
Snakebites in a rural area in northern Vietnam – a southeast Asian context

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THE majority of venomous snakes are found in the world's tropical regions, and the majority of snakebites occur in rural areas of these regions where many people have to cope with snakes literally in their own backyard. Actual statistics are usually unreliable, especially when attempting to attribute cases to specific species. Snakebite statistics are not systematically reported in most countries. Many cases do not find their way into official records, and for many developing countries they may be of local interest only. Very few countries possess a reliable epidemiological reporting system capable of providing precise data on snakebites. The lack of accurate statistics has prompted researchers to rely on scientific reports and other publications in an attempt to understand these issues.

The first comprehensive review of the global snakebite situation was made by Swaroop and Grab (1954). This survey estimated the total number of snakebite deaths in the world (excluding China, the USSR and the central European countries) at between 30 000 and 40 000 annually. Of this total, the highest figures were those for Asia (25 000–35 000), followed by South America (3000–4000). North America (including Mexico), Europe and Oceania had relatively few snakebite related deaths (300–500, 50 and 10, respectively). For Africa, the authors thought that the annual total number of deaths was around 400–1000. It was difficult for them to provide any approximate estimate for lack of reliable records.

The authors stressed that the available statistical data were mostly unreliable and at best could serve to provide only an approximate and highly conservative estimate of the snakebite problem. Reexamining the study it is not hard to find many inaccuracies. It is, however, important to stress that the lack of reliable sources from that period must have been part of the problem. The authors did not have at their disposal authoritative data and sources to support several statements about snakebite incidence.

Chippaux (1998) attempted to update the study by Swaroop and Grab, but he also relied on limited

epidemiological data in arriving at estimates. According to his survey, Asia had in the 1990s about 100 000 deaths per year, Central and South America 5000, USA and Canada 15, Europe 15, the Middle East 100 and finally Oceania 200. Altogether Chippaux's total figure for snakebite deaths was 125 000 per year. Swaroop and Grab's figures, according to Chippaux, were greatly underestimated. But it is also hard to authenticate Chippaux's high death rates as his study is mostly based on uncertain assumptions and literature reviews.

In the meantime, many countries have taken measures to reduce snakebite incidence by building better houses, using shoes and boots while walking or working in the fields etc. The most successful effort to reduce the number of fatalities, although not in all countries, is the widespread use of antivenom. In many countries this treatment has drastically reduced the number of deaths caused by snakebites.

The southeast Asia context

Southeast Asia harbours one of the richest snake faunas in the world, which can be exemplified by Malaysia. According to Tweedie (1961), the snake fauna comprises 137 species of land and seasnakes in peninsular Malaysia. The Malaysian region, including Sabah and Sarawak, has a combined total of 192 species of snakes which are found in all manner of habitats (Lim & Lee, 1989). The number of snake species in East Malaysia (Sabah and Sarawak) is probably lower than in peninsular Malaysia.

The first epidemiology of snakebites in Malaysia was reported by Reid *et al.* (1963). This report stated that of the 2114 cases in 1958 and 1959 in the states of Perlis, Kedah and Penang, most of the snakebites were inflicted by the marbled pit viper, also named Malayan pit viper (*Calloselasma rhodostoma*, previously known as *Agkistrodon rhodostoma*). The mortality rate was 1.6 %.

A report by Lim & Abu Bakar (1970) comprising 15 919 cases of snakebites, mainly in northwestern parts of Malaysia (Perlis, Kedah,

Penang and Perak) during the period between 1960 and 1968, found a general mortality rate of 0.8 %. An updated report comprising cases from 1960 to 1979 (Lim, 1982) throughout 11 states of West Malaysia (peninsular Malaysia) referred to a total of 53 216 snakebites inflicted by both venomous and harmless snakes. From these, 249 deaths occurred giving a total mortality rate of 0.46 %.

The analysis, based on these 11 states, shows that the highest incidence of snakebites was from the states of Perlis and Kedah with 3.1 and 15 bites per 1000 population as compared to 0.5 bites in Penang and much lower rates in all other states (0.02 to 0.23 per 1000 population).

Between 1960 and 1973 there was a consistent increase in snake bite cases at an average of 12.9 % per year. The six-year period from 1974 to 1979 showed an average annual increase of 0.56 %. In contrast, the mortality rate was the highest in 1961 and 1962 with a steady decline over the years to 0.27 % in 1979. The consistent increase in snakebite cases throughout the period was to be attributed to factors such as the increased speed of deforestation which forces snakes out from their natural niches to seek new environments near and around human habitation, implying that the serpents come closer to houses and gardens in search of prey. The decline of the mortality rate may be due to the availability of antivenom for treatment and perhaps most bites were inflicted by harmless snakes or by defensive biting.

