

**Poisonous snakebites of Myanmar with special references  
to the bites and case fatality rate (1998-2005)**

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Retrospective study of data collected by the Department of Health Planning on bites and case fatality rate of poisonous snakes of the whole country from 1998 - 2005 were analyzed. The objective of the study was to determine the trend, number of bites and case fatality rate of poisonous snake bites of the states and divisions. The average poisonous snakebites (1998-2005) of the whole country were 8107 (6529-9600) with a case fatality rate of 7.43% (4.93-8.82%). The yearly trend of the snake bite is on increase and Mandalay, Magway, Sagaing and Bago (W) Divisions have the highest numbers of snakebite ranging from 1001 to 2000 per year and Chin, Kachin, Shan (East and North), Rakhine and Kayah States and Taninthayi Division, each has less than 50 per year. Townships with no report of snakebite are also highlighted. Ayeyawady Division has the highest case fatality rate 17.75%, followed by Rakhine State 10% and Magway Division 8.96%. The exceptionally high fatality rate (11-40%) of 24/26 townships of Ayeyawady Division needs to be investigated. The information obtained from the study will be useful for the policy makers and project managers concerned, in planning, distribution and in estimating the amount of antivenom required for the whole country.

## INTRODUCTION

Snakebite is an occupational hazard of farmers and plantation workers. It is endemic in Myanmar. Epidemiology of snakebite of the country (1984-88) was presented at the National seminar on prevention and management of Russell's viper bite in 1989 [1]. In the later years, few reports on epidemiological studies of snakebite have been published [2, 3]. Because of the increase demand of anti-venom by the township hospitals, it is likely that the morbidity of snakebite is on increase. In order to know the situation of snakebites of the country, we carried out retrospective study of hospital data collected by the Department of Health Planning from

all townships of the states and divisions of Myanmar from 1998 to 2005. The objectives of the study were to determine the morbidity and mortality and trends of snakebite occurring in townships and the states and divisions of the country in past 8 years and to identify townships with and without report of snakebites in order to estimate requirement and distribution of antivenom to township hospitals.

## MATERIALS AND METHODS

Data related to poisonous snake bites and fatal cases (1998-2005) reported from 320 townships of the states and divisions of Myanmar collected by the Department of Health Planning, Ministry of Health were

studied. Coded data were entered and analyzed using SPSS version 11.5 software. Arbitrary grading of the bites was used to stratify morbidity of the bites in the states and the divisions to cases ranging from 1001-2000/yr, 501-1000/yr, 101-500/yr, 51-100/yr and less than 50/yr and at township level to 101-200 bites/yr, 51-100/yr and less than 50/yr. Incidence of snakebite per 100000 was calculated based on population growth of 2% per year. Case fatality rate (CFR) was calculated by dividing number of fatal cases by the total number of bites and multiplied by 100.

## RESULTS

### *Incidence of snakebite*

The average poisonous snakebites per year of 8 years (1998-2005) of the whole country are 8107 (6529-9600). Mandalay, Magwe, Sagaing and Bago (west) Divisions have average poisonous snakebites per year ranged from 1001-2000, Ayeyawady, Bago (east) and Yangon (501-1000), Mon State (101-500) and Shan (south) and Kayin States (51-100). Majority of the states, Chin, Kachin, Shan (north and east), Rakhine and Kayah States and Taninthayi Division have average bite per year less than 50. Among them, Mandalay Division tops the chart (1828 bites/yr) followed by Magwe, Sagaing and Bago (west) Divisions. The snakebite morbidity per 100000 populations of the states and divisions are tabulated in Table 1 & 2. The incidences of snakebite per 100000 populations of all divisions except Taninthayi are higher than that of all states except Mon State. Bago (west) Division has the highest incidence of snakebite per 100000 populations throughout 8 years followed by Magwe, Mandalay, Bago (east) and Sagaing Divisions (Table 1).

### *Trend of snakebite*

The yearly trend of incidence of snakebite per 100000 populations of the divisions

(mean) is high (>20/100000) compared to the states (mean) (<5/100000) and shows a slight decrease in the incidence from year 1998 to 2000 and an upward trend from 2001 to 2004 with a slight drop in 2005 (Fig. 1). The yearly trend of snakebite per 100000 populations of the divisions also shows a similar trend except Bago (East) which shows an increase in incidence of bite in 2005 (data not shown). Moreover, a similar trend was observed in the divisions when the yearly incidence of snakebite based on number of bites per year is considered (data not shown).

