

Epidemiological Study of Child Casualties of Landmines and Unexploded Ordnances: A National Study from Iran

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Abstract

Background: Despite landmine-risk education programs and extensive demining activities on the Western border of Iran, landmines and unexploded ordnance (UXOs) still cause civilian and child casualties three decades after the Iraq-Iran war (1980-1988). The objective of this study was to understand the epidemiological patterns and risk factors of injury in child casualties of landmines and UXOs in Western and Southwestern Iran.

Methods: Children who were 18 years old or younger at the time of study and who sustained injuries from landmines and UXOs were identified through a search at the Iranian National Veterans Registry. These children participated in a 5-day gathering. The information on socioeconomic status, health-related issues, quality of life, health care utilization, and clinical profiles concerning the landmine and UXO injuries were collected. The method of data collection consisted of three component surveys: health interview, social survey, and medical examinations. Social surveys and health interviews were conducted in a face-to-face method by utilizing a questionnaire consisting of 39 questions addressing household and individual components, including information on time and type of injuries, physical activity, mental health, and quality of life. A comprehensive team of physicians in different subspecialties evaluated and examined children to assess the current medical and psychiatric conditions and physical activity, and recommended and arranged further medical, rehabilitation, or surgical planning.

Results: Seventy-eight child casualties were identified and participated in the study. The mean age of the participants at the time of study was 16.11 years old (SD = 2 years). The mean age of victims at the time of injury was 8.2 years (SD = 3.12 years; ranged from 2 to 15 years old). Sixty-seven (85.9%) of the children were male. Provinces of Kurdistan and Kermanshah had the highest number of casualties, with a total number of 54 children (68.3%). Eighty percent of the injuries were caused by landmines, and UXO explosions were reported in 20% of the cases. Overall, 24 children (30%) had received some landmine-risk education before or after the events. Sixty percent of the explosions had happened in the morning between 9:00 AM and 12:00 PM. Playing and grazing livestock were the most prevalent activities/reasons at the time of injury, which were reported in 77% of the subjects. Sixty-three percent of incidents had multiple casualties and in only 13 explosions were the children the only victims of the explosion. The most prevalent injuries were amputations in 41 subjects (52.56%), followed by hearing loss in 23 subjects (29.5%). Amputations were more common in upper extremities (62%) than in lower extremities (38%).

Keywords: child casualties; Iran; landmine; unexploded ordnance; UXO

Abbreviations:

UXO: unexploded ordnance
VMAF: Veterans and Martyr Affair Foundation

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Conclusion: Landmines and UXOs comprise a significant safety hazard to the children living in the Western border of Iran decades after the Iraq-Iran War. The large number of injuries and lack of risk training among victims suggest that landmine cleanings and landmine-risk education should be age-specifically targeted and expanded substantially.

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Introduction

Landmines and unexploded ordnance (UXOs) are common threats to civilians' safety in the aftermath of war in many mine-affected countries. The International Campaign to Ban Landmines (ICBL; Geneva, Switzerland) estimates that 15,000-20,000 people are killed or injured by landmines each year, among them, children account for one in every five victims.¹⁻³ This report has echoed in The United Nations Children's Fund's (UNICEF; New York, New York USA) report that estimates that 30%-40% of mine victims are children under 15 years old.^{2,3} In the most recent reports by Landmine & Cluster Munitions Monitor (Geneva, Switzerland) in 2014, child casualties represented 46% of all civilian casualties in 2013, the second highest percentage of total annual civilian casualties since 2005.⁴

Children particularly are at higher risk of injuries as they are smaller and their body mass is closer to the impact of a mine explosion. They especially are vulnerable to landmines because their curiosity and their love of play create more attraction to the intriguing and colorful appearance of landmines. Children are more likely to be blind to the dangers of playing in, or traversing, the mine-affected areas. Landmine injuries often cause higher mortality among children compared to adults, where about 85% of child victims lose their lives before reaching hospitals.^{2,3,5}

