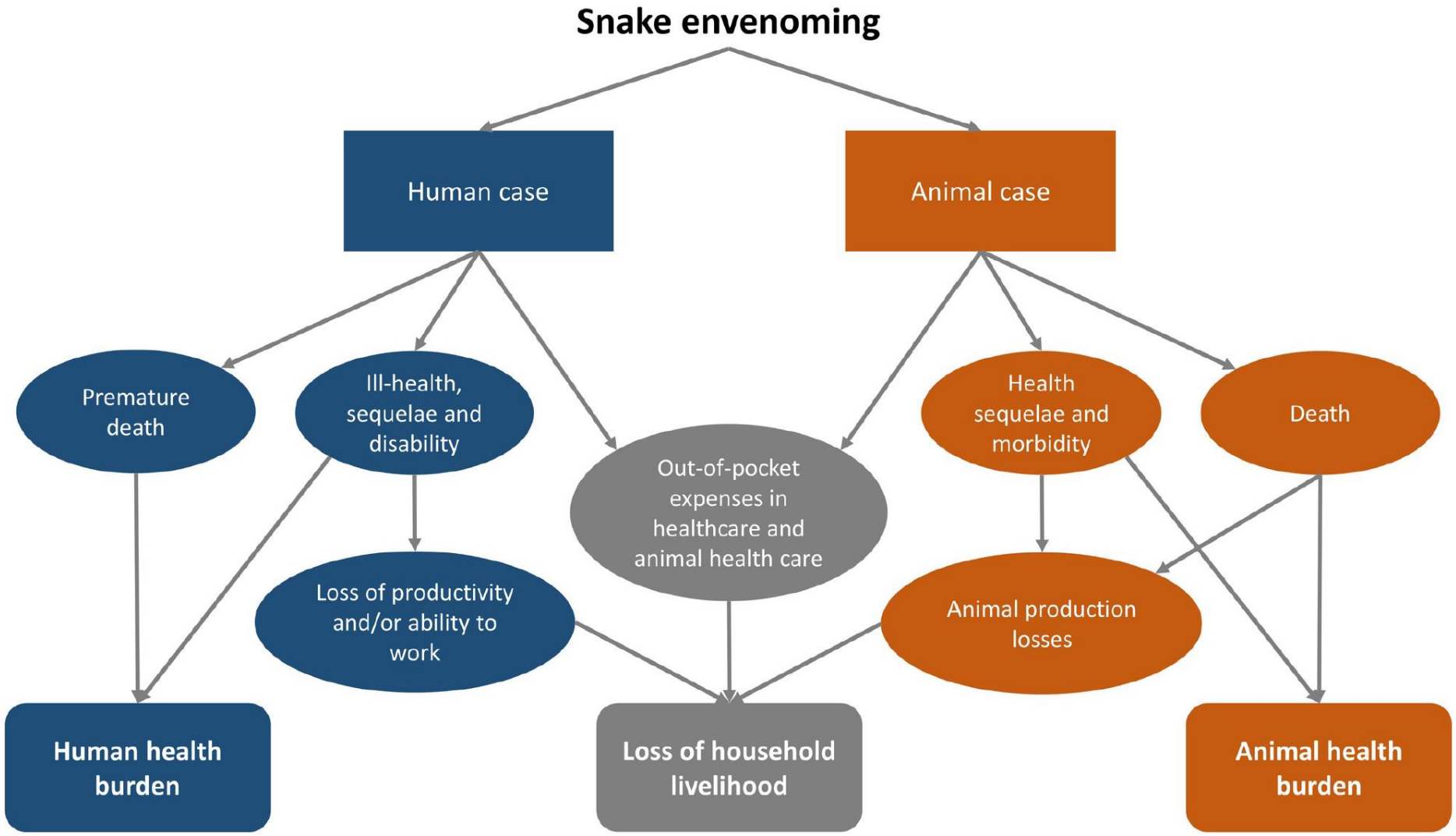
Pre-existing data



- Annual incidence = 1’162/100’000
- Annual mortality = 162/100’000 (CFR: 14%)
- **Location of deaths**: village (40%), transport (40%), hospital (20%)
- Risk factors for death:
  - ↑: consultation at traditional healer, transport impossible
  - ↓: treatment with antivenom, transport by motorcycle

Sharma et al. *Am J Trop Med Hyg* 2004; 71(2): 234-8

One Health approach to the socio-economic impact of snakebite



Babo Martins et al. *PLoS Negl Trop Dis* 2019; 13(9): e0007608

Assessing the Burden of Snakebite in Nepal Applying a One Health Approach

- The Snake-byte project -

- Nepal: **Sanjib Kumar Sharma**, Anup Ghimire Bhupendra Shah, Manish Subedi, Mamit Rai.
- Geneva: Gabriel Alcoba, Rafael Ruiz de Castaneda, Isabelle Bolon, Carlos Ochoa, Sara Babo Martins, Nicolas Ray & François Chappuis

