



# Unintentional injuries over a 1-year period in a rural Vietnamese community: describing an iceberg

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## KEYWORDS

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**Summary Objectives.** To document unintentional injuries in a rural community over a 1-year period as a basis for prioritizing preventive activities.

**Study design.** Quarterly home visits over 1 year to elicit experience of injury among household members in the preceding 3 months.

**Methods.** In total, 24,776 people living in rural communities in the Bavi District, Northern Vietnam, were surveyed in home visits during 2000. In the home visits, injuries that needed care or disrupted normal activities were recorded, together with their circumstances.

**Results.** Overall, 2079 new non-fatal injuries were recorded over 23,338 person-years, a rate of 89/1000 person-years-at-risk. Males had a significantly higher injury rate than females for all age groups except for those aged 35-59 years and the elderly ( $P < 0.05$ ). The elderly were at highest risk of injury ( $P < 0.05$ ), particularly females. Home injuries occurred at the highest overall rate, particularly among the elderly. Road traffic injuries were most common among children. Most injuries involved contact with another object. Less than one-quarter of injury victims sought care at a health facility.

**Conclusions.** Community-based household surveys revealed the hidden part of the injury iceberg, as well as showing high incidence rates, indicating that injury is an important public health problem which should be a priority for intervention in rural Vietnam, and probably elsewhere. This comprehensive study is intended to contribute evidence and methods to the Ministry of Health's national programme for injury prevention, and to a wider audience.

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‡ Sadly, our colleague Professor Ton That Bach died suddenly during the final stages of this study. His great contributions to the research community in Vietnam are sorely missed and we would like to dedicate this paper to his memory.

## Introduction

Unintentional injury is a major global public health issue,<sup>1</sup> but its impact is often overlooked in poorer

countries due to inadequate or inaccessible health facilities and a lack of reporting systems.<sup>2</sup> Actual incidence thus varies considerably with recorded injuries in different settings, and statistical reports often only present the tip of the iceberg.<sup>3</sup> Reported patterns of injury that rely on retrospective health facility data should certainly be regarded with suspicion. Furthermore, rapid development and industrialization in many countries is profoundly affecting patterns of injury as occupational and lifestyle hazards change.<sup>4</sup>

In Vietnam, injuries are an increasing problem, particularly since *Doi Moi* political reforms started in 1986. From 1989 to 1998, police statistics showed an increase of 274% in fatal road traffic accidents and 404% in injuries. The rate of traffic accidents increased from 7.1 per 1000 inhabitants to 24.9, and fatalities rose from 3.9 to 7.4, giving Vietnam one of the highest rates in the world.<sup>5</sup> According to the Traffic Safety Community, there were 10,477 deaths due to traffic accidents in 2001.<sup>6</sup> The crude injury mortality rate in Vietnam was estimated to be 189/100,000 person-years from a cross-sectional survey.<sup>7</sup> Injury data from non-comparable sources have been variously reported from the Ministry of Health, the Ministry of Labour, Invalidity and Social Welfare, the Ministry of Transport and others.<sup>8</sup> This makes the planning and implementation of effective injury prevention very difficult. The Ministry of Health also initiated a national programme on injury prevention and safe communities in 1996, achieving remarkable results within a short time, although further studies and improvements are needed. Therefore, a priority for policy development is epidemiological research at the household level, to establish a more complete community-based picture of injuries in Vietnam<sup>9</sup> and thus characterize the submerged part of the iceberg.

An epidemiological field laboratory was established in Northern Vietnam in 1999. This study used that framework, building on a previously reported pilot study that presented methods and patterns of injury elicited from a single household survey using 3-month recall.<sup>10</sup> A longitudinal picture of household injury events during the year 2000 has been compiled from four quarterly surveys to give a comprehensive picture of all types and circumstances, and to identify risk groups, hazardous environments and major causes of unintentional injury in a defined rural Vietnamese community.

