

Epidemiology of snakebite in Sri Lanka

An understanding of the pattern of snakebite throughout the country and the snakes involved as well as the outcome of treatment is essential in developing a rational plan of action to improve medical care to those bitten. At present, there is no systematic collection of snakebite data. The information that we have is patchy, and dated. The first island wide epidemiological study was published in 1976 (de Silva, 1976¹) and elaborated some years later (de Silva & Ranasinghe, 1983²).

The 2016 WHO guide³, on page 86 quotes figures from the Epidemiology Unit, Ministry of Health for the years 1991 to 2005 and states that fatalities peaked in 2000 to 194, falling to 134 in 2005. A study in the Kandy district for the period 1967 to 1987 based on death certification found that bites were caused by *Daboia russelii*, (30%), hump-nosed viper (*Hypnale hypnale*) (22%), *Naja naja* (17%) and kraits (mainly *Bungarus caeruleus* but a few *B. ceylonicus*) (15%). A later study in the Moneragala district during the period 1999 to 2003 found a 63% underestimate by hospital records of the true number of snakebite deaths⁴. A community based, countrywide study of snakebite that included nearly 1% of the population published in 2016 provides more recent data. The incidence of bites, envenoming and mortality from snakebite was found to be 398 (95% CI: 356–441), 151 (130–173) and 2.3 (0.2– 4.4)/100 000/year, respectively. This amounts to more than 80 000 bites, 30 000 envenomings and 400 deaths in the country each year⁵ (Ediriweera et al, 2016). However, it is possible that the figure of 400 deaths each year is an overestimation when considering the large number of bites by non-venomous snakes seen in the wet zone of the country.

A prospective study of the management of snakebite in hospitals in the Kurunegala District⁶ (Seyed Shahmy et al, 2017) showed that the majority of snakebites in the district were successfully cared for within the primary hospitals. Antivenom was not required for the majority of patients reflecting the high proportion of *Hypnale* spp. bites for which antivenom is not indicated. There were 2186 admissions of snakebites and no deaths in primary hospitals. An additional 401 patients from the district were admitted directly to the teaching hospital, with 2 deaths recorded in this group. The authors point out that the population incidence of hospitalized snakebite was 158/100,000 which was significantly lower than community survey estimates of 499/100,000.

There had been 737 adult snakebite admissions to the Teaching Hospital Kurunegala (direct admissions and transfers). The majority of the bites (36%) had been attributed to hump-nosed pit vipers. Bites by Russell's viper,

¹ Anslem de Silva, (1976). The Pattern of Snakebite in Sri Lanka, *The Snake* 8(1): 43-51

² Anslem de Silva & L. Ranasinghe, (1983). Epidemiology of snake-bite in Sri Lanka: A review, *Ceylon Medical Journal*, 28(3): 144-154

³ Guidelines for the management of snake-bites, 2nd edition, World Health Organization 2016.

⁴ Fox S et al., (2006). Underestimation of snakebite mortality by hospital statistics in the Moneragala District of Sri Lanka. *TransR Soc Trop Med Hyg.* 100:693-5.

⁵ Ediriweera DS, Kasturiratne A, Pathmeswaran A, Gunawardena NK, Wijayawickrama BA, Jayamanne SF, Isbister GK, Dawson A, Giorgi E, Diggle PJ, Laloo DG, de Silva HJ. Mapping the risk of snakebite in Sri Lanka - A national survey with geospatial analysis. *PLOS Neglected Tropical Diseases* 2016, 10 (7): e0004813.

⁶ Seyed Shahmy, Senanayake A. M. Kularatne, Shantha S. Rathnayake, Andrew H. Dawson. A prospective cohort study of the effectiveness of the primary hospital management of all snakebites in Kurunegala district of Sri Lanka. *PLOS Neglected Tropical Diseases* 2017, 11(8): e0005847, <https://doi.org/10.1371/journal.pntd.0005847>.

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cobra and krait accounted for (respectively) 8%, 3% and 2% of the total. Snakes such as cat snakes, water snakes, wolf snakes and rat snakes accounted for 1.5% of the bites while in 49% the biting snake was unidentified.