Child casualties of landmines and UXOs often suffer from amputations, vision or hearing loss, and internal organ injuries. They usually undergo multiple surgeries with complications and suffer psychologically from the trauma of a landmine injury. The majorities of these children suffer from permanent disabilities and are often deprived of adequate medical treatment. They often are pulled out of school and face limited future prospects for education and employment that can preclude their full and equal participation within their communities.⁵⁻¹²

The most contaminated planted landmine countries are: Afghanistan, Angola, Brunei, Bosnia-Herzegovina, Cambodia, Iraq, Nepal, and Sri Lanka.¹³ Approximately one-third of victims in Afghanistan, Bosnia, Cambodia, and Mozambique have lost their lives from an explosion. In recent years, many more children suffered from the active landmine injuries. More recent conflicts, such as those in Afghanistan, Iraq, and Sudan, have resulted in an increased number of casualties from landmines and UXOs. For example, between 1999 and 2008, Afghanistan had the highest number of landmine casualties (12,069) in the world, according to the Landmine Monitor Report 2009.¹⁴ Approximately one-half of these victims die, and survivors suffer from serious injuries such as amputated limbs and/or blindness.

Assisting the victims of landmines and UXOs by providing them with health care and ensuring their thorough integration into society is an obligation indicated and emphasized at two major disarmament treaties – the 1997 Mine Ban Treaty and the 2010 Convention on Cluster Munitions.¹⁴

The mined areas in Western and Southwestern Iran, particularly the provinces of Khuzestan, West Azerbaijan, Kermanshah,

Ilam, and Kurdistan, are the result of the 1980-1988 Iraq-Iran war. Landmines and UXOs in these areas are still a threat to civilians in the war zone areas even three decades after the war. It is estimated that during the 1980s, 12 to 16 million landmines were planted across 42,000 square kilometers of Iran's West and Southwestern borders. These areas include the towns and villages of five provinces of Western Azerbaijan, Kurdistan, Kermanshah, Ilam, and Khuzestan. Over the past three decades, demining operations have cleared large areas of landmines and UXOs, and this, combined with increased public awareness, has significantly reduced the number of victims and casualties. Despite these tremendous demining efforts, civilians in landmine-affected provinces of Iran have yet to overcome this scourge, which harms innocent civilians and children.^{3,7,9-12,15}

The objective of this study was to understand the epidemiological patterns and risk factors of injury in child casualties caused by landmines and UXOs in Western and Southwestern Iran three decades after the Iraq-Iran war (1980-1988). For the first time, in this study, the authors evaluated the epidemiological patterns and risk factors of injuries (area of residence, location and cause of injury, type of injury, activity at the time of injury, and participation in the landmine-awareness training classes) in children survivors of landmines and UXOs in Iran.

Materials and Methods

In this cross-sectional study, child casualties who were 18 years old and younger at the time of study and who were injured by landmines and UXOs were identified through a search at the Iranian National Veterans Registry at the Veterans and Martyr Affair Foundation (VMAF; Tehran, Iran). Analysis of surveillance data on landmine and UXO injuries in Iran collected by the Iranian National Veterans Registry at the Health and Veterans' Affair facilities throughout the country was completed. By accessing data at the time of study, the authors found the number of child victims of landmines and UXOs to be 78 cases, in which they were able to complete the survey and examinations in two separate gathering sessions.

The VMAF is the official source to keep track of these children and civilians who were injured after war with landmines and UXOs and is responsible for providing medical and social services required after injuries. The documents and information about injuries available at the registry at VMAF were reviewed and data for all children who were 18 years old and younger at the time of study were extracted. All the cases were from five mine-affected provinces of Iran: West Azerbaijan, Kurdistan, Kermanshah, Ilam, and Khuzestan. Children participated in a 5-day gathering at a social health camp in Northern Iran. Information on socioeconomic status, health-related issues, quality of life, health care utilization, and clinical profiles concerning the landmine and UXO injuries were collected. These data were collected with three component surveys: health interview, health examination,

and social survey. To collect demographic data and health status, a validated questionnaire was used.