## Methods

The study took place in Bavi District, Hatay Province, 60 km west of Hanoi, in Northern

Vietnam. Bavi District has 32 communes and covers 410 km<sup>2</sup>, including lowland, highland and mountainous areas, with a total population of approximately 235,000 in 1999. The commune is the lowest level of local government organization. In this mainly rural area, farming and livestock breeding are the main economic activities of 81% of the people, and the major products are wet rice, cassava, corn, soybean, green beans and fruit. The main income is from rice production, averaging 290 kg/person/year in 1996 (equivalent to approximately US\$ 40). An epidemiological field laboratory was established in Bavi District in 1999, called FilaBavi. Surveillance initially covered about 51,000 people living in 11,000 households in a dynamic cohort formed by randomly selecting village clusters with probability proportional to size. This surveillance site is described in detail elsewhere.<sup>11</sup>

The following definitions were used in this study. Injury denoted the somatic medical consequences of an accident. An accident was defined as 'a sudden, unexpected series of undesired occurrences in the interplay between individual and environment which led to personal injury'.<sup>12</sup> The definition excluded intentional injuries. Unintentional injuries typically comprised road traffic accidents, poisonings, falls, burnings, scaldings, drownings and submersions, accidents caused by machinery, cutting and piercing instruments, plus all other accidents including late effects, drugs and medications causing adverse effects.

The injury questionnaire included details of place and mechanism of injury together with victims' activity at the time of injury according to the Nordic Medico-Statistical Committee (NOMESCO) classification.<sup>13</sup> Additional information on care-seeking behaviour, severity and consequences of injury was collected. Free-text descriptions were used to cross check information coded by interviewers. Background variables were available from routine FilaBavi surveillance. FilaBavi fieldworkers were specially trained for the injury questions and performed quarterly interviews in respondents' homes. At each interview, heads of household were asked whether any household member had sustained any non-fatal injury in the last 3 months, with the intention of interviewing each injury victim individually. If the injury victim was not at home or was a child (under 15 years), the head of the household or a household member who knew about the injury was interviewed as a proxy respondent.

An injury was included in the study when it was serious enough to meet any of the following conditions: need for any kind of medical care; need to stay in bed for at least 1 day; or need to stop

regular work or activity for at least 1 day after injury. Injuries were also categorized according to the place and the main activity performed by the victim at the time of injury.

Data quality control was monitored by the researchers and five full-time field supervisors. The field supervisors had various types of medical qualification and were trained to detect and deal with problems in the field. The researchers checked 15% of all completed questionnaires randomly. If information was missing or errors were detected, the supervisors as well as the researchers returned the questionnaires to the interviewers for correction. To assess the reliability of collected information, 5% of the study population, selected at random, was re-interviewed. No major problems were identified.

Using FilaBavi as a sampling frame, our previous pilot study identified 23,807 individuals in 30 village clusters as a target population for a household injury interview, and this same sample was retained as the basis for the four quarterly injury incidence surveys described here. Thus, in principle, each household in the sample was under surveillance for a 1-year period, more or less corresponding to the year 2000. However, in practice, interviews had to be staggered as illustrated in Fig. 1, and a minority of individuals were only present for part of the year as a result of births, deaths and migrations. Using this approach, it was possible to determine person-years-at-risk (PYAR) on an individual basis as the denominator for injury incidence.

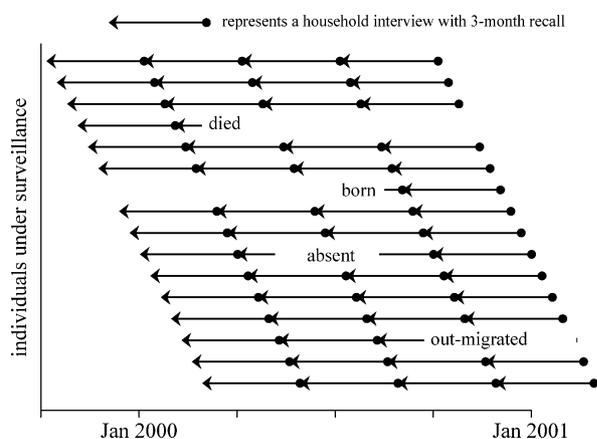
Data were managed using Epi-Info version 6.04 and dBase IV, and analysed using Cohort (Umeå University) and Stata. Injury incidence rates and 95% confidence intervals were calculated. Rate ratios for gender, age/occupation groups and geographic areas were determined using a Poisson

regression model. Significant differences between incidence rates were noted where the 95% confidence interval of the rate ratio excluded unity.

