

Original Article**UXO victims and health status of populations living in Xiengkhuang Province, Lao PDR: A household-based survey****Outavong Phathamavong^{1,*}, Nao Boutta², Panome Xayamoungkhoun³, Chushi Kuroiwa¹**¹ Department of Health Policy and Planning, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan;² Ministry of Health, Vientiane, Lao PDR;³ Mother and Child Health Center, Ministry of Health, Vientiane, Lao PDR.**Summary**

During the Vietnam War from 1964 to 1973, over 2 million tons of bombs were dropped on Laos. Approximately 30% of the bombs did not explode and have posed a continued threat to civilians throughout the country. Approximately 200 casualties per year have been reported nationwide. Therefore, we conducted a household survey to better understand magnitude of UXO victims, accessibility to the MCH services and child healthcare seeking behaviors of the population in the Xiengkhuang province. The household-based survey was carried out in February 2006 among 6 of 541 villages. 283 household representatives were interviewed. The cumulative number of UXO victims identified from 1973 to 2005 was 45 casualties, of which 9 (20.0%) occurred in the year 2005. 37.5% reported knowledge of danger zones for UXO contamination. Among the 91 children under the age of 5 years, households on average reported 1.7 episodes per year for diarrhea, 2.7 for respiratory disease, 2.3 for fever and 1.7 for measles. 69.4% of children under five were completed the routine immunization program, 62.6% of mothers used ANC service for their most recent pregnancy, 58.2% accessed family planning services, and 28.6% delivered their most recent child at a healthcare facility. UXO victims in the targeted villages sharply increased in 2005. Insufficient knowledge about UXO danger and MRE seems to be a central factor in the high rate of UXO-associated accidents. Diarrhea, respiratory disease and measles remained health problems for children under 5 years. MCH services utilization were higher than Laos nationally.

Keywords: Rural health, Unexploded ordnance, War, Maternal and child health, Injury prevention, Laos

1. Introduction

The Lao People's Democratic Republic (PDR) is a small, landlocked country in South East Asia with a population of 5.6 million people (1) surrounded by China, Myanmar, Thailand, Cambodia and Vietnam. Due in part to its geographical location, during the Vietnam War (Indo-China war) from 1964 to 1973, more than 2 million tons of bombs were dropped on Laos, more than any other country involved in the war (2). This amounted to 660 kg per capita (3),

far exceeding even the 280 kg per capita dropped over Vietnam (4). Of these 2 million tons of bombs, approximately 30% failed to explode and remain a persistent threat affecting over 50% of all agriculture land countrywide. The Xiengkhuang province was reported as one of the most heavily UXO-affected provinces in Laos (5).

Since the war ended, the number of victims has been recorded by UXO Laos nationwide. From 1973 through 1997, 11,928 casualties were recorded; during the 1980s, an average of 200 cases per year occurred. In 1996, 199 casualties were identified and in 1997, 140 casualties. One hundred nine casualties in 2003 were recorded and 117 casualties in 2004, in which 54% were children, 85% males (3). In 2005, more than 150 people were injured or killed due to UXO accidents (6).

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The economic burden due to UXO-related accidents and UXO contamination on agriculture lands exacerbates the poor socioeconomic and health conditions of the people (5).

In 1995, the Lao PDR Trust Fund was established in collaboration with the United Nations Development Programme (UNDP) and UNICEF to provide financial support for UXO clearance activities and mine risk education (MRE) (7). The National UXO Programme was established the following year (5). It is estimated, however, that it will take 100 years to clear all UXO from ground surfaces countrywide.

The people of the Xiengkhuang province, already suffering from poor living conditions, are particularly affected by UXO. Previous reports demonstrated just high rates of UXO-associated casualties in the province; however, they did not explore UXO-related information which would raise awareness of the population on UXO explosion and their health (2). Therefore, we conducted a household survey to better understand magnitude of UXO victims, accessibility to the mother and child health (MCH) services and child healthcare seeking behaviors of the population. Our study will provide essential information for future research focusing on health interventions aimed at improving the dire health status of the people of the Xiengkhuang province.