A hospital-based retrospective study of the prevalence of snakebite cases at Hospital Kuala Lumpur (Jamaiah *et al.*, 2006) was carried out over a five-year period from 1999 to 2003. A total of 126 snakebite cases were recorded. Most of the cases were reported in the 11–30 year age group and the male/female ratio was 3:1. About 25 per cent of the cases (both suspected and confirmed) were inflicted by cobras, 10 per cent by vipers, 4 per cent by pythons and 1 per cent of the bites were inflicted by seasnakes. In 60 per cent of the cases the snake could not be identified. There were no fatal cases among the patients.

Thailand's snake fauna is as rich as that of Malaysia. According to Queen Saovabha Memorial Institute and Snake Farm, Thailand is the home of more than 180 snake species. The

various zoogeographic regions have important influences on the composition of the herpetofauna. Within Thailand, distinct distribution boundaries are recognizable. The Isthmus of Kra, the narrowest part of the Thai/Malayan peninsula, represents such a significant natural boundary. Many species south of this fauna shed do not occur north of it (Chan-Ard *et al.*, 1999). A large portion of the species inhabiting the central and northern parts of continental Thailand, on the other hand, shares traits with the herpetofauna of Indochina and Myanmar (*ibid.*).

Sawai *et al.* (1972) reported a total of 15 292 snake bite cases from 68 provincial hospitals between 1965 and 1969. The identified cases were 4851 or 31.7 per cent, whereas 9728 or 63.6 per cent were unidentified and 713 or 4.6 per cent were bites by non-poisonous snakes. Of the identified cases, 34 per cent came from the Malaysian viper (*Calloselasma rhodostoma*), 29.6 per cent by green vipers (*Trimeresurus*), 25.2 per cent by cobras (*Naja sp.*), 8.3 per cent by Russell's viper (*Daboia siamensis*, previously grouped with *Daboia russelii*; Thorpe *et al.*, 2007) and 2.9 per cent by other venomous snakes. The mortality rate of the Malayan pit viper was 1.6 per cent and a majority of all cases were found in the southern parts of Thailand. The mortality rate of cobra was 6.5 per cent, with the majority found in central and western parts of the country. Green pitviper bites were most frequent around Bangkok, while cases from Russell's viper were mainly recorded in central parts of Thailand. Despite some small errors in the statistical data, the study shows a mean number of deaths of about 75 persons per year (author's comment). Thailand has developed a rather good system with access to antivenom in medical clinics throughout the country.

A study (Meemano *et al.*, 1987) which stresses the prominence of green pitviper cases in and around Bangkok, shows that their share in this region is more than 90 per cent of total bites. Another study (Rojnuckarin *et al.*, 1998) deals with 278 patients attacked by green pitvipers admitted to Chulalongkorn Hospital from 1987 to 1995. No deaths due to bites by green vipers were reported at the hospital since the development and use of the specific antivenom.

The small country of Singapore, located roughly 130 km north of the equator, has a total land area (including the smaller islands) of 682 square kilometres. Since British colonization in 1819 most of the dense lowland tropical rainforest has disappeared with other terrestrial and freshwater habitats. This has drastically reduced the number of animal species, including snakes. Singapore is a very densely populated (4 million people) city state, albeit with some 2000 hectares of protected nature reserves. Of 55 different snake species historically found in Singapore, most are now threatened by extinction. Encounters with snakes and incidence of snakebites still occur. Snakes are not solely confined to the natural habitats but can also be found in built-up areas.

In 1984, a total of 50 snakebite patients were admitted for treatment in hospitals of the Ministry of Health. Most of the patients were not bitten in forests but at places of work, schools and recreational areas (Gopalakrishnakone *et al.*, 1990). According to Lim & Lee (1989), snakebites are uncommon, with an estimated 40 cases treated at hospitals each year. The mortality rate is low with only one death in the past three years (*ibid.*). A case of morbidity from the bite of a red-necked keelback snake (*Rhabdophis subminiatus*) was reported in 2000 (Seow *et al.*, 2000). This so-called non-venomous snake was kept as a pet. The patient recovered after hospital treatment.