The incidence of snakebite per 100000 populations in all states including Taninthayi Division remained fairly stable (<5/100000) except fluctuation between years in Rakhine State (data not shown).

### *Case fatality rate (CFR)*

The average yearly CFR of the snakebite of the country is 7.43% (4.93-8.82%). Ayeyawady Division has the highest yearly CFR of snakebite (17.75%) in the country followed by Rakhine (10%) and Magwe (8.96%) Division (Table 1). The yearly trend of CFR of snakebite of the country showed a rising trend (Fig. 2).

### *Trend of CFR*

The yearly trend of CFR of the snakebite of the divisions (mean) and the states (mean) showed fluctuation between years with a rising trend in the former (data not shown) especially in Ayeyawady Division (Fig. 2). The yearly trend of CFR of snakebite of the country shows a similar rising trend.

### *Morbidity and mortality of snakebites of the states and divisions*

#### Mandalay Division

All 31 townships of Mandalay Division reported incidence of snakebites during 8 years. Five townships (Myingyan, Kyaukpadaung, Taungtha, Meikhtila and Kyaukse) have incidence of snakebite (101-200/yr), 13 (51-100/yr), 7 less than 50/yr and 6 with no report of fatality

following the bites (data not shown). The CFR of the townships are less than 10% except in 3 townships (Kyaukpadaung, NyaungU and Sintkine) (11%).

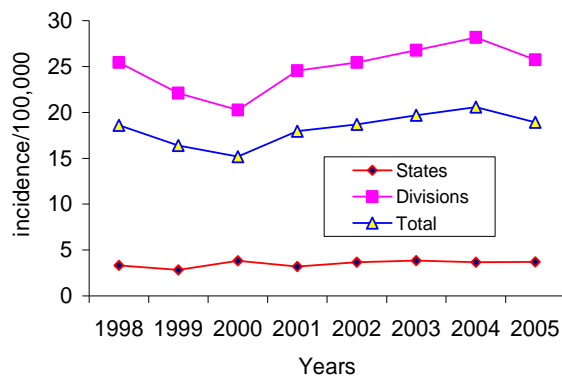


Fig.1. Trend of incidence of snakebite morbidity per 100000 populations of the states (pooled), divisions (pooled) and the country, total (1998-2005)

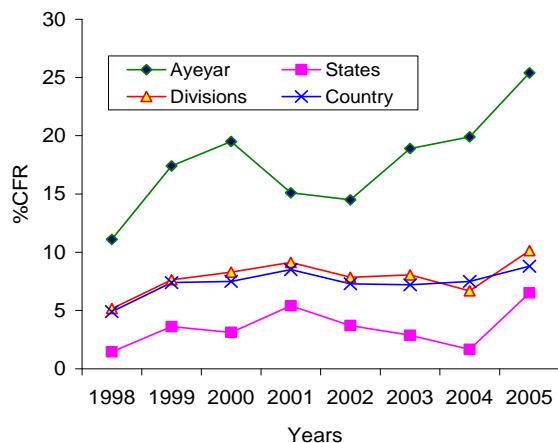


Fig. 2. Trend of CFR of snakebite of the states (pooled), division (pooled), Ayeyawady Division and the country, total (1998-2005)

### Magwe Division

Twenty-four out of 25 townships of Magwe Division had reported incidence of snakebite during the study period except Gantgaw Township. Of 24 townships, Taungdwingyi and Aunglan have (101-200/yr) incidence of snakebite, 7 have 51-100/yr, 12 have less than 50/yr and 3 with no report of fatality following the bites. CFR of 11-20% were reported from 6 townships (Taungdwingyi, Natmauk, Myothit, Minbu, Pauk and Myaing).

### Sagaing Division

Sagaing Division has the third highest snakebite in the country. Of 37 townships, Sagaing and Kantbalu townships have snakebite of 101-200/yr, 8 have 51-100/yr, 15 less than 50/yr and 7 with no report of fatality. Throughout 8 years, no report of snakebite was recorded in Nanyun, Mawlike, Layhae, Layshe and Indaw townships. Monywa, Pale and Yinmarbin townships have CFR 11-20%.

