

THE LEGACY OF WAR: AN EPIDEMIOLOGICAL STUDY OF CLUSTER WEAPON AND LAND MINE ACCIDENTS IN QUANG TRI PROVINCE, VIETNAM

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Abstract. The study examines the epidemiology of cluster weapon and land mine accidents in Quang Tri Province since the end of the Vietnam War. The province is located just south of the demarcation line and was the province most affected during the war. In 2009, a cross sectional household study was conducted in all nine districts of the province. During the study period of 1975-2009, 7,030 persons in the study area were exposed to unexploded ordnances (UXO) or land mine accidents, or 1.1% of the provincial population. There were 2,620 fatalities and 4,410 accident survivors. The study documents that the main problem is cluster weapons and other unexploded ordnances; only 4.3% of casualties were caused by land mines. The legacy of the war affects poor people the most; the accident rate was highest among villagers living in mountainous areas, ethnic minorities, and low-income families. The most common activities leading to the accidents were farming (38.6%), collecting scrap metal (11.2%), and herding of cattle (8.3%). The study documents that the people of the Quang Tri Province until this day have suffered heavily due to the legacy of war. Mine risk education programs should account for the epidemiological findings when future accident prevention programs are designed to target high-risk areas and activities.

Keywords: cluster weapons, land mine accidents, Vietnam

INTRODUCTION

The province of Quang Tri is located along the 17th Parallel in Central Vietnam. During the Vietnam War, from 1955 to 1975, the country was divided at the Ben Hai River, which constitutes the northern border of Quang Tri Province. Quang Tri has nine districts with a total population of

632,840 persons (year 2009), of which the Kinh ethnic group (Vietnamese) accounts for 92%, and the ethnic minorities Van Kieu and Pa Co made up 6.4% and 1.5%, respectively (Quang Tri Province, 2005).

The war had tragic and lasting effects on the land and the people of Vietnam. Widespread contamination of unexploded ordnances (UXO) has been one of the country's most severe problems, impeding socio-economic development, threatening people's lives and safety, and damaging the environment. According to the

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Landmine Monitor Report, US military forces deployed 15 million tons of bombs and landmines, shells, and other weapons during the war in Vietnam; three times the amount used by the Western forces during the Korean War (International Campaign to Ban Landmines, 2003, 2006). The US Department of Defense estimates that about 10% of this ordnance did not detonate as designed, meaning that there are hundreds of thousands of tons of UXO, landmines, and other lethal weapons still scattered across Vietnam (Labor and Social Publishing, 2004). Quang Tri took a heavy load of the ordnances as compared to most other Vietnamese provinces.

Despite the earnest endeavors of government authorities, the army, local people, and international organizations in carrying out clearing operations, public data collected yearly by the civilian and military authorities document that 1.1% of the population of Quang Tri Province have been victims of UXO and land mine accidents since 1975. An estimated one-half of all land in the province is still contaminated, endangering the living and working conditions of the people and obstructing community development efforts. However, the public data available do not give detailed information about etiology and socio-economic consequences of the accidents. Therefore, Project RENEW (Restore the Environment and Neutralizing the Effects of the War, a Vietnamese NGO) and the Department of Health of Quang Tri Province launched in 2009 a study of the epidemiology of UXO and land mine accidents using a knowledge, attitudes, practices, and beliefs (KAPB) survey. The aim of the KAPB survey was to examine incidence rates and risk factors in UXO and land mine accidents in order to provide a scientific basis for efficient accident prevention programs in the future.

MATERIALS AND METHODS

The reference population for the study was the human population of Vietnam. The study sample was selected from families in Quang Tri Province who had been exposed to UXO and/or land mine accidents during the period from 1975 until September 2009 (Fig 1). The study was carried out as a household survey with cross sectional design. The identification of accident victims was done stepwise. First, the administrative head of all villages provided the study committee with lists of all deaths and injuries that had occurred during the study period. The village data were then crosschecked with data from the local health center, and finally scrutinized by direct interviews where investigators contacted each listed family as well as family neighbors. The study sample was then selected from this pool of casualties.

The required sample size for the KAPB study was calculated by the formula:

$$n = Z^2_{(1-\alpha/2)} P(1-P)/d^2$$

where n = sample size, α = significance level at 0.05, $Z = 1.96$, d = expected preciseness at 0.014, and the probability $P = 0.5$. This gives a sample size estimate of 4,900 study units. Taking into account an exclusion rate of 5%, a total of 5,100 subjects were required for this study. The research subjects were then selected among the verified casualty population in all nine districts of the province, dividing the survey sample into 30 random subsamples of 170 study subjects. The subsample demography was balanced for population age and gender; however, all research subjects should be at least seven years old and able to respond to the questionnaire. The sample design



Fig 1–Map of the study area.

was purposive with over-representation (>50%) of low-income households and rural inhabitants in all subsamples.