Spread across more than 14000 islands, Indonesia's large population is dispersed and clustered on islands, large and small. On a geographical basis, Indonesia is conveniently, but informally, divided into the Greater Sunda Islands, including the Indonesian part of Borneo, Java, Sulawesi and Sumatra, and the Lesser Sunda Islands, which include, among other islands, Bali, Flores, Lombok, Sumbawa and Timor. In recent decades Indonesia has gone through dramatic environmental changes with areas of primary forest disappearing. According to Groombridge (1992), Indonesia loses annually between 6000 and 9000 km² of closed tropical wet forest. Indonesia is very rich in snake species, with about 240 land species recorded in the country. The figure excludes sea snakes and taxa restricted to the Malaysian part of Borneo, but includes those from Irian Jaya (David & Vogel, 1996).

The only report published on snakebites in Indonesia was carried out by Kawamura *et al.* (1975). The authors visited hospitals and health services in Java, Bali, Sumatra, Sulawesi, Kalimantan and Timor and collected historical records of patients and information on snakebites. The total number of cases were not available. About 50 % were due to green vipers (*Trimeresurus*), probably most by *Cryptelytrops albolabris* (formerly *T. albolabris*), with a mortality rate of 2.4 %. Thirty-three per cent of the bites were caused by the Malayan pit viper (*C. rhodostoma*) with a fatality rate of 3.5 per cent.

The most eastern part of Indonesia, Papua Barat/West Papua (formerly Irian Jaya), which is the western part of New Guinea, has not been subject to any snakebite study. The eastern part of the island, Papua New Guinea, has been studied by Campbell (1969), Currie *et al.* (1991) and Lalloo *et al.* (1995). As the whole island of New Guinea is located far east of the Wallace Line, the fauna differs much from that of the Sunda Islands and the rest of southeast Asia. New Guinea's snake fauna thus more resembles that of Australia where the elapids constitute the greater majority of snake species and the family Viperidae is not present.

In their study Swaroop & Grab (p. 74) state that in the Philippine Islands "relatively few poisonous reptiles are found and mortality from snakebite is therefore negligible. However, two coral snakes – *Doliophis bilineatus* and *D. philippinus* – are known to occur" [this should be Oriental coral snakes; the species are now considered subspecies of *Calliophis intestinalis*]. No source of data to support this statement is given. Although venomous, most of coral snakes are relatively small serpents, with small mouths, and generally considered incapable of inflicting an effective bite on an adult human, unless roughly handled (author's comment).

It is correct that the Philippines are inhabited by far less poisonous snakes species compared with continental parts of southeast Asia, but among scientists it has been known for a long time that the country is inhabited by the King cobra (*Ophiophagus hannah*), Wagler's pitviper (*Trimeresurus wagleri*, renamed *Tropidolaemus wagleri*) and three cobra species (*Naja*); *N.*

philippinensis, in the north, *N. samarensis* in the south and *N. sumatrana* on Palawan. The cobras can be considered the most serious snakes in the islands with respect to snake bite incidence and deaths.

Reyes and Lamanna (1955) reported a snakebite mortality rate of 1.26 per 100 000 population between 1928 and 1939, with most cases reported from the rice and sugar-growing regions of Luzon. During this period an average of 183 deaths were reported. The Diseases Intelligence Center of the Philippine Government reported that 294 died from snakebites in 1968, 237 or 81 per cent of the deaths occurred in Luzon and 36 or 12 per cent of fatal cases were reported in Mindanao (Sawai *et al.*, 1972).

Watt *et al.* (1987) confirmed in a study based on interviews with villagers in three agricultural areas, that cobra bite (*N. naja philippinensis*) was an important factor of deaths among rice farmers in the area studied. The death rate from cobra bite was estimated as high as 107.1 per 100 000 each year at one site. The confirmed death rate averaged 53.8 per 100 000 for the three villages.

The actual figures from Burma are very uncertain, but the country has a large number of venomous snakes species; cobras (*Naja* spp.), King cobra (*Ophiophagus hannah*), kraits (*Bungarus* spp.), vipers, especially Russells viper (*Daboia russelii*) and pit vipers (*Trimeresurus* sp. complex).

Swaroop & Grab (p. 63) states the following,

"As compared with other countries of the world, the incidence of snakebite in Burma is very high, the average being 15.4 per 100,000 population, with the district Sagaing recording as high a rate as 36.8 per 100,000. Of a total of 30 districts, 15 have snakebite death rates as high as 15.0 per 100,000 or over."