2. Methods

2.1. Study site

The northern mountainous Xiengkhuang province, which shares a border with Vietnam, is divided into 7 districts consisting of 541 villages. The total population of this province is 228,882 (1). During the Vietnam War, Xiengkhuang was a part of the Ho Chi Minh trail.

Six villages located along main roads from 2 districts (Pek and Kham) were included in this study. These villages were chosen because of their accessibility and their relative safety from UXO accidents over the previous year (2004).

2.2. Study design

We conducted a descriptive household survey in February 2006. Trained research assistants recruited household representatives and conducted interviews at temples, schools or village meeting halls. Verbal informed consent was obtained from all household representatives prior to the interview. The National Ethics Committee for Health Research (NECHR) and the Ministry of Health of Laos approved the study.

2.3. Data collection

The research assistants conducted face-to-face interviews with a representative of each household

capable and available to participate in the study. When collecting data on children under five, we interviewed their mothers. Structured questionnaire was developed based on the World Health Organization guidelines for conducting community surveys on injuries and violence (8). The questionnaire was developed to investigate demographic characteristics, socioeconomic status, prevalence of UXO-associated trauma, and overall population health status. The latter had a particular focus on maternal and child health (under 5 years of age).

Three trained research assistants interviewed each household representative at the various meeting locations. Additionally, research assistants actively sought out representatives who were absent from the meeting, so as to cover all households for the study.

3. Results

3.1. Socio-demographic

Two hundred eighty-three household representatives from 6 villages took part in the study. Of these, 256 (90.5%) were lowland Lao (Lao Lum), and 274 (96.8%) were farmers (Table 1). There was no difference in mean educational level between husbands and wives (4.8 year vs. 4.2). The median of household income was US\$300 dollars per year.

3.2. UXO-associated trauma

The cumulative number of UXO victims from 1973 to 2005 was 45 casualties, of which 9 (20.0%) casualties occurred in 2005 (Table 2). Thirty-seven (82.2%) of casualties were males. The average age of UXO victims was 18.5 years old. Of the 45 casualties, 17 (37.8%) died and 25 (55.6%) were disabled. Nineteen

Table 1. Socio-demographic of study population and their households ($n = 283$)

	No	%
Ethnicity		
Lowland	256	90.5
Midland	16	5.7
Highland	10	3.5
Missing	1	0.3
Age (years): Mean (SD)	40.0 (12.5)	
Occupation		
Farmer	274	96.8
Governor	5	1.7
Other	4	1.4
Education level (year)		
Husband: Mean (SD)	4.8 (2.4)	
Wife: Mean (SD)	4.2 (2.3)	
Family income (US\$)		
Median (interquartile range)	300 (162-500)	
Number of children: Mean (SD)	4.4 (2.4)	
Household member: Mean (SD)	6.4 (2.2)	

Table 2. Cumulative number of UXO victims (*n* = 283)

	No	%
Household with UXO victims		
Yes	36	12.7
No	244	86.2
Missing	3	1.1
Number of casualties from 1973 to 2005	45	
Only 2005 (<i>n</i> = 45)	9	20.0
Age Median (interquartile range)	18.5 (12.0-36.0)	
≤ 18	22	48.9
> 18	20	44.4
Missing	3	6.7
Sex		
Male	37	82.2
Female	8	17.8
Casualties situation		
Died	17	37.8
Disabled	25	55.6
Recovered	3	6.7
Disability (<i>n</i> = 25)		
Arm	7	28.0
Leg	7	28.0
Eye	7	28.0
Ear	1	4.0
Other	2	8.0
Missing	1	4.0
Place of accident		
Agriculture land	19	42.2
Village compound	16	35.6
Forest	7	15.5
Other	1	2.2
Missing	2	4.4
How did it happen?		
Accident	16	35.6
Someone did it	7	15.5
Myself	8	17.8
Don't know who did	14	31.1

(42.2%) and 16 (35.6%) UXO accidents occurred on agricultural land and village compounds, respectively. Sixteen casualties (35.6%) occurred by accident, when victims did not know; while 15 (33.3%) became victims even though they knew that the object was a UXO and nevertheless were playing with it, firing it, or being thrown it from someone else.