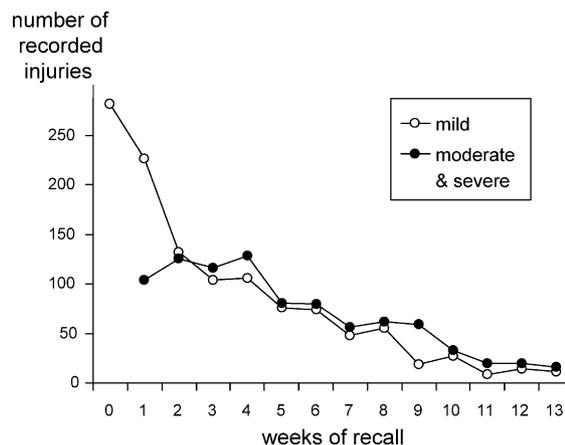
The Research Ethics Committee at Umeå University gave ethical approval for the FilaBavi household surveillance system, including data collection on vital statistics (reference number 02-420). Specific approval for the injury investigation was given by Karolinska Institute, Stockholm, and by the Ministry of Health, Hanoi. Informed consent for the interviews was obtained from heads of household and injury victims by the interviewers.

## Results

In total, 24,776 people living in the study area were surveyed. Of these, 1917 reported 2079 new non-fatal injuries during the four 3-month periods of observation. Recall of injuries diminished considerably over each 3-month period, particularly for mild injuries (defined as incapacitating the victim for less than 1 week), as shown aggregated in Fig. 2. Over the whole period, 136 people were injured twice and 13 were injured three times. This pattern of injury recurrence among individuals differed significantly from a Poisson distribution, in which 82 individuals would have been expected to sustain multiple injuries ( $P < 0.001$ ). There were 23,338 person-years observed among 24,776 people (mean individual time of observation 0.94 years). The majority (59%) of the person-time was in the working age group (15-59 years). The male to female population ratio was 0.93:1. The overall rate of injuries was 89/1000 PYAR (95% CI 85-93/



**Figure 1** Conceptual framework of quarterly surveillance over a 1-year period on an individual basis.



**Figure 2** The effect of recall over a 3-month period in reporting injuries, by severity (mild injuries defined as incapacity for less than 1 week), in a rural Vietnamese community.

**Table 1** Injury incidence rates by age and gender in a rural Vietnamese community for the year 2000.

Age group (years)	Incidence rates per 1000 person-years-at-risk (95% CI)		
	Males	Females	Total
0-4	77 (60-95) <sup>a</sup>	48 (33-62)	63 (52-75)
5-14	130 (117-144) <sup>a</sup>	62 (53-72)	97 (88-105)
15-34	105 (95-115) <sup>a</sup>	62 (54-70)	83 (77-90)
35-59	94 (83-105)	82 (72-92)	87 (80-95)
60+	91 (72-111)	126 (108-142) <sup>a,b</sup>	113 (100-126) <sup>b</sup>
Total	105 (99-111) <sup>a</sup>	75 (70-79)	89 (85-93)

<sup>a</sup> Significantly higher incidence rate between males and females.

<sup>b</sup> Significantly higher incidence rate among age groups.

1000), shown by age and gender in Table 1. Males had a higher injury rate than females for all age groups except for those aged 35-59 years and old people aged 60 years and above ( $P < 0.05$ ). The elderly were at highest risk of injury ( $P < 0.05$ ). Some seasonal variation was observed in overall injury rates, with monthly rates ranging from 57 to 115/1000 PYAR.

Table 2 shows some basic risk factors for injury, presented as bivariate rate ratios and multivariate

(adjusted) ratios, using a Poisson regression model in which individual person-time was the rate multiplier. Age and occupation have been combined into a single factor so that children and elderly people can be seen alongside different adult occupational groups. Gender, age/occupation and geographic area were all significantly related to the risk of injury. The lowest overall risk was observed in adult women engaged in service industries in the highlands (RR 0.49), and the highest was observed among elderly men in the mountains (RR 1.6).

