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Trends in snakebite deaths in India from 2000 to 2019 in a nationally representative mortality study

The number of snakebite deaths over the past two decades in India far exceeds previous estimates, says new study

In the largest ever nationally representative mortality survey to include snakebites, published in 2011 (<https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0001018>), researchers of the Million Death Study (MDS) estimated 46,000 annual snakebite deaths in India. These astonishing results were largely responsible for convincing the World Health Organization (WHO) to recognise snakebite as a top-priority neglected tropical disease (NTD) and changing world opinion about the public health importance of snakebite. WHO revised their global estimates of annual snakebite mortality to 80,000–140,000. Survivors with amputations and permanent physical disabilities may number three times more, in addition to post-traumatic stress disorders.

A new study published today in eLife (<https://elifesciences.org/articles/54076>) conducted by the Centre for Global Health Research (CGHR), at the University of Toronto, Canada, with Indian and UK partners, expands the results of the 2011 study by adding 11 more years of field data from the MDS, covering 600,000 randomly selected deaths, and a systematic review of 78 Indian snakebite studies. It reports a staggering 1.2 million snakebite deaths in India during the 20-year period 2000 to 2019, an average of 58,000 per year. Around 70% of these occurred in limited low altitude, rural areas of eight states - Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, Andhra Pradesh (including Telangana), Rajasthan and Gujarat. Half of all deaths occurred during the monsoon period from June to September. Available data indicated that most envenomations were due to Russell's vipers followed by kraits and cobras.

The senior author Professor Prabhat Jha, Director of CGHR at Unity Health Toronto, comments, *“Our study directly quantified and identified the populations most affected by fatal snakebites in India. We showed that the overall lifetime risk of being killed by snakebite is about 1 in 250, but in some areas, the lifetime risk reaches 1 in 100.”*

Snakebite, which primarily targets rural farmers and their families, was the most neglected of all NTDs, but, since 2017, has been prioritised by WHO. In 2019, WHO launched its strategy for prevention and control of snakebite, aiming to halve the numbers of deaths and serious disabilities by 2030. Another author Professor David Warrell one of the world's leading figures in tropical medicine said *“Achieving this will be challenging in India, where half of the world's total snakebite deaths occur. Snakebite deaths and disabilities are also common in impoverished rural communities in many other parts of Asia, Africa, Latin America and New Guinea”*.

Bites by venomous snakes are acute medical emergencies, killing by shock, paralysis, haemorrhage or acute kidney injury, and injuring by inflicting gangrene. However, the risk of bites can be reduced through community education, while most deaths and serious consequences are preventable by timely access to safe and effective antivenoms.

The Government of India's official declaration of snakebite deaths in public hospitals during the period 2003 to 2015 was only 15,500, one tenth of the 154,000 snakebite deaths detected during this same period by the MDS from public and private hospitals. To repair this gross under-reporting, the authors recommend that the Government of India designate and enforce snakebite as a 'Notifiable

Disease' within the Integrated Disease Surveillance Program. Accurate snakebite data are essential if the Government of India's strategies to reduce snakebite deaths are to succeed.

"Snakes are a vital part of our ecosystem as rodent controllers and are important in religion and mythology," says Romulus Whitaker, at the Centre for Herpetology/Madras Crocodile Bank. "Since deaths are restricted mainly to lower altitude, intensely agricultural areas, during a single season of each year, this should make the annual epidemics easier to manage. India's tremendous snakebite burden is staring us in the face and we need to act now!"

Targeting certain areas with education about simple methods, such as 'snake-safe' harvest practices, wearing rubber boots and gloves and using rechargeable torches (or mobile phone flashlights), could reduce the risk of snakebites. Mass distribution of mosquito nets (which also protect against scorpion sting and mosquito-borne and sand fly-borne diseases) may also help. The new study calls for improved knowledge of the distribution of venomous snake species as well as the human consequences of bites. An enhanced snake species database, with habitat details, clear photographs, and geographical distributions, is now available as a downloadable Android phone app from www.indiansnakes.org.

India has sufficient manufacturing capacity to produce large volumes of antivenom. Better understanding of the distribution of India's many venomous snake species could help in the design and development of more appropriate antivenoms. The current Indian antivenoms neutralize venom from only spectacled cobra (there are three other Indian cobra species), common krait (there are seven other krait species), Russell's viper and saw-scaled viper. At least 12 other species that are not covered by current antivenoms are known to have caused fatal bites in India. Only in some states do emergency ambulance services equip vehicles with lifesaving equipment and drugs, including antivenom.

Collectively, improved data, focused prevention and antivenom treatment could help India to achieve WHO's goal of halving snakebite death and disability rates by 2030.



PHOTO: Russell's viper is common in agriculture throughout much of India and causes a high percentage of fatal snakebites

Photograph by Ben Owens

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