Social Survey and Health Interview

The demographic and health interview questionnaire consisted of 39 questions addressing household and individual components which were collected using a face-to-face interview method. The interview was conducted by trained social experts who were familiar with the local language of each province. Each interview took place in a private area for 10–15 minutes. The individual components of the health interview questionnaire included information on time and type of injuries, age at the time of injury, duration of injury, level of education, education after casualty, type of explosives, type of injuries, location of accident, type of activity at the time of injury, participation in the awareness workshops, and current health problems. Several organizations provided training and awareness sessions at schools and in the communities of the landmine-affected areas.

Medical and Psychiatric Examinations

Trained staff members, including physicians and health interviewers, conducted the health interviews and medical examinations. A comprehensive team of physicians in different subspecialties (including orthopedics, surgery, internal medicine, ophthalmology, plastic and reconstructive surgery, ear/nose/throat, family medicine, physical and mental rehabilitation, and psychiatrists) visited the survivors. The visits were based on evaluating the current medical conditions and physical activity, mental health, and quality of life in real-time through comprehensive medical examinations. The medical examiners collected information regarding current injuries, need for surgery and/or rehabilitations, and further medical planning.

This study was reviewed and conducted under approval of the ethics committee at the Janbazan Medical and Engineering Research Center (JMERC) in Tehran, and all participants or their guardians provided informed consent to be enrolled in this study.

The statistical software package SPSS version 22.0 (IBM SPSS Incorporated; Chicago, Illinois USA) was used to perform statistical analysis. Chi-square tests were used to determine the impact of activities at time of injury, age grouping, gender, level of education at the time of injury, province, area of residence, and location of injury on types of injuries. A *P* value <.05 was considered statistically significant.

Results

Seventy-eight child casualties were included in the study. The mean age of the participants at the time of study was 16.11 years old (*SD* = 2 years). The mean age of victims at the time of injury was 8.2 years (*SD* = 3.12 years; ranged from 2 to 15 years). The duration from the time of injury ranged from three to 16 years, with a mean of 8.8 years (*SD* = 3.14 years; Table 1).

Sixty-seven (85.9%) of the children were male. Kurdistan and Kermanshah had the highest rate of casualties with 54 (68.3%). In 62 children (80%), injuries were caused by landmines, and UXO explosions were reported in 20% of the cases.

Overall, 24 children (30%) had received some training regarding the landmine risks before or after the events, but 54 of the victims (70%) never received any training in this regard. In most cases (60%), explosions happened in the morning from 9:00 AM to 12:00 PM. Playing and grazing livestock (77%) were the most prevalent activities/reasons at the time of injury. Sixty-three percent of

Variables	Classification	Frequencies (%)
Age, Years (At the Time of Injury)	0-4	6 (7.7)
	5-9	45 (57.7)
	10-14	25 (32.1)
	15-18	2 (2.6)
Age, Years (At the Time of Study)	5-9	1 (1.3)
	10-14	11 (14.1)
	15-18	66 (84.6)
Gender	Male	67 (85.9)
	Female	11 (14.1)
Residence Province	Kurdistan	29 (37.2)
	Kermanshah	25 (32.1)
	West Azerbaijan	13 (16.7)
	Ilam	7 (9)
	Khuzestan	4 (5.1)
Education (At the Time of Injury)	Pre-school	12 (15.3)
	Elementary	9 (11.5)
	Middle School	20 (25.6)
	High School	37 (47.4)
Area of Residence	Urban Areas	31 (39.7)
	Rural Areas	47 (60.3)

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Table 1. Demographic Features of Child Casualties of Landmines and UXO in Iran (*n* = 78)
Abbreviation: UXO, unexploded ordnance.

incidents had multiple victims, and in only 13 explosions (37%), the child was the exclusive victim of the explosion. Amputation (52.56%) and hearing loss (29.5%) were among the most prevalent injuries in this cohort of patients with landmine and UXO injuries (Table 2).