Severe injuries, defined as causing a temporary disability for at least 30 days, comprised 7.8% of the total, whilst 35.4% were moderate injuries (7-29 days' disability). The first care-seeking behaviour following injury involved public health services in only 476 cases (22.9%). The relationship between severity and care-seeking behaviour is shown in Table 3.

Incidence rates by circumstances and mechanism of injury according to the NOMESCO classification, presented by age/occupation groups, are shown in Table 4. Home injuries had the highest aggregate rate (37/1000 PYAR), followed by road traffic injuries and work-related injuries. Home injuries among the elderly were particularly frequent

**Table 2** Risk factors for injury in a rural Vietnamese community, expressed as multiplicative injury rate ratios from a Poisson regression model (95% confidence intervals).

Parameter	Value	Bivariate rate ratio (95% CI)	Multivariate rate ratio (95% CI)
Gender	Male	1, reference	1, reference
	Female	0.72 (0.66-0.78)	0.70 (0.64-0.77)
Age/occupation	15-59 years—farmers	1, reference	1, reference
	15-59 years—services	0.74 (0.58-0.94)	0.72 (0.56-0.91)
	15-59 years—others	0.91 (0.80-1.03)	0.82 (0.72-0.94)
	<15 years	1.06 (0.95-1.07)	1.02 (0.92-1.13)
	≥60 years	1.22 (1.06-1.40)	1.26 (1.10-1.45)
Geographic area	Lowlands	1, reference	1, reference
	Highlands	0.97 (0.87-1.08)	0.97 (0.87-1.08)
	Mountains	1.28 (1.14-1.44)	1.30 (1.15-1.47)

**Table 3** Numbers of injuries (%) by severity in relation to first care-seeking behaviour in a rural Vietnamese community during 2000.

Care-seeking behaviour	Severity of injury			
	Severe (30+ days disability)	Moderate (7-29 days disability)	Mild (<7 days disability)	All injuries
Health services	83 (51.2%)	206 (28.0%)	187 (15.8%)	476 (22.9%)
Other providers	53 (32.7%)	199 (27.0%)	208 (17.6%)	460 (22.1%)
None or self-treatment	26 (16.0%)	331 (45.0%)	786 (66.6%)	1143 (55.0%)
Total	162 (100%)	736 (100%)	1181 (100%)	2079 (100%)

**Table 4** Incidence of injury/1000 person-years-at-risk (95% CI), by circumstances and mechanisms of injury and age/occupation group, in a rural Vietnamese community during 2000.

	Age (years)/occupation group					Total
	0-14	15-59 farm-ers	15-59 ser-vices	15-59 others	60+	
<i>Circumstances of injury</i>						
Home	34 (30-38)	31 (28-35)	24 (15-33)	32 (27-38)	76 (66-87) <sup>a</sup>	37 (35-39)
Road traffic	30 (26-34)	24 (21-27)	27 (18-37)	24 (19-29)	21 (16-27)	26 (24-28)
Work-related	4 (2-5)	26 (23-29) <sup>a</sup>	8 (3-13)	17 (13-21)	11 (7-15)	15 (14-17)
School	11 (8-13) <sup>a</sup>		0.5 (0-1)	3 (1-4)		4 (3-5)
Others	11 (8-13)	6 (4-8)	5 (1-9)	9 (6-12)	2 (0.4-4)	7 (6-9)
<i>Mechanism of injury</i>						
Cutting, crushing	16 (13-19)	24 (20-27)	11 (5-18)	22 (17-26)	16 (11-21)	20 (18-22)
Hit by contact with object etc.	33 (29-37)	42 (38-46)	33 (23-44)	39 (32-45)	30 (23-37)	38 (36-41)
Fall	25 (21-28)	18 (15-21)	14 (7-21)	19 (15-23)	64 (54-74) <sup>a</sup>	25 (23-27)
Burn and scald	8 (6-10)	2 (1-3)	3 (0-6)	3 (1-4)	2 (0-4)	4 (3-5)
Others	2 (1-3)	2 (1-3)	3 (0-6)	3 (1-5)	0.4 (0-1)	2 (2-3)

<sup>a</sup> Significantly higher incidence rate compared with other age/occupation groups.