### Bago (East and West) Division

Bago (E and W) Division has 14 townships each. Three townships from Bago (W) (Pyay, Thayawady & Paukkaung) and Nyaunglaybin from Bago (E) have snakebites 101-200/yr. Nine townships from Bago (W) and 6 from Bago (E) have bites ranging from 51-100/yr and 2 from Bago (W) and 7 from Bago(E) have less than 5 bites/yr. Kawa, Thanatpin, Bago & Oaktwin townships from Bago (E)) have CFR of 11-25%.

### Ayeyawady Division

Snakebite occurred in all 26 townships of Ayeyawady Division. Six have moderate bites (51-100/yr) and remaining 20 have less than 50/yr. Although snakebite morbidity was not so high, 92% (24/26) of the townships have CFR of 11-40%. This division has high yearly CFR throughout 8 years (Table 1). High CFR 31-40% was recorded in 4 townships (Zalun, Pyapone, Latbuta and Einme), 21-30% in 6 (Maubin, Pantanaw, Daedaye, Bogalay, Mawkyun & Kangyidaunk) and 11-20% in 14 townships.

### Yangon Division

Of 43 townships in Yangon Division, Taikgyi Township has snakebite of 101-200/yr, Hlegu and Kyauktan 51-100/yr and the rest less than 50/yr. Ten townships reported of snakebite with no fatality during the study period. No snakebite was recorded in 19 townships. High CFR (11-40%) was reported in 7 townships, 20-40% in 4 (Thonegwa, Kayan, Kawmu and South Dagon) and 11-20% in 3 (Twantay, Htantabin and Thanlyin).

Table 1. Snakebite morbidity and case fatality rate of divisions (1998-2005)

Divisions		1998	1999	2000	2001	2002	2003	2004	2005	Mean
Bago (West)	Inc/100000	58.78	49.96	41.6	55.32	58.90	45.53	53.31	43.01	50.76
	CFR %	3.70	4.00	5.90	6.60	5.30	4.10	4.30	4.20	4.70
Magway	Inc/100000	31.09	24.14	27.57	38.99	35.99	47.17	38.03	31.51	34.31
	CFR	4.95	11.10	9.10	11.50	10.40	6.60	8.99	9.80	8.96
Mandalay	Inc/100000	37.6	26.67	26.25	33.14	30.24	35.27	39.21	37.51	33.23
	CFR%	4.70	4.40	5.10	6.50	5.20	5.00	4.60	4.99	5.10
Bago (East)	Inc/100000	21.94	23.8	20.42	20.37	23.68	23.55	23.58	30.62	23.49
	CFR%	3.60	6.67	7.87	7.83	6.75	8.68	8.07	8.66	7.38
Sagaing	Inc/100000	21.94	20.01	6.16	19.73	21.03	26.33	28.32	24.55	22.23
	CFR%	3.40	5.40	4.40	4.80	6.30	5.40	5.30	6.40	5.30
Ayeyawaddy	Inc/100000	16.13	16.47	13.01	15.08	14.75	15.08	16.05	14.12	15.08
	CFR%	11.10	17.40	19.50	15.1	14.5	18.99	19.90	25.4	17.75
Yangon	Inc/100000	9.14	10.5	11.80	8.85	15.54	10.26	13.59	12.58	11.53
	CFR%	4.79	4.49	6.23	11.65	5.46	7.33	9.57	11.49	7.70
Taninthayi	Inc/100000	2.52	1.11	1.79	1.45	1.72	1.17	1.94	1.83	1.68
	CFR%	2.52	1.11	1.79	1.45	1.72	1.17	1.94	1.83	2.23
Mean	Inc/100000	25.45	22.1	20.26	24.55	25.43	26.77	28.16	25.73	24.80
	CFR%	5.17	7.63	8.30	9.13	7.84	8.05	6.68	10.14	7.86

Table 2. Snakebite morbidity and case fatality rate of states (1998-2005)