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BP Koirala Institute of Health Sciences, Nepal

Swiss National Science Foundation

Objectives of the Snake-byte project

Primary

Measuring the impact of snakebite by analyzing individual **human and animal health** (incidence, mortality, disability) and **household economic indicators**

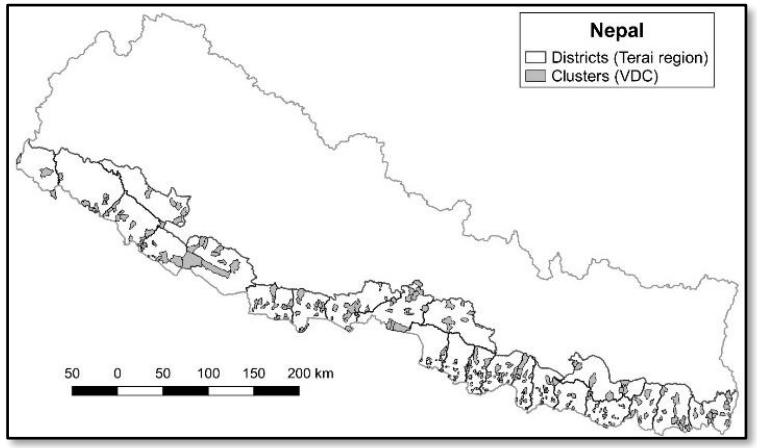
Secondary

1. Developing and validating a predictive model of snakebite envenoming in humans and animals integrating environmental factors and socio-economic activities
2. Analyzing and modelling geographic accessibility of life-saving care such as antivenom and ventilatory support with a focus on cost-effectiveness (economic analysis)
3. Analyzing how potential environmental changes might affect snakebite risk
4. Recommending public health measures to prevent snakebite morbidity and mortality in human and animals

Snake-byte survey methodology

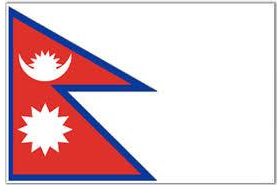
In Nepal's Terai region:

- Cross-sectional household survey
- 250 randomly selected clusters
- Urban areas excluded
- 13 879 randomly selected households (63 454 human participants)
- Spatial randomization + selection via high resolution satellite images
- E-questionnaires

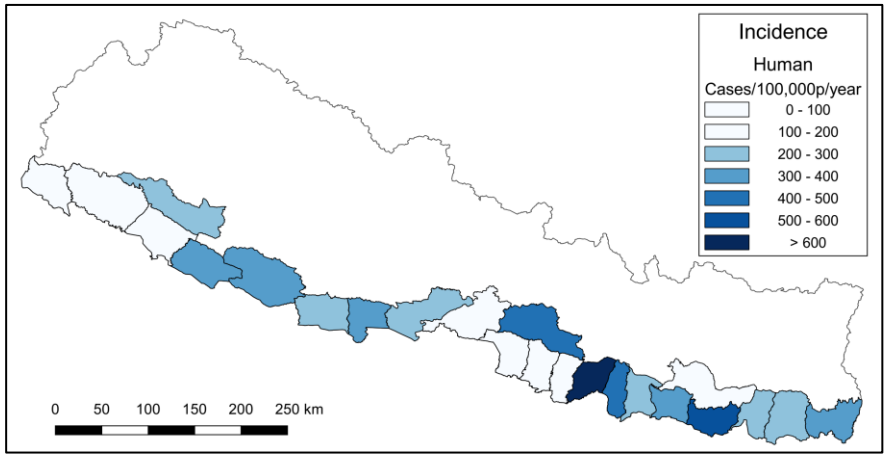


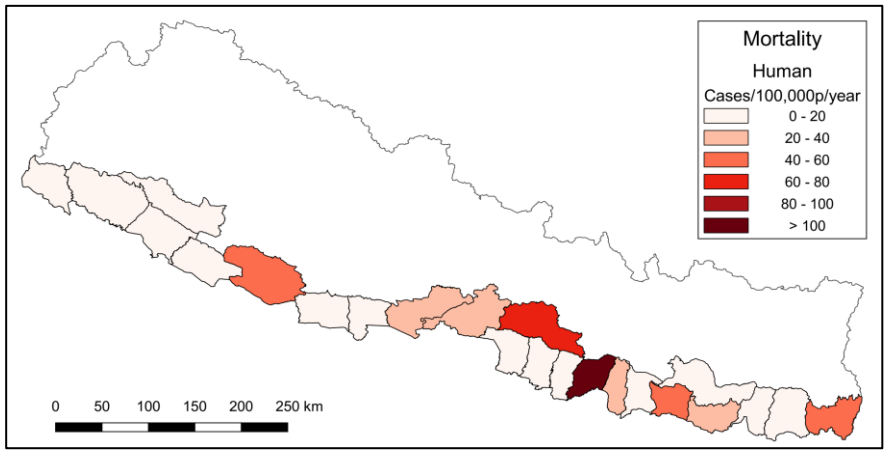
Alcoba et al. *PLoS Negl Trop Dis* 2021; 15(2): e0009023