(76/1000 PYAR) and work-related injuries were particularly associated with agriculture (26/1000 PYAR). Road traffic injuries were most common among children (30/1000 PYAR). Being hit by another object was the most common mechanism in all age/occupation groups except for the elderly, where falls dominated. Falls that took place in the home represented a major proportion of injuries among the elderly. Bicycles were involved in almost half of the cases of road traffic injuries (48%) and motorcycles were involved in 25%, while only three injuries (0.5%) occurred in people travelling in vehicles. Traffic accidents generally resulted in longer periods of disability compared with other types of injuries. Among work-related injuries, being hit by objects was the most common cause (42%). Cuts to the feet accounted for 62% of work-related injury cases, often related to farmers stepping on broken glass or glazed terracotta in their fields.

The purpose of the activity that the victim was engaged in at time of injury was recorded. The majority of the injuries occurred during unpaid work such as cooking, household maintenance and caring for children (35%), followed by road travel (32%) and working for income (12%). Females were more often injured during unpaid work.

## Discussion

Even though this study only recorded injuries that needed care or disrupted normal activities, and despite an obvious decline in incidence between each quarterly survey, assumed to represent recall

bias, an incidence approaching one in 10 of the population per annum was recorded. Since less than one in four of these injury victims used the public health services, the burden of injury in this Vietnamese community was both huge and largely unseen, truly an iceberg scenario.

Considerably higher rates of injury occurred among males compared with females, at least during childhood and working life, probably reflecting gender stereotypes that influence behaviour and working patterns. However, the overall findings show that both genders of all ages were subject to a considerable burden of unintentional injury. Those living in mountainous areas were more likely to be injured, although they enjoyed lower overall mortality than the populations of other areas.<sup>14</sup> Our multivariate modelling of gender, age/occupation and area did not show major interactions between these factors, although each was significantly related to injury incidence. Some individuals were prone to repeated injury.

Severity of injury, as expressed by the time for which the victim was incapacitated, was very strongly related to care-seeking behaviour. Whilst this is an area that could be pursued further, our findings here show that there are clear patterns of care-seeking which presumably follow a well-developed sense of self-awareness of the nature of an injury at the time of its occurrence. Further research may be needed to understand whether the large proportion (67%) of mild injury victims who did not seek care followed that path because of either perceived shortcomings or inaccessibility of health services.

Our incidence rate of 89/1000 PYAR is consistent with other studies in developing countries. For example, Sathiyasekaran found an unintentional injury incidence of 121/1000 PYAR in an urban slum in Madras, India<sup>15</sup> and as far back as 1959, Gordon et al.<sup>16</sup> reported an injury incidence of 116/1000 PYAR in four Indian villages. In a similar household survey of injury in Ghana, Mock et al.<sup>17</sup> found an injury rate of 78/1000 PYAR using 1-year recall. Latin American injury studies combined institutional recording with household surveys and found 60/1000 PYAR in Cuba, 220 in Venezuela and 303 in Chile.<sup>18</sup> Despite all these studies, high rates of injury continue to represent a serious public health problem.

As might be expected in this rural setting, most injuries occurred in and around the home, with fewer traffic and industrial events, and this is consistent with other studies from developing countries.<sup>15-21</sup> Common causes of falls were due to slipping on the floor because of wet or mossy ground, falling down steps, or stumbling, and most often occurred in the very young and old. Stabs, cuts, burns and scalds were leading causes of minor injuries, often occurring in inadequate kitchens. Prevention strategies to avoid these household hazards could include having better light in the evening so that the elderly can see clearly; making gravel paths around the house and clearing moss to avoid slipping; wearing protective clothing when using electrical equipment; and improving kitchens. Education and awareness about the possibility of such household injuries could also help in their prevention.