The KAPB data were collected by structured interviews at family homes with the facilitation of local guides and interpreters. The questionnaire was developed by repeated tests, including research subjects belonging to ethnic minorities. The investigators were all experienced graduate medical staff. To ensure data precision, the research committee trained the team of investigators and interpreters using the questionnaire before the interviews were conducted. In fatal cases, data were collected from family members and/or survivors from the same accident.

After data collection, the research team at Quang Tri Health Service validated all forms. All 5,100 questionnaires proved to have sufficient data and were

included for study. The data were processed by Confidence Interval Analysis® version 1.2 (BMJ Publishing Group and MJ Gardner, London, UK). Means and proportions are expressed with 95% confidence intervals.

Before launching the study, provincial health authorities announced the purpose and implementation of the survey in the local newspaper and radio. Also, the media stated the right to abstain and precautions taken to ensure confidentiality. The data were processed anonymously, only the research committee having the key to personal identification. Participation in the study was voluntarily, all informants signing an informed consent letter. None of the selected informants refused to participate. The Quang Tri Peoples' Committee Ethical Board approved the study (N° 22/QD-UBND, 2010 Jan 11).

Table 1

Incidence rates of UXO and land mine casualties per district, 1975-2009, proportions expressed by 95 % confidence intervals in brackets.

District	Population total	Casualties	Casualties, % of population	Fatalities	% fatalities
Trieu Phong	107,893	1,293	1.2 (1.1-1.3)	475	36.7 (34.1-39.4)
Hai lang	104,290	1,119	1.1 (1.0-1.14)	534	44.7 (47.8-50.6)
Gio Linh	79,822	1,088	1.4 (1.3-1.5)	382	35.1 (32.3-37.9)
Vinh Linh	91,290	810	0.9 (0.8-1.0)	289	35.7 (32.4-39.0)
Cam Lo	48,657	785	1.6 (1.5-1.7)	272	34.6 (31.3-38.0)
Huong Hoa	70,718	1,088	1.5 (1.4-1.6)	322	29.6 (26.9-32.3)
Dakrong	34,315	397	1.2 (1.1-1.3)	147	37.0 (32.3-41.8)
Dong Ha Town	84,162	283	0.3 (0.2-0.4)	129	45.6 (39.8-51.4)
Quang Tri Town	23,421	167	0.7 (0.6-0.8)	71	42.5 (34.9-50.4)
Provincial total	644,568	7,030	1.1 (1.07-1.12)	2,621	37.3 (36.2-38.4)

RESULTS

A total of 7,030 study persons were exposed to UXO and/or land mine accidents during the study period, comprising 1.1% of the provincial population. There were 2,621 deaths (37.3 % of all casualties, Table 1). More than 95 % of the casualties were UXO related; only 4.3 % of casualties were caused by land mines. Cluster munitions and M-79 rifle grenades were the most common type of weapons involved in UXO accidents, accounting for 44 % and 14% of all UXO accidents, respectively. There were no significant variations in trauma mortality rates between the study districts (Table 1).

There was a significant decrease in annual casualty incidence rates during the study period. During the first ten-year period, there was a reduction of accident rates by two-thirds indicating efficient clearing operations by the Vietnamese army (Fig 2). Since 1990, the number of annual landmine/UXO casualties has been steadily on the decline.

The study results showed that UXO

and land mines contaminate all districts of the province. The districts with the highest casualty figures from landmine/UXO casualties were Trieu Phong, Hai Lang, Gio Linh, and Huong Hoa, respectively. Trieu Phong and Hai Lang are the two districts with the highest populations.

The majority of casualties, over 90%, were living in rural areas. Compared to the province mean, the casualty incidence rates were significantly higher in Cam Lo, Huong Hua, and Gio Linh, homelands of the ethnic minorities Van Kieu and Pa Co (Table 1). The geographical skewedness is confirmed when we look at ethnicity: while the ethnic minority groups comprise only 7.9% of the province total, 16.3% of casualties were found in this subsample. Out of all affected households, 72% earned less than USD 130 annually, as compared to an average income per capita in the province of USD 330 (2005 estimate) (World Bank, 2005; People's Committee of Quang Tri Province, 2006).

The casualties belonged to all age groups, but the vast majority were children,

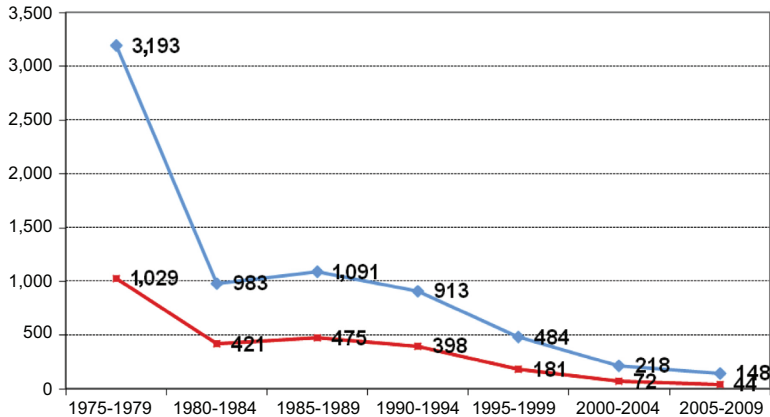


Fig 2—Incidence rates of UXO and land mine casualties in Quang Tri Province by five-year periods.

teenagers, and middle-aged adults. Victims under 36 years old constitute 81% of total casualty numbers, and those younger than 20 years made up 47% of the total. There was a skewedness of gender among the casualties: male victims comprised 83%, although the study population was well balanced in terms of gender (females 50.4% and males 49.6%). The most common causes of accidents related to outdoor income-generating activities such as farming (38.6%), collecting scrap metal (11.2%), herding of cattle (8.3%), and tampering with explosive devices (6.3%).