States		1998	1999	2000	2001	2002	2003	2004	2005	Mean
Mon	Inc/100000	15.03	11.75	14.21	13.36	14.49	13.05	10.75	10.76	12.92
	CFR %	4.54	7.59	3.58	8.02	3.86	7.29	4.08	10.50	6.16
Chin	Inc/100000	7.85	11.66	5.17	5.49	5.38	7.30	8.55	7.99	7.42
	CFR%	7.85	11.66	5.17	5.49	5.38	7.30	8.55	7.99	2.46
Kayah	Inc/100000	12.04	1.54	11.06	0.98	14.97	1.42	0.35	5.45	5.97
	CFR%	0	0	0	0	0	0	5.50	0	0.87
Shan (South)	Inc/100000	1.76	2.45	4.21	4.02	3.52	6.64	4.69	4.50	3.97
	CFR%	6.45	0	1.29	4	10.44	1.55	2.15	7.69	4.39
Kayin	Inc/100000	2.68	3.57	2.44	2.84	3.93	4.11	5.21	4.50	3.66
	CFR%	0	15.09	10.81	11.36	3.22	10.76	5.95	2.70	7.20
Kachin	Inc/100000	2.53	1.15	6.25	3.32	3.17	2.61	1.92	2.98	2.99
	CFR%	3.57	0	0	7.69	2.63	0	0	2.63	2.10
Shan (North)	Inc/100000	1.82	1.03	2.87	1.25	12.00	0.8	0.98	1.59	1.44
	CFR%	0	0	0	0	4.16	0	0	6.06	1.55
Shan (East)	Inc/100000	0.27	0.13	0.26	1.01	2.98	0.61	1.43	1.40	1.01
	CFR%	0.27	0.13	0.25	1.01	2.98	0.61	1.43	1.40	0.06
Rakhine	Inc/100000	0.34	0.64	0.33	0.58	0.39	0.56	0.68	0.74	0.53
	CFR%	0	11.76	11.11	12.5	9.09	6.25	15.00	4.09	10.00
Mean	Inc/100000	3.34	2.86	3.85	3.22	3.68	3.87	3.70	3.72	3.53
	CFR	1.46	3.62	3.12	5.4	3.7	2.88	1.67	6.51	3.54

## States and Taninthayi Division

Majority of the states including Taninthayi Division have snakebites less than 500 in 8 years (<50/yr) except Mon, Southern Shan and Kayin States (50-200 /yr). No snakebite was reported in 12 townships (9.2%) (13/130) during 8 years and 57.7% (75/130) of townships have reports of snakebites with no fatality. The number of fatal cases reported in 8 years in the former (<50/yr) ranged from 1-8 and 1-18 in the latter (50-200/yr).

Township with the highest snakebites/fatality in 8 years in each state and Taninthayi Division are, Nyaungshwe (159/7) (Southern Shan), Kutkhine (78/2) (Northern Shan), Kyaingtone (24/0) (Eastern Shan), Phyuso (38/0) (Kayar), Harkar (157/4) (Chin), Shwegu (66/1) (Kachin), Kawkayeik (180/13) (Kayin), Manaung (39/8) (Rakhine), Mudone (345/6) (Mon) and Palaw (41/1) (Taninthayi Division).

In summary, poisonous snakebites reported in 88.4% (383/320) of the townships of the country (7618 bites in 190 townships of the division and 489 in 130 townships of the states including one division) totaling to 8107 cases per year in 320 townships. Snakebite with no fatality was reported in 35.6% (101/383) of the townships (26 in the divisions and 75 in the states) amounts to 177 cases/yr (80 in the divisions and 97 in the states) (2% of the total bites). No report of snakebite was recorded in 11.5% (37/320) townships of the country (25 in the divisions and 12 in the states).

## DISCUSSION

The trend of poisonous snakebite of the country of last 3 ½ decades (1970, 1980, 2000 and 2005) showed that there is much reduction in incidence of snakebite per 100000 populations in all states (1 to 8 times) and divisions (1.4 to 4.8 times) except in Bago Division (an increase from 54.5 to 73.63/100000), Mandalay Division

(35.5 to 37.51/100000) and Shan State (6.1 to 7.48/100000) on comparing data at 1970 and 2005. However, the trend of snakebite morbidity of last 3½ decades indicated that there was a decrease in morbidity from 1970 to 1980, followed by an increase in the morbidity from 2000 to 2005. Fluctuation in the morbidity rate was observed between decades in Chin and Kayin States.

Later studies on epidemiology of snakebite of the country (1994-2002) indicated that the incidence of snakebite decreases from 1994 to 2000 and is on increase from 2001 to 2002 [2, 3]. The present observation on epidemiology of snakebite of last 8 years (1998-2005) is in agreement with the rising trend of snake bite and CFR.