Road traffic injuries are a huge burden to this population as well as in many urban areas in Vietnam and other countries.<sup>20-24</sup> Although studies in urban Vietnam have found motorcyclists and car drivers to be the largest group of injured road users, our findings emphasize the greater plight of cyclists as vulnerable road users. In Vietnam, the last 10 years have seen an explosive growth in the numbers of motor cycles (five-fold) and cars (double), associated with increased hazards to pedestrians and cyclists. Although much of this increase has been among urban populations, similar trends are now being observed in rural areas. Additionally, many motor vehicles are in poor condition, which is a major safety concern. Motorcycles account for 93% of all means of road transport and constitute the major cause of traffic accidents.<sup>6</sup>

More attention needs to be given to preventing injuries among users of motorized vehicles, such as the use of helmets, seat belts and driver education. Bavi contains various unsafe types of roads, such as on mountainsides or along bunds

around the Red River area. Roads made of clay are often very slippery in the rainy season. Low-quality vehicles coupled with poor roads are likely to increase traffic accidents. For example, some accidents happened when bicycles were going down the slope of a bund and their brakes were faulty. It would be useful to develop methods for protecting pedestrians and cyclists from road traffic accidents, such as having separate paths. However, while improving road surfaces may reduce slip hazards, better roads may also increase the speed of vehicles and lead to more serious accidents, and certainly imply a need for better driver training. The World Health Organization's plans to highlight road safety in World Health Day for 2004 reflect the high international importance given to traffic injuries.

Our findings on work-related injuries among farmers were reflected in a huge burden of disability resulting from agricultural injuries in Ghana. Injuries sustained during non-mechanized farming and by part-time farmers have received scant attention worldwide, despite their probable effect on food production.<sup>16,25</sup> In view of the large proportion of farmers in this population as well as in many other rural areas of Vietnam and the high rates of agricultural injuries, this is a further important target for prevention efforts. Such efforts could include educating farmers on safe working practices, such as not throwing empty glass pesticide bottles into the farm, and wearing shoes or boots when working in wet fields. Manufacturers could change to packaging pesticides in plastic instead of glass bottles.

Injuries not only affected people's health, but were also a great financial burden. In the sampled communities, the total annual cost of unintentional injuries was 345,712,000 VND (US\$ 23,842). Ninety percent of this economic burden fell on households, only 8% on government and 2% on the health insurance agency. The cost of a severe injury to the victim corresponded to approximately 7 months of earned income. Home and traffic injuries together accounted for more than 80% of the total cost (45 and 38%, respectively). It is clear that unintentional injuries impose a large economic burden on society, especially on the victims, and this principle certainly applies in resource-poor settings such as Vietnam.<sup>26</sup>

Our study only considered unintentional injury, possibly underestimating overall injury incidence compared with other studies, because it would be extremely difficult to explore sensitive issues such as violence, attempted suicide and homicide in household interviews in Vietnam. There was also some difficulty in classifying some injuries

between work and home, since some people are primarily farmers (in which case, farming is readily classified as 'work'), while many others employed in service industries also engage in part-time farming in their spare time, which may be perceived or recorded differently.<sup>27</sup> The study relied on self-reporting by respondents. The veracity of some information such as the occurrence of injury events or the duration of the resultant disability could not be independently verified.<sup>17</sup> This factor, along with recall bias, probably led to underestimates of injury problems.

Community-based household surveys gave more complete results than we could have obtained from facility-based studies, and thus the hidden part of the injury iceberg became more visible. It was valuable to make use of the field laboratory as a framework for these surveys, and to provide accurate denominators. We have demonstrated that injury is an important health problem in rural Vietnam, and identified some specific groups of high-risk individuals and injury types. It is likely that these findings could apply to rural communities in many developing countries. Simply documenting large numbers of injuries is not in itself sufficient, but it demonstrates a clear need for targeted injury prevention programmes, particularly against home and traffic injuries, which happen frequently and amount to a large economic and social burden. Intervention programmes need to be based on evidence, as well as being carefully monitored and evaluated using a similar injury surveillance methodology on a sentinel basis. We therefore hope that this comprehensive study will contribute to the Ministry of Health's injury prevention programme as well as providing a methodology for future injury assessments.

## Acknowledgements

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