Table 1 gives a summary of cases and deaths from snakebite reported in the Indoor Morbidity & Mortality Reports of the Medical Statistics unit of the Health Ministry over a number of years (the most recent figures available are for 2014). There is little change over the years. Considering that the study by Ediriweera et al, 2016 suggests that there could be about 400 deaths each year, including snakebite deaths not captured by hospital records, it is clear that real time epidemiological data of snakebites and associated deaths is very necessary. This the Snakebite Committee recognised and initiated action.

Notification of death due to snakebite

In response to letters from the Chairman of the Snakebite Committee addressed to the Director General of Health Services of the Ministry of Healthcare & Nutrition in June and July 2008, a Ministry Circular was issued (effective 1.9.2008) requiring that all deaths attributed to snakebite be reported on the prescribed form to the DDG(MS). The form was due to be revised on 1.9.2009. This was never done; however, seven completed forms were returned covering the period July to November, 2009. A brief summary of the data is given in Table 2.

Table: 1

Year	Cases	Deaths
2004	34,596	102
2005	36,861	134
2006	39,793	100
2007	39,321	91
2008	38,381	58
2009	39,728	86
2010	42,146	88
2011	NOT	AVAILABLE
2012	41,462	76
2013	40,373	95
2014	37,215	94

Source; IMMR, Medical Statistics, MoH

Table: 2

Summary of deaths following snakebites, July to November, 2009

Hospitals reporting: BH Puttalam, GH Chilaw, GH Negombo, BH Homagama, GH Kalutara, DH Wariyapola, TH Batticaloa.

Time of bite-admission interval: 30 mins to 4 hrs. There were 2 transfers. No/insufficient data in 3.

Species of biting snake: Cobra and Russell's viper were identified in two instances; Russell's viper/hump-nosed viper were queried in two; the snake was not identified or not stated in three.

Antivenom use: There had been one death on admission, antivenom had been given in the other admissions in doses ranging from 10 vials to 40 vials per case, in repeated doses.

Causes of death: Renal failure (2), Respiratory failure (4), Excessive bleeding (3). Multiple causes were reported in 2 cases. One autopsy: large ICH*; one CT: intraventricular & intracerebral bleed*; one ?DIC.

*Note: in both cases the biting snake was unidentified but thought to be Russell's viper or hump-nosed viper.

Lessons learnt

- The data collection form needs to be revised to enable extraction of more accurate and useful information to assess shortcomings in patient management;
- Improved guides to identifying the biting snake are needed;
- The possibility of intracranial bleeding following envenoming by Russell's viper should be appreciated;
- Improved guides to promote rational and systematic antivenom use are needed.
- Involvement of the Health Ministry at all levels is a must if we are to achieve anything positive.

Surveillance of snakebite - Sentinel Surveillance Sites

On 30th July, 2008, the Snakebite Committee met with an officer of the MoH Epidemiology Unit to discuss the possibility of including snakebite as part of the unit's sentinel surveillance system for NCDs (see Table 3 for a list of the survey sites). The idea was to obtain the services of the trained nursing officers who collected and reported NCDs so as to ensure the highest quality data. It took the committee one year to agree and design a suitable form that was sent to the Epid. Unit in June 2009. The Epid. Unit officers further improved it and finalised the **Snakebite Surveillance - Case Investigation Form**. This was a single page document in three sections: 'Admission details', 'Patient details', and 'Snakebite details'. (The form *Snakebite Surveillance: Case Investigation Form* is reproduced as Annex I to this page).

As no action was seen on the ground we followed up and were taken aback by the reply in May, 2010. While admitting that the Epid. Unit was responsible for NCD surveillance and that snakebite surveillance also came under NCD surveillance, the unit was unable to initiate the new surveillance system because of its current work load.

Table: 3

Sentinel Survey Sites

1.	Northern Province	BH Vavuniya
2.	North Central Province	TH Anuradhapura, GH Polonnaruwa
3.	North Western Province	BH Puttalam
4.	Western Province	GH Gampaha
5.	Central Province	GH Kandy
6.	Uva Province	BH Moneragala
7.	Sabaragamuwa Province	GH Ratnapura
8.	Southern Province	GH Matara
9.	Eastern Province	GH Ampara

While waiting for the Epid. Unit to respond to our communication of June 2009, the Snakebite Committee had, through the office of the DGHS, circulated copies of the form **Epidemiological data related to snakebite in hospital** that it had developed (dated 8.6.2009). There were no forms returned to the SLMA until a vigilant junior doctor familiar with the work of the SLMA discovered a pile of papers lying in one of the Ministry offices that he thought may interest the Snakebite Committee. In September, 2010, we received a bundle of completed forms that we were unable to analyse at the time.

