

# POTENTIALLY HAZARDOUS ENVIRONMENTAL FACTORS FOR POISONING IN RURAL VIETNAM: A COMMUNITY-BASED SURVEY

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**Abstract.** Poisoning represents one of the most common threats against public health. This population-based study was undertaken to identify potentially hazardous environmental factors for poisoning in Vietnam, and thereby to improve the background information needed to take adequate preventive measures. The study population comprised 3,814 individuals from 942 randomly selected households in Phu Tho Province. Their mean age was 32.7 years, 50.4% were male. Data collection methods included face-to-face interviews using a structured questionnaire, and reality observations following a structured checklist. Of the study population, 438 individuals (11.5%) recalled having suffered from at least one episode of symptomatic poisoning. The toxic agents most commonly involved in these incidents were pesticides (68.7%). Hazardous exposure to toxins was reported to occur frequently and pesticides were again the agents most commonly involved. The presence of insecticides and other pesticides in the home were common (39%) and 21.7% of studied households kept poisonous chemicals in places easily accessible to children. Nearly half the households kept medications at home, often without any medical safe-box. Fifty-six point two percent reported prescriptions were not necessary for purchasing pharmaceuticals. Common habits among household members put them at risk for poisoning by natural toxins. Among these, frequent use of unusual herbs, and the practice of raising and eating poisonous animals were most important. In conclusion, the widespread use of pesticides, risk for exposure to natural toxins and self medication constitute major hazards for poisoning in Vietnam. Effective control regulations and safe strategies are lacking.

**Key words:** poisoning, environmental factor, pesticide, toxin, Vietnam

## INTRODUCTION

Poisoning is one of the most common threats to public health worldwide (Peden *et al*, 2002). Defined as drug overdose, food poisoning, or symptomatic exposure to an

environmental toxin, poisoning is a pervasive health care problem. The panorama of frequently occurring toxins and exposure hazards differs considerably from country to country. Thus, epidemiological studies with toxicological surveillance data for each country are necessary to determine countries' specific problems and risks, so that preventive measures can be taken. However, toxico-epidemiological data from developing countries are sparse

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(Peden *et al*, 2002). Moreover, most published studies on acute poisoning are hospital-based (Liu *et al*, 1997; Fathelrahman *et al*, 2005; van der Hoek and Konradsen, 2006) and the reports are often based on data from highly selected patient populations. Examples of published surveys of poisoning in rural areas of different developing countries are from Brazil (Presgrave *et al*, 2008), Malaysia (Fathelrahman *et al*, 2005) and Thailand (Wanankul *et al*, 2007).

Vietnam is a low-income, agricultural country in which toxic exposure is common, and poisoning has had an important impact on public health. Vietnam has an area of nearly 330,990 km<sup>2</sup> and a population of approximately 85 million. We recently reported characteristics of and clinical findings in patients with acute poisoning admitted to the first toxicological intensive care unit in northern Vietnam (Hung *et al*, 2008). The aim of the present study was to identify the most commonly occurring exposure hazards and other risks of acute poisoning in rural areas of northern Vietnam, and to improve the background information needed to take adequate preventive measures.

## MATERIALS AND METHODS

This cross-sectional population-based epidemiological study was conducted in Phu Tho Province, northern Vietnam during the year 2008. This province is situated at the apex of the Red River delta linking Hanoi with the northern mountainous provinces (Fig 1). Its area is 3,519 km<sup>2</sup>, corresponding to 1% of the whole country, and its population in the year 2006 was about 1.3 million, approximately 1.5% of the total country population. The rural population of Phu Tho accounts for 85% of its total inhabitants, a proportion which resembles that of all of Vietnam. There are



Fig 1—Map of Vietnam and Phu Tho Province.

13 local administrative regions (11 districts, one city, and one township) in Phu Tho Province, comprising a total of 273 communes. Among these, 2 out of 12 communes in Lam Thao District were chosen as the study setting. The inhabitants of these two communes are representative of Vietnam regarding occupational distribution and the communes are typical of Vietnam regarding population density and nature of agriculture. The main crops in the study area are rice and different kinds of vegetables, similar to most of rural Vietnam.