Despite comprehensive clearing operations, explosive devices were still encountered where people are living and working: in hilly and mountainous areas (38%), in cultivated fields (32%), on former military base areas (10%), near peoples' homes, and on trails (9%). Also beaches, riverbanks, main roads, and schools were places where the informants reported to have encountered mines or UXO. More than half of the informants said they encounter UXOs or land mines at least once a year, and 5% reported to encounter such devices weekly or daily. Most of the

incident sites (92%) were not marked with warning signs.

DISCUSSION

During a ten-year period (2000-2009) when the province has been cooperating with international mine action NGOs, the average number of annual victims was 53 people, a reduction of 76% compared with the average of the 1975-2009 period. But still, the leg-

acy of the Vietnam War imposes a heavy burden on the population of Quang Tri. Until recently, the casualty numbers from this single province in Vietnam has been higher than total national figures from other post-war countries. For example, in the year 2004, after 30 years of clearing operations, Quang Tri Province alone had 49 UXO and land mine casualties. A number higher than the national figures reported from Bosnia, Chad, Azerbaijan, Eritrea, and Mozambique; twice the number reported from Albania, Thailand, and Croatia; and three times higher than that reported from Kosovo, Lebanon, and Tajikistan (International Campaign to Ban Landmine, 2006). We have to look to history to understand the reason why Quang Tri suffers this heavy burden. For years, Quang Tri was the frontline between the forces from the North and the South. Well-known battle sites, such as Khe Sanh, Lang Vay, Doc Mieu, "Rockpile," La Vang, Ai Tu, and the Quang Tri Citadel are all located in the populated areas of the province. At the best-known battle site, Khe Sanh, the US Army in 1968 launched more than 8,000 air strikes with

20,000 tons of bombs. At the Quang Tri Citadel, close to the province capital, the amount of bombs and weapons used by the US in 1972 alone was equivalent to the firepower of seven nuclear bombs of the type dropped on Hiroshima in 1945 (Frankum and Moxner, 2003).

UXO and land mine injuries are severe, with high mortality rates. Reliable data on road traffic accident (RTA) mortality rates in Quang Tri Province are not available for the entire study period; however, the death rate in year 2005 from UXO/land mine accidents in the province was 37% as compared to RTA death rate of 11% (Phung, 2010). Other affected countries report trauma mortality rates from UXO and mine accidents in the range of 30% to 40% (Andersson *et al*, 1995; Aschiero *et al*, 1995; Jahanlu *et al*, 2002; Husum *et al*, 2003). As trauma mortality rates are similar in the study districts, we should conclude that the contamination of weaponry is rather uniform throughout the study area (Table 1).

There are significant geographical variations in casualty incidence rates: Cam Lo, Huong Hua and Gio Linh having higher rates than the province mean. These findings could be explained by the pattern of warfare: the hottest combat zones were located in these three districts where the ethnic minorities provided crucial logistic support to the Vietnamese resistance along the "Ho Chi Minh Trail." The ethnic skewedness in casualty distribution may also be an indicator that previous mine awareness programs did not penetrate efficiently in indigenous communities, possibly because of cross-cultural communication problems.

Cluster munition and mines are placed easily, but clearing of forests and mountainous areas is arduous. Despite 30

years of clearing operations, the population of the most affected districts still live inside the minefields. The injustice of the situation is emphasized further by the fact that this post-war problem mainly affects the poor portions of the population. One reason may be that poor people have to take higher risks in order to make an income and provide their family, and even access areas that they know are contaminated by explosives.

To this day, the people of Quang Tri Province suffer from the legacy of UXO and land mines left during the Vietnam War. This study confirms that 1% of the population has been involved in accidents; unexploded cluster munitions representing the main problem. As recently as 2004, Quang Tri Province reported higher casualty numbers compared with most other contaminated countries. The problem mainly affects low-income households in remote rural areas. Mine risk education programs should take the epidemiological findings into account when future campaigns are designed in order to target high-risk populations and activities.

ACKNOWLEDGEMENTS

The study was sponsored by the Quang Tri Provincial Health Department and Project RENEW, Vietnam. We would like to thank Quang Tri People's Committee for their permission and for the facilitation of this study. The civil organizations in the local study areas helped organize the study. Project RENEW provided logistic support. We also want to thank all colleagues at Quang Tri Health Service for professional support.

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