The study showed that poisonous snakebite were reported in 88.4% of the townships of the country and its morbidity is high in the divisions (with reference to total numbers of the bites (7616/yr) as well as bites per 100000 populations) compared to the states (489 bites/yr). It is endemic in rice growing divisions namely Mandalay, Magwe, Sagaing, Bago (East and West), Ayeyawady and Yangon. Bago (W) Division has the highest incidence of snakebite per 100000 in the country with Bago (E) showing rising trend of snakebite morbidity. Most divisions are engaged in agricultural and plantation work and in some multiple cropping are in practice. Increase contact between man and snakes at work accounts for higher morbidity in the divisions compared to the states.

The average CFR of snakebite of the country (8 years) is less than 9%. However, high CFR (11-40%) recorded in townships with bites less than 50/yr in 4/7 townships in Bago (east) (11-25%), 7/11 townships in Yangon Division (11-40%) and Manaung (Rakhine State) (12.5-100% in 8 yrs) and in 24/26 townships in Ayeyawady Division (11-40%), raised a special concern in the current management of snakebite in the country. Failure of using protective wears at work, use of incorrect ineffective first aid

measures and delay in getting treatment at the health centres are important contributing factors for high CFR. It is high time to reevaluate the implementation of snakebite control programme of the country. Health education leading to change in attitude of farmers and plantation workers in using protective wears, correct first aid and avoid wasting valuable time should be achieved in order to bring down the morbidity and mortality of the snakebite. Further in-depth studies of the causes of high mortality in selected townships of the states and the divisions need to be carried out in order to find a remedy for it.

Community-based epidemiological study of snakebite carried out in Taungdwingyi Township (4) indicated that there was under reporting of morbidity of snakebite (17.5%) and CFR (38.7%) in data collected by the hospital. It is speculated that the morbidity and mortality rate of snakebite of the country could be much higher since not all snakebite cases sought medical treatment and usually terminal snakebite cases were discharged from the hospital on request.

#### *Townships with reports of snakebite and no fatality*

One hundred and one townships (35.6%) reported of poisonous snakebites with no fatality throughout 8 years, of which majority came from the states (75 townships). If the bites are due to genuine poisonous snakebites, then these bites could be attributed to green snake species, which inhabited elsewhere throughout the country and also could be result of “dry bites” of poisonous snakes. In clinical studies of snakebite cases, about 30% of the Russell’s viper (*Daboia russelii siamensis*) bites failed to inject venom into the victims or were “dry bites” [5]. Malayan pit viper (*Calloselasma rhodostoma*) bites could not be excluded in nonfatal bites occurring in Yale Township of Mon State and in Kayah State since the bites have been reported earlier in these places [6, 7]. It is suggested that inclusion of name of the species of

snakes responsible for the bites in future study will be helpful in epidemiological survey of snakebites and selection of antivenom.

#### *Townships with no report of poisonous snakebites*

Throughout 8 years there were no reports of poisonous snakebites in 37 townships (11.5%) of the country including 19 townships in Yangon Division. Although green snake bites have been reported in Bahan Township in Yangon Division [8, 9] these were not on record of primary health centre of Bahan Township because the victims preferred to seek treatment at the Yangon General Hospital instead. Similar incidences might also occur in the other townships of the Yangon Division. It is likely that there were under reporting of the cases in primary health centres which needs to be taken into consideration in future compilation of the data. It is highlighted that antivenom could be spared in these townships with no report of snakebites.

#### *Antivenom requirement and distribution*

The study indicated the townships with different grades of morbidity, townships with no report of snakebite (n=37), townships with snakebite and no mortality (177 cases in 101 townships) and incidence of snakebites per 100000 population of the states and divisions of the whole country. Townships of the states and divisions of the country with high snakebite morbidity rate are also highlighted. It is hoped that the information provided from the study will be useful for health managers concern in quantifying antivenom required for the whole country and individual townships and distribution of antivenom to the target townships. Since 30% of the bites are “dry bites” [5], a substantial amount of antivenom could be saved, However, more useful data could be generated if species of poisonous snakes causing morbidity and mortality are known and it is suggested to be included in future hospital returns.

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