The study population initially comprised 1,000 randomly selected households in the two above mentioned communes, which consisted of 23 villages. After giving informed consent, 942 households comprising 3,814 individuals, were finally enrolled in the study. The data col-

lection methods included face-to-face interviews using a structured questionnaire, and reality observations following a structured checklist. The questionnaire covered information about demographic features and general epidemiological points, poisoning events, and risk factors for poisoning. Poisoning was defined as drug overdose, food poisoning, or any symptomatic exposure to an environmental toxic substance. The checklist included the presence of pesticides, other toxic chemicals, pharmaceuticals, or drugs of abuse at home, and safe storage methods, equipment for preparation and use of pesticides, and existence of poisonous plants or animals. Pesticides commonly used in Vietnam include insecticides (mostly organophosphorus compounds and carbamates), herbicides, and rodenticides (several toxic agents).

## RESULTS

Of the total study population of 3,814 persons, 1,921 (50.4%) were male. Their mean age was  $32.7 \pm 19.7$  (range 1 - 94) years. The study population consisted of 942 families (households). The mean number of family members was  $4.0 \pm 1.2$  (range 1-8) people. A majority of the study population were agricultural workers. Other common occupations were students, industrial laborers and commercial workers (Table 1).

Hazardous exposure to toxic agents commonly occurred. Pesticides and other chemicals used in agriculture were the most frequently involved toxic compounds (Table 2).

Of the total study population, 438 individuals (11.5%) recalled having suffered from at least one symptomatic episode of acute poisoning. The toxic agents reported to be most commonly involved in these

Table 1  
Occupational distribution of the study population.

Occupation	<i>n</i> (%)
Agricultural worker	1,981 (51.9)
Student	917 (24.0)
Industrial worker	332 (8.7)
None	254 (6.7)
Commercial worker	97 (2.5)
Small child	48 (1.3)
Housewife/husband	7 (0.2)
Other or unknown	178 (4.7)
Total	3,814 (100)

Table 2  
Occurrence of hazardous exposure to toxic agents.

Toxic agent	Household, <i>n</i> (%)
Insecticides	783 (83.1)
Herbicides	601 (63.8)
Household products	223 (23.7)
Rodenticides	202 (21.4)
Adulterant chemicals	23 (2.4)
Industrial chemicals	22 (2.3)
Preservation chemicals	19 (2.0)
Toxic gases	1 (0.1)

incidents were different kinds of pesticides (Table 3).

Among the studied households, 48 (5.1%) reported having at least one family member with some chronic medical consequence of a poisoning. None of these sequelae was life-threatening, but were graded as mild to moderate. Examples of these chronic symptoms included general tiredness, weakness and numbness of distal extremities. They were most commonly (71%) the consequence of exposure to pesticides.

Table 3

Toxic agents reported to have been involved in the most recently occurring symptomatic poisoning episode among the study population.

Toxic agent	<i>n</i> (%)
Pesticides	301 (68.7)
Pollution	8 (1.8)
Other chemicals used in agriculture	5 (1.1)
Food poisoning	4 (0.9)
Industrial chemicals	2 (0.5)
Medications	1 (0.2)
Other or unrecognized	117 (26.7)

Table 4

Toxic agents kept at home.

Toxic agent	Presence in household, <i>n</i> (%)
Insecticides	294 (31.2)
Chemical household products	274 (29.1)
Herbicides	44 (4.7)
Rodenticides	21 (2.2)
Adulterant chemicals	6 (0.6)
Industrial chemicals	4 (0.4)
Preservation chemicals	3 (0.3)
Other toxic chemicals	119 (12.6)

Table 5

Sources of information concerning methods of safely keeping toxic agents at home.

Source of information	Households, <i>n</i> (%)
Seller	479 (50.8)
Agricultural expert	303 (30.2)
Self-learning from other sources	293 (31.1)
Media	275 (29.2)
Relatives, friends, neighbors	97 (10.3)
None	66 (7.0)

Concerning the presence of toxic agents in the home, different pesticides were again the most common. Other common toxic agents kept at home were household chemical products and agrochemicals (Table 4).

A majority of households had obtained knowledge regarding safely storing toxins directly from sellers. Only one-third of households had received the necessary knowledge to correctly store chemicals from an appropriate person such as an agricultural expert. Approximately 7% of households had not been given any information concerning safely storing chemicals (Table 5).