The average number of deaths for each year from 1935 to 1937 were 2072, according to Swaroop & Grab. Minton and Minton (1969) mentioned similar numbers and incidence, but their data were unsourced. When comparing these figures, it appears that Minton and Minton relied on Swaroop and Grab for data. In Burma, which seems to have the highest snakebite mortality in Asia, many serious cases are apparently caused by the *Daboia*

russelii (Aung-Khin, 1980; Myint-Lwin *et al.*, 1985; Naing, 1985). No data are available for Cambodia and Laos.

Published data available on the snakebite issue in Vietnam are outdated. From 1948 to 1952, 124 cases of cobra bites were treated in the Institut Pasteur, Saigon; of these two died. The Province of Cantho registered four deaths from snakebites in the period from 1948 to 1950 (Swaroop & Grab, 1954). Michael Barne, former Director of the Pasteur Institute Laboratory in Saigon reported a high incidence of fatal cases from seasnake bites. However, the exact number of cases cannot be confirmed due to the spread of superstitions about snakebite in many villages situated in areas far away from urban centres (Barne, 1963).

Information from the Ministry of Health (April, 2004) stated that some hospitals and research institutes in Vietnam have collected information about snakebite victims and their treatment for several years, but this information/statistics has not been published. Information by a doctor (April 2004) at the large Bach Mai Hospital in Hanoi revealed that about 70–100 snake bite patients in northern Vietnam and about 200–300 patients in southern parts of Vietnam. are treated at large hospitals each year,

The empirical parts of this paper is a field study to examine the snakebite incidence in the Cho Don district in the Bac Can province in northern Vietnam. This is the first field study of the snakebite problem in Vietnam.

THE FIELD STUDY

During the second part of September 2003 a field study was carried out in the Cho Don district (47 000 inhabitants, 2000) in the Bac Can province (280 700 inhabitants, 2000) in northern Vietnam. The field trip was carefully planned so that meetings with responsible medical staff could take place at all administrative levels in the areas investigated. To facilitate obtaining more reliable knowledge of the real snakebite situation, interviews and discussions took place with snakebite victims, their relatives and other community members.

The Cho Don district is located in a mountainous area of northern Vietnam. Most of the district is located at an altitude of 400–900 m. above sea

level, with mountains reaching above 1000 m. The district has a large cover of primary moist tropical rain forest and secondary forest after exploitation, intersected by river valleys and wet rice fields. Yearly rainfall is about 1800 mm concentrated during summer. The district is located around the 22nd parallel. The annual mean temperature is about 23° C, with an average high of 28 + C and an average low of 17°C.

The vegetation reflects the burn-beating that is practised in the area and is a mixture of moist tropical evergreen forest, different species of bamboo, woody brush, grasses and wet rice fields.

The first visit was made to the districts main clinic. Then visits were made to two communes (Nam Chuong and Bang Lang) in the Cho Don district. Nam Cuong commune is located about 60 km north of the district town Cho Don, and is reachable by a rudimentary road, using a 4WD jeep. The Bang Lang commune is located about 10 km south of Cho Don district town.

Cho Don District Clinic

The district has a total population of about 47 000 people. The clinic mainly serves Cho Don town and the surrounding countryside, but has also the role of assisting patients from the more remote villages in the district. Interviews and discussions took place with 5 doctors working at the clinic. They were responsible for medical treatment at the clinic and each of them had worked for many years at this particular location. In general the Cho Don Clinic received about 3 to 4 cases of snakebites each year. No casebooks were used, except for the king cobra case below, so the estimated 3 to 4 cases a year were based on experience.

At the clinic only one death owing to snakebite had happened since the year 2000. That year a 30-year old man had arrived at the clinic at 11 p.m., bitten by a king cobra, and had deceased 8 hours later at 7 a.m. Although this is a district clinic with a staff close to 20 doctors, there was no antivenom available and the only treatment possible was life-supporting treatment such as respiratory support. The medical staff at the clinic had no special training to deal with snakebite poisoning and consequently very limited resources to treat serious snakebite cases. During the interviews and discussions, a few of the doctors also expressed the

opinion that traditional healers probably were better to deal with snakebite patients than their own clinic! They also said that a majority of all snakebite cases were treated by healers rather than at the medical clinic.

According to the doctors at the clinic, there are three main causes of people being bitten by snakes: people walking in a forest searching for firewood, people working in ricefields and people searching for snakes, i.e. snake handlers or snake traders. The most common snake species involved are kraits, cobras and green vipers.