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There were 47 completed forms returned, 43 for September to December, 2009 and 4 for February and September, 2010. The reporting hospitals were: GH Kalutara (20), GH Polonnaruwa (24) and TH Batticaloa (3). The forms were not analysed further and there is no information to explain why only these three hospitals responded.

Lessons learnt

- Data can be collected, but would need a high level of interest among the hospital staff, probably with much encouragement and support from the hospital administrators.
- The improved version of the form developed for use in the sentinel surveillance system would be more user-friendly. If the Epid. Unit is unable to include surveillance of snakebite as part of its NCD surveillance, these forms could be used by anyone interested in studying snakebite in their own hospital or area of interest.
- A meaningful analysis of completed forms is a must. This would pose problems unless a suitable computerised database is developed to enable data extraction for analysis. It is suggested that this could be undertaken by the IT units that are now fairly widespread throughout the health service.
- The Snakebite Committee will be unable to cope with the task of receiving and analysing the volume of data expected. It is suggested that this task should be undertaken at a Provincial level.

Making snakebite a notifiable disease

In April, 2016, a letter was addressed to the DGHS by a Co-Chair of the Snakebite Committee requesting that

- Snakebite be made a notifiable disease by general circular;
- The annexed notification form is circulated to all hospitals (i.e. *Epidemiological data related to snakebite in hospital*, 8.6.2009);
- Snakebite notification and essential aspects of management are included in the orientation training programme of intern medical officers.

The matter was put to the Minister of Healthcare, Nutrition & Indigenous Medicine at a meeting on 9th May, 2016, pointing out that deaths from snakebite are preventable. The Minister was agreeable to our request and instructed the DGHS to implement.

We are waiting.

Compiled by Malik Fernando
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ANNEX I: Case Investigation form for Snakebite Surveillance

Snakebite SurveillanceCase Investigation FormSerial No:

To be filled by the treating Medical Officer. Please print clearly, underline the response or tick in box as appropriate.
Completed forms to be sent to the Epidemiology Unit, Ministry of Health, 231, de Saram Place, Colombo 10.

1. Admission Details

- 1.1 Name of the hospital:
- 1.2 Ward No: / ICU
- 1.3 BHT No:
- 1.4 Date of admission: (dd/mm/yyyy)
- 1.5 Time of admission: (am/pm)
- 1.6 Mode of admission: 1 Direct 2 Transfer
- 1.7 If transfer, from which hospital:

Patient Details

- 2.1 Name:
- 2.2 Age in years (at last birthday): If infant, age in months at the time of bite:
- 2.3 Sex: 1 Male 2 Female
- 2.4 Present address:
- 2.5 Name of the MOH area & District:
- 2.6 Occupation: 1 Unemployed 2 Housewife 3 Agricultural worker
4 Other outdoor occupation (specify):
5 Other (specify):

3. Snakebite Details

- 3.1 Date of bite: (dd/mm/yyyy)
- 3.2 Time of bite: (am/pm)
- 3.3 Place of snakebite: 1 Home 2 Worksite (specify)
3 Other (specify):
- 3.4 Activity at time of bite: 1 Harvesting 2 Cultivation 3 Sleeping
4 Walking 5 Other (specify):
- 3.5 Identification of snake: 1 Russell's viper 2 Saw scaled viper 3 Common krait
4 Cobra 5 Hump nosed viper
6 Other (venomous) specify
7 Other (non venomous) specify 8 Unknown
- 3.6 Identification was based on (if not identified, skip this question): 1 History 2 Observation
- 3.7 Part of body bitten: 1 Toes 2 Foot 3 Leg 4 Thigh 5 Fingers
6 Hand 7 Forearm 8 Arm 9 Trunk 10 Other (specify):