Among the studied households, 204 (21.7%) reported that they had kept poisonous chemicals in places accessible to children, and 505 (53.6%) had never locked chemical storage boxes or drawers. One hundred thirty-one households (13.9%) had not kept hazardous chemicals in their original containers, and among these, 33 (3.5%) had used food containers to keep poisonous chemicals. More than a fourth of the households (27.7%) did not have a habit of explaining to their children about the risks of toxic chemicals.

The risk of overdosage of pharmaceuticals was also seen in this study. Nearly half the households kept medications at home, but only one-fourth had any medical safe-box. A large proportion of households (56.2%) reported prescriptions were not necessary for purchasing pharmaceuticals.

Some common habits of the studied households put their members in danger of poisoning by natural toxins. Among these, frequent use of herbs, and raising and eating poisonous animals, were the most important hazardous practices (Table 6).

Table 6  
Possible risk factors for natural toxin poisoning.

Possible risk	Households, <i>n</i> (%)
Collection and ingestion of unusual herbs <sup>a</sup>	292 (30.1)
Use of poisonous animals as food	241 (25.6)
Honey collection from bee and wasp nests	125 (13.3)
Raising poisonous animals	86 (9.1)
Ingestion of animal gallbladders	30 (3.2)

<sup>a</sup>After advice from quacks in approximately half the households.

When observing the problem with their own eyes, the interviewers found pesticides were present in 369 of the households (39%). Pesticides were most commonly kept in containers without a lock (97.5%). The presence of pharmaceuticals at home was found in 564 households (60%). Besides bees' nests, which were common, venomous snakes were seen to be raised in 75 of the households and poisonous toads in 14.

## DISCUSSION

The major finding in this study was that the availability and accessibility of pesticides constitute the main risk factor for poisoning among ordinary people in Vietnam. This is partly explained by the fact that many kinds of highly toxic insecticides, herbicides, and rodenticides are widely available and commonly used in Vietnam, and partly by the lack of effective regulations and strategies to reduce this threat to public health. Acute poisoning by agricultural pesticides is a well established public health problem in developing countries, with an estimated 300,000 deaths annually worldwide (Gunnell and Eddleston, 2003). Previous scientific reports have suggested that the widespread availability of pesticides in rural commu-

nities is a crucial risk factor in the majority of fatal self-poisonings (Eddleston and Phillips, 2004; Konradsen *et al*, 2006). Easy accessibility of pesticides to adults and children is also a reality in many developing countries, such as Sri Lanka and China (Liu *et al*, 1997; Hawton *et al*, 2009). This fact requires a prompt poison-prevention approach to reduce the availability of pesticides, especially those that are most toxic.

A second finding in this study was that another important source of toxins in rural areas of Vietnam is its poisonous flora and fauna. The hazardous habit of ingesting and otherwise using unusual and unknown herbs reflects the fact that remedies and traditional medicines are popular in this area, and many Vietnamese people do not believe herbs are toxic. The lack of necessary public information and control regulations makes the situation worse. This is an important problem not only in many Asian countries but also in other parts of the world (Liu *et al*, 1997; Deng, 2002). The belief that ingestion of poisonous animals is good for health has resulted in the fact that many households raise venomous snakes for economic reasons, and life-threatening envenomations are not uncommon in Vietnam (Hung *et al*, 2009).

Another risk factor for poisoning found in this study was the availability and inadequate storage of hazardous household products. Such products were commonly within reach of children and were sometimes stored in beverage bottles, thereby constituting a risk for unintentional poisoning. This finding is consistent with previous reports from other regions (Sawalha, 2007; Wananukul *et al*, 2007; Presgrave *et al*, 2008).

Self-medication, through retail pharmacies without professional consultation, was commonly found in this study. The problem of drug utilization and self-medication in Vietnam has been reported previously (Okumura *et al*, 2002). In a recently published hospital-based study on poisoning in Vietnam (Hung *et al*, 2008), pharmaceutical overdose was recorded as one of the most common types of acute poisoning.

The limited sample size and cross-sectional design of this epidemiological study make it impossible to draw any conclusions from the results regarding the incidence of severe poisoning in Vietnam. Moreover, the question in the interview questionnaire concerning previously occurring poisoning episodes was not possible to be validated, and therefore constitutes another limitation of the study. However, to our knowledge, this is the first population-based study in English regarding hazardous environmental factors for poisoning in Vietnam.

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