Of the 283 representatives, 37.5% reported knowledge of danger zones for UXO contamination (Table 3). Of these, 27.4% had learned about these zones from UXO staffs, whereas 50.0% reported that they had learned about UXO on their own. Surprisingly, 78.3% of those reporting knowledge of danger zones had nevertheless entered into a zone, typically because it was a part of their agriculture land (62.7%), or because their village or house were located within it (8.4%). Approximately 96.8% of the household representatives received UXO-related information from specific UXO staffs who visit the villages once a year (66.1%).

3.3. Maternal and child health

Children under 5 years of age were identified from 91 (32.2%) of 283 households (Table 4). The prevalence and number of episodes of illness among these children in the past 12 months was 23.1% and 1.7 for diarrhea, respectively, 42.9% and 2.7 for respiratory disease,

Table 3. Sources of UXO-related information (*n* = 283)

	No	%
Know dangerous area for UXO		
Yes	106	37.5
No	177	62.5
If "Know"		
Know from		
Myself	53	50.0
UXO staffs	29	27.4
Other	23	21.7
Missing	1	0.9
Go into dangerous area		
Yes	83	78.3
No	23	21.7
If "Go", Why?		
Bomb in village	7	8.4
Agriculture	52	62.7
Cutting wood	10	12.0
Hunting	8	9.6
Other	6	7.2
UXO-related information		
UXO staffs	274	96.8
Others	6	2.1
Missing	3	1.1
Number of visits in the past year		
1 time	187	66.1
2 times	63	22.3
3 times	23	8.1
> 3 times	7	2.4
Missing	3	1.1

46.2% and 2.3 for fever, and 7.7% and 1.7 for measles. Twenty-three (82.1%) of those children suffering from diarrhea, 42 (75%) of those suffering from respiratory disease, 48 (82.8%) of those who had fever, and 6 (60%) of those who were infected with measles received treatment at a healthcare facility.

A total of 124 children under the age of 5 years old were identified from 91 mothers, of whom 86 (69.4%) had received the complete immunization schedule (one dose of BCG, 3 doses of DPT, 1 dose of measles and 3 drops of polio myelitis) and 35 (28.2%) received an incomplete course (Table 5). Of 91 mothers with children under 5 years of age, 57 (62.6%) received at least one antenatal visit during their most recent pregnancy, 53 (58.2%) had used family planning services, and 26 (28.6%) gave birth to their most recent child at a healthcare facility. Of 283 households, 274 (96.8%) were using insecticide-treated nets (ITNs) and 274 (96.8%) had their own latrine.

4. Discussion

UXO-associated trauma remains a serious problem for the people living in Xiengkhuang province. Although this study cannot be completely representative of the entire province due to the non-random sampling methodology and the small sample size, the large number of casualties identified in 2005 (9 out of 45 casualties) is concerning. These were identified among villages located along the main roads and close to the city. This figure suggests an increasing number

Table 4. Episode of illness of children under five and health seeking behaviors ($n = 283$)