Snakebite epidemiology in humans



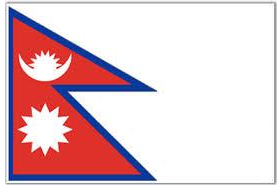
- 166 snakebites out of **63,454 participants** over the previous 12 months
- Annual incidence = **262**/100’000
- Median age = **30** years (range: 4-71)
  - Subgroup of deceased = 20 years (**46% 5-14 years**)
- **64·4%** women/girls (76·9% of deceased)
- 61% bitten while working in the field or walking on a path
- 48·8% were envenomed (n=81) and **7·8%** died (n=13)
- Most severe envenoming were neurotoxic
- **23% had long term sequelae**
  - Walking disability (13%), arm-hand disability (10%)
  - Persistent stress, anxiety, phobia (9%)
- **Extrapolated burden across Nepal’s Terai:**
  - **37,661** (95% CI 32,362–43,836) victims/year
  - **2,949** (95% CI 1,728–5,053) deaths/year





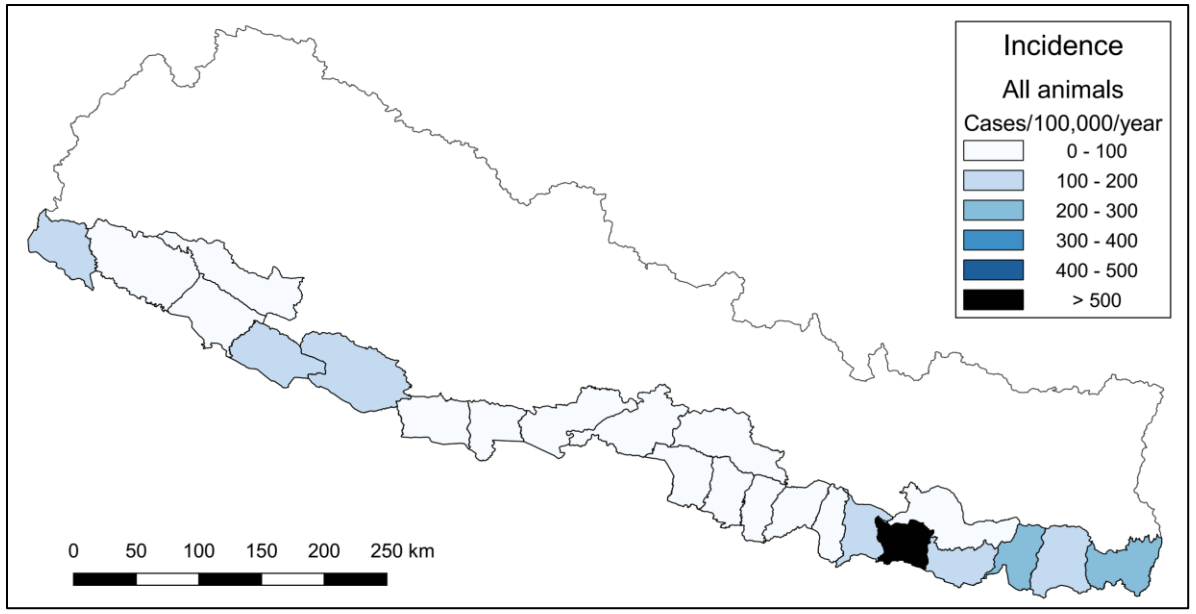
Alcoba, G; Sharma SK et al, *The Lancet Global health* 10.3 (2022): e398-e408

Snakebite epidemiology in domestic animals



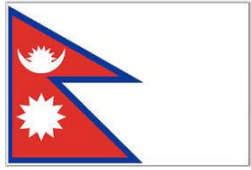
- 144 reported snakebite cases out of 183 949 animals surveyed
- Incidence rates varying by animal type (Table) and district (Figure)
- Mortality 79-100 % varying by animal type
- Extrapolated burden across Nepal's Terai:
  - **38,616** (32,020–46,570) animal victims/year

Animal type	N	Incidence /100k/y	Mortality Rate (%)
Poultry	80	66·2	100
Cattle/Buffalo	15	62·0	78·6
Goat	13	41·6	92·3
Sheep	1	202·4	100
Dog	1	196·9	100
Horse/Donkey	0	0	0
Pig	0	0	0
Cat	0	0	0
Total	**110**	**61·5**	**96·3**



Alcoba et al, *The Lancet Global health* 10.3 (2022): e398-e408.