Nam Cuong Commune (Figure 1)

At the time of the visit, the Nam Cuong rural district had 3027 inhabitants distributed among 11 villages. The field visit took place in one village with roughly 300 inhabitants served by a small clinic headed by a nurse. The medical resources at this level are extremely limited and there are no possibilities to deal with snakebites. There are a few (3–4) cases in the village each year, but nearly all visit traditional healers. Since 2000 she (the nurse) had received three patients (1 in 2000, 2 in 2001), of which one died in 2001. No casebook was used, so this was a recollection. The two cases which survived were, according to the nurse, caused by cobras.

The fatal case took place in September 2001. Early in the evening a male, 30 years of age, went out fishing after a rain had ceased. He put a bait (a piece of meat) in a net and then placed the net just below the water surface in the dam, located in the village. When he returned late in the evening, he noticed an object floundering in the net where he had placed the bait. He assumed it was a fish and grasping it he was immediately bitten. He killed the snake, then went home, but because he did not feel any symptoms he went back fishing. After a few hours he felt difficulties in breathing and returned home (interview with his wife). A few hours later he died, mainly due to respiratory failure. Based on the description of the snake, it was probably a krait (*Bungarus fasciatus* or *B. multicinctus*).

From interviews in the village, it is clear that most cases of snakebites are dealt with by traditional healers still practising their ancient medicine in the area. Another snakebite case in the same village took place in 1998. A girl of 18 was



Figure 1. The dam in Nam Cuong Commune. © S. Eriksson.

resting in her bed. At 3 p.m. she stepped down directly on a cobra lying on the floor and was bitten in a foot. She suffered immediate effects from the bite and became unconscious after about one hour. The victim was sent to a traditional healer and then brought back to her home where she slowly recovered. She suffered from necrosis in her foot and went through surgery at the district clinic. Altogether the community has an annual snakebite incidence of about 10 bites per 1000 population, which is a high figure.

Bang Lang Commune (Figure 2)

This district had 1453 inhabitants, distributed among 9 villages, with one common health clinic. According to the medical staff about 3–4 snakebite victims visit the clinic each year. No medical casebooks are used, so these figures are based on memory. In 2002 there were 3 cases. The victims were working in the forest looking for firewood or animals. According to the doctors most cases are dealt with by traditional healers. None of the cases in recent years had been fatal. The medical staff told of a case in the late 1990s or early 2000s: A woman had been bitten at about 8 p.m. while searching for firewood. According to the doctors, the offending snake was a krait (no particular species identified) and the patient died eight hours later.

Visits were also made to two villages in the Bang Lang commune. The first village had about 200 inhabitants. The author interviewed a man

who was 46 years old at the time of the bite (spring 2002). He was bitten by a snake at 6.30 p.m. while walking in the ricefield on his way home. He stepped on the snake and experienced an intense pain shortly after the bite. His foot and leg swelled and began bleeding from the punctures, which are typical symptoms of viper bites. According to the victim, the snake had a length of about 60 to 70 cm, was greyish and had a triangular head which was broader than the body. This description matches that of a viper.

In this case the man first went to the rural clinic, where he received a tourniquet around his leg and cleaning of the wound. Later he went to a traditional healer to be treated with customary herbs. After about one week the patient recovered. He estimated that two or three persons in the village were bitten by snakes each year and recalled that one person in a neighbouring village had died from a snakebite a few years ago but said it was not the woman searching for firewood earlier mentioned. The medical staff at the commune clinic had no knowledge of the case. According to this man most snakebites were caused by cobras, kraits and green vipers.

The author visited another village in Bang Lang rural district. The village had about 150 inhabitants. An interview was made with a woman (41 years old in 2001) who had suffered from a snakebite in August 2001. At lunchtime she went out in the forest close to the village in search of firewood. She was bitten in the foot and felt intense pain and the wound began bleeding. In a short time the leg became very swollen. She went to a traditional healer who treated her with herbs and some kind of drinkable fluid.

Regarding the offending snake, the woman said it was a krait. She said she knew nothing about snakes, but a neighbour had told her that it probably was such a snake. However, the symptoms do not support a bite from krait. They are typical of viper envenomation. Kraits are usually very timid during daytime and very

inclined to bite during the night (author's comment). At the interview she said that the snake was yellow or brown, about 80 cm in length, and had a broad triangular head. This description indicates that the snake was a viper. The patient recovered after a month, although she still had scars on her foot.