	No	%
Have under 5 children		
Yes	91	32.2
No	188	66.4
Missing	4	1.4
Prevalence and episode ($n = 91$)		
Prevalence of diarrhea	21	23.1
Episode of diarrhea: Mean (SD)	1.7 (1.0)	
Treatment		
Self treatment	3	10.7
Village health volunteer	1	3.6
Traditional healer	0	0.0
Pharmacy	1	3.6
Health facility	23	82.1
Prevalence of respiratory	39	42.9
Episode of respiratory: Mean (SD)	2.7 (2.0)	
Treatment		
Self treatment	3	5.4
Village health volunteer	0	0.0
Traditional healer	4	7.1
Pharmacy	7	12.5
Health facility	42	75.0
Prevalence of fever	42	46.2
Episode of fever: Mean (SD)	2.3 (1.5)	
Treatment		
Self treatment	1	1.7
Village health volunteer	0	0.0
Traditional healer	1	1.7
Pharmacy	8	13.8
Health facility	48	82.8
Prevalence of measles	7	7.7
Episode of measles: Mean (SD)	1.7 (1.3)	
Treatment		
Self treatment	1	10.0
Traditional healer	1	10.0
Village health volunteer	1	10.0
Pharmacy	1	10.0
Health facility	6	60.0

of UXO victims compared with previous years in the Xiengkhuang province and in Laos as a whole. Insufficient knowledge about UXO dangers and MRE seems to be a central factor in the high rate of UXO-associated trauma among the people living in these villages. Indeed, 37.5% of villagers reported that they were aware of the danger zones for UXO; half of these individuals reported that they had learned of these dangers on their own. Specific UXO-awareness workers only visited these villages once a year, however. Furthermore, UXO contamination in agriculture lands and village compounds were repeatedly reported. The study suggests that effective action, especially MRE and UXO clearance, is urgently needed to reduce the risks associated with UXO.

The underlying hypothesis of this study was that UXO contamination plays a detrimental role in the ability of the population to access healthcare. Essential public health interventions such as antenatal care, hospital delivery, family planning and ITNs are operational in the province and enjoy higher utilization

Table 5. Mother and child health services among 124 children, 91 mothers, and 283 households

	No	%
Immunization		
Complete	86	69.4
Incomplete	35	28.2
Missing	3	2.4
\geq one ANC visits		
Yes	57	62.6
No	28	30.8
Missing	6	6.7
Family planning		
Yes	53	58.2
No	32	35.1
Missing	6	6.7
Delivery		
Hospital	26	28.6
Home	59	64.8
Missing	6	6.7
Insecticide Treated Nets		
Yes	274	96.8
No	8	2.8
Missing	1	0.4
Latrine		
Yes	274	96.8
No	8	2.8
Missing	1	0.4

rates than are found nationally: the antenatal care utilization rate in the study population was 62.6% compared with 38.7% nationally; 28.6% of mothers gave birth in a hospital for their most recent child, higher than 16.8% reported nationwide; and 96.8% of ITNs coverage in this study, higher than 54% in national level (9). Likewise, 69.4% of children aged less than five completed the routine immunization program, higher than the 53.8% in the national survey (9). These relatively high rates were likely due to the location of these villages, situated close to the provincial and district hospital.

We also expected that this would result in the poor health status of the people living in Xiengkhuang province, particularly mothers and their children. The results demonstrated that diarrhea, respiratory disease and measles are the main public health problems among children under 5 years of age in these villages. The prevalence of diarrhea (23.1%) and respiratory disease (42.9%) in this study were higher than national figures (13.4% for diarrhea and 5.4% for acute respiratory infection) (9). The number of measles cases reported from these villages was also high (7.7% of prevalence and 1.7 episodes). Fortunately, 60% to 80% of parents sought medical care at health facilities for the treatment of these illnesses.

5. Conclusions

This descriptive study demonstrated an increase in UXO victims in 2005 among 6 villages in the Pek

and Kham district. Diarrhea, respiratory disease, and measles were observed to be the main public health problems among children under the age of 5 years. Nevertheless, the study population enjoyed utilizing health intervention programs including antenatal care, family planning, birthing at a healthcare facility and immunization than Laos nationally. This is likely due to the location of these villages, which are situated close to the provincial and district hospital, allowing easy access to care by foot, bicycle, or motorbike. UXO must have been cleaned in this area in the past decades. Additionally, studies are urgently needed that focus on remote, rural villages where people experience significant challenges in accessing high-quality healthcare services. Such studies will help in designing appropriate interventions for people living in areas similar to the Xiengkhuang province.

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