Health and socioeconomic impact assessment: A One Health perspective



- Human health impact measured in terms of **Disability-adjusted Life Years (DALYs)**
- Livelihood losses encompassed
  - out-of-pocket healthcare expenditures
  - losses of productivity due to days off work
  - losses due to domestic animals mortality and treatment costs
- Domestic animals mortality losses were also estimated as **Animal Loss Equivalents (ALE)**
- Overall human and animal health impact expressed using **zDALYs (DALY + ALE)**

Babo Martins et al. *The Lancet Global Health* 2022
Torgerson et al. One Health 2018; 5: 40-5

Socioeconomic impact of snakebite

At the Terai level, annual **losses associated with domestic animal cases are** estimated to be **$ 1,72 million.**

Overall, **snakebite in humans and domestic animals** is estimated to lead to annual losses **of $ 2,8 million**.

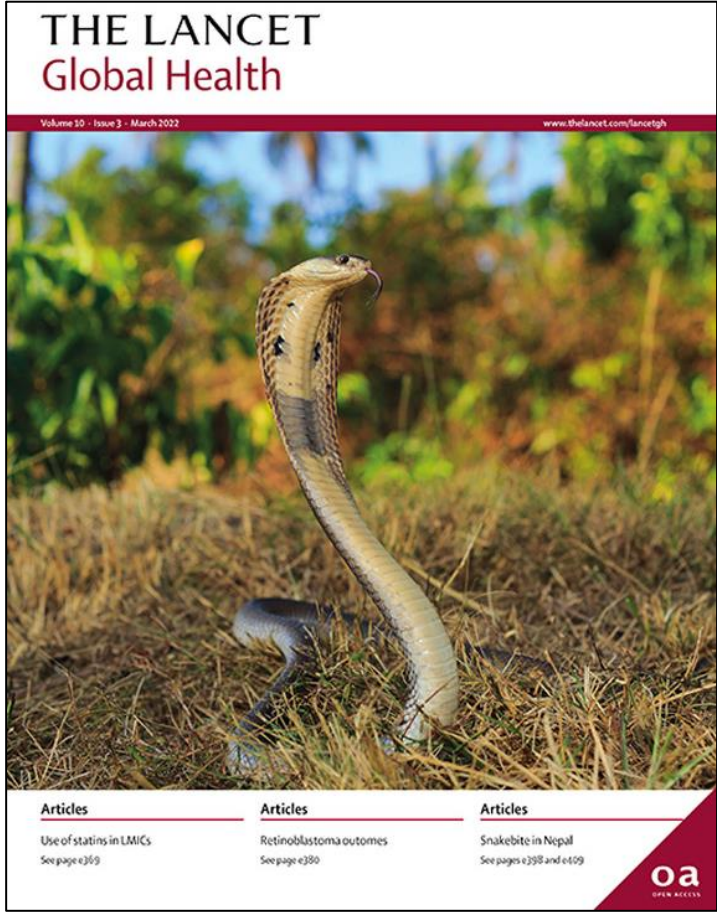
Babo-Martins et al. (2022). *The Lancet Global Health*

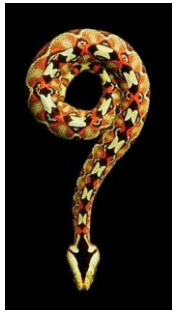
Source: ILRI

Thank you to :

- The Snake-byte research team
- The field teams in Nepal
- The surveyed villagers
- Our external experts/advisers

Swiss National Science Foundation





WE THANK YOU FOR LISTENING

Case definitions for domestic animal snakebite cases

- **Confirmed:** The bite has been witnessed, and clinical signs are consistent with snakebite envenomation (swelling, bleeding, ptosis, hypersalivation, respiratory difficulties, or paralysis)

- **Probable:** The bite has not been witnessed but evidence of contact with a snake (animal playing, fighting a snake, a snake found close to the animal) and clinical signs consistent with snakebite envenomation or presence of fang marks, and: i) animal alive with clinical signs consistent with snake envenomation or ii) animal found dead with signs of hypersalivation, swelling bleeding, nose froth

- **Suspected:** The bite has not been witnessed, there is no evidence of contact with a snake, no report of fang marks, but the animal has been found alive or dead with clinical or post-mortem signs compatible with snakebite envenomation