The woman knew at least 3 other snakebite cases in the village during the previous two years, all had recovered. None had been in contact with the clinic. Throughout the years she was not aware of anyone bitten by snake having sought treatment at the clinic.

Both villages seem to have a snakebite incidence of about 10 bites per 1000 population, which is similar to the rate estimated for the village in Nam Cuong commune.

DISCUSSION

This case study investigates snakebite incidence in two communes in the Bac Can province in northern Vietnam. The investigation indicates a relatively high snakebite incidence, which can partly be explained by a completely rural population working in an environment dominated by agriculture and outdoor activities. Another factor explaining the high incidence is this study's reliance on interviews rather than clinical data, thus incorporating snakebite cases not known to clinics. In the three villages investigated there was one known death in the period 2000–2002. The three other deaths were from villages not included in this study.

In Vietnam there are no snakebite data collected, neither on a local nor on any other administrative level, except unpublished data from a few hospitals and institutes. In the investigated communities no medical casebooks were used, except in one case. Another important factor behind inadequate knowledge about snakebite incidence is the victims' decisions to visit traditional healers instead of seeing a medical clinic. From this field study there are no data



Figure 2. Typical environment at Bang Lang Commune. © S. Eriksson.

showing the share of people visiting traditional healers, but a rough estimate is that less than 20 per cent of the snake-bite victims visit a clinic. Those visiting the healers include victims with mild cases as well as more serious ones.

With their limited resources the clinics have very little to offer. Their capacity to treat serious cases is curtailed as they lack antivenoms. The field study also revealed that some of the doctors interviewed expressed the opinion that traditional healers were better at dealing with snakebite cases than modern medicine! This also implies another serious medical as well as structural problem when dealing with these issues. In the light of the scanty clinical data available and the interviews with the villagers, most serious snakebite cases take place in the evenings and nights. People are bitten in the forest while collecting firewood or walking along small paths. People working in ricefields are also prone to snakebites and according to staff at the clinics it is not uncommon for snakebites to occur among persons deliberately handling venomous snakes, i.e. mainly snake collectors. Most serious cases seem to be caused by cobras and kraits.

But there are some sources of error in making such a statement. During the evening and night it can be difficult to identify snake species and many people have a very limited knowledge of snakes. If a correct identification of the snake cannot be made, the symptoms are usually a good guidance.

Venoms of elapids (cobras, kraits, etc) generally produce neurotoxic symptoms, causing respiratory paralysis, acute heart failure etc. Bites by some kraits causes no local pain or swelling and the effect can be delayed for some hours, such as the case from Nam Cuong. Otherwise the symptoms are similar to those of cobra bite. Most bites from elapids can be avoided by wearing protective boots when walking in fields and forests. Other cases reported in the study and oral information received during the field trip reveal that vipers are an important source of snakebites. Mostly referred to are green tree vipers but these snakes are seldom the cause of serious problems. However, their bite incapacitates the patient for some days or a week. In this study there were also two suspected bites from terrestrial vipers, although the species were not identified.

There are clear indications that the snakebite problem in Vietnam is more serious than in many other southeast Asian countries. Vietnam has a large rural population, limited medical resources at rural and district clinics and lack of antivenom treatment. In more economically developed countries, such as Malaysia and Thailand, better medical resources are available, including general access to antivenom.

Based on this pilot project there are a number of reasons to learn more about humans and snakebites in Vietnam:

* There is a need to know more about the extent and structure of snakebites in Vietnam's provinces. Additional information obtained after the field study (during 2004–2005) reveals that antivenom is not deployed in provincial hospitals and is also lacking in most city hospitals. This implies that a large number of snakebite victims in Vietnam do not receive antivenom treatment.

* Consideration should also be given to the situation in other parts of Vietnam, with divergent geographical characteristics such as altitude, vegetation, population density and occupation patterns. There are also some differences in the number and composition of snake species between northern and southern Vietnam.

* It is also important to reflect on what appropriate measures could be taken for the future.

ACKNOWLEDGEMENTS

Many thanks to faculty at the Center of Environmental Economics and Regional Development at NEU, Hanoi, who assisted me in planning and conducting the field trip. Special thanks to Dr Le Thu Hoa at NEU, who also assisted with information from the Ministry of Health and Bach Mai Hospital, Hanoi. Thanks are also due to Dr Le Van Hoi (MD, MSc) who prepared the visits to the clinics and translated the conversations throughout the field trip.

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