Upper extremity amputations were more common (62%) than lower extremities (38%). Overall amputations were more prevalent among boys compared to girls (52% versus 18%). This association was found to be statistically significant (*P* = .036).

Bilateral blindness was most prevalent in the age group of 10–14 years old (20%), followed by the five to nine age group (2.3%). Very young children less than four years old did not have bilateral blindness. Age at the time of injury had significant association with bilateral blindness (*P* = .03).

The pattern of disabilities and prevalence of injuries were different in the five provinces. Amputation was significantly higher in the Kurdistan province (*P* = .026). Eye injuries were

Variables	Classification	Frequencies (%)
Location of Injury	Home	8 (10.3)
	Road	3 (3.8)
	Field or Wilderness	41 (52.5)
	Other	26 (33.3)
Activity at Time of Injury	Crossing Place	6 (7.6)
	Grazing Livestock	28 (35.9)
	Manipulation	2 (2.6)
	Collecting Food	6 (7.7)
	Playing	32 (41)
	Farming	2 (2.6)
	Other	2 (2.6)
Types of Injury	Amputation	41 (52.56)
	Upper Limb (One Side)	16 (43.24)
	Upper Limbs (Both Sides)	7 (18.91)
	Lower Limb (One Side)	12 (32.43)
	Lower Limbs (Both Sides)	2 (5.4)
	Upper and Lower Limbs	3 (8.1)
	Hearing Loss	23 (29.5)
	Eye Injury	22 (28.2)
	Both Eyes Blind	3 (13.64)
	One Eye Blind	19 (86.36)
	Spinal Cord Injury	3 (3.8)
	Two or More Injuries	35 (44.87)
	Other Injuries	18 (23.1)

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Table 2. Epidemiology of Injuries in Child Casualties of Landmines and UXOs in Iran (n = 78)
Abbreviation: UXO, unexploded ordnance.

higher in West Azerbaijan ($P = .024$). The total number of patients with eye injury was the lowest in Kermanshah's survivors ($P = .001$); however, the ratio of bilateral blindness to the overall eye injuries was higher in these survivors.

There was significant association between the explosions occurring in the house and ear injury ($P = .05$).

Additional mine injuries were significantly associated with grazing livestock ($P = .012$). Explosions with multiple injuries (three or more injuries in each casualty) were more common in urban areas compared to rural areas with a ratio of 10:1. There was significant association between multiple injuries and area of residence ($P = .009$).

At the time of survey, 15% of children had completed their high school education, while 48% of victims were still enrolled in different stages of their training (K-12). Thirty-seven percent of these children quit their school training after injuries. There was not any significant association between level of education and types of injuries ($P > .05$).

Discussion

Landmines and UXOs in Iran continue to pose a significant threat to civilian and child safety decades after the Iraq–Iran war.^{3,7,11,12} Children are innocent victims who sustained injuries while they were at home, school, or doing their daily life routines. These children in mine-affected areas in Western and Southwestern Iran are more exposed to landmines and UXOs, and they may not have received effective and appropriate landmine-risk education and awareness training.

None of the survivors reported that the areas where the accident occurred were marked as hazardous areas. Thirty percent of children survivors reported receiving some landmine-risk and awareness education before or after the accident. Although the results of this study do not allow for proper evaluation of awareness training, it may suggest that those who receive the training are more likely to recognize the alarming signs that may prevent some of these explosions. Therefore, landmine-risk and awareness training programs for children must address both landmines and UXOs and should be conducted with age-appropriate methods to improve efficacy.

The majority of these injured children are from the five provinces of West Azerbaijan, Kurdistan, Kermanshah, Ilam, and Khuzestan, which appear to be the most mine-affected areas after the Iran–Iraq war.^{3,7,9}

Kurdistan had the highest number of child casualties, followed by West Azerbaijan and Kermanshah. However, there has been variability in the pattern of injuries in the different provinces. Kurdistanian children have had the highest number of amputations and multiple (three or more) injuries. This variability may arise from the level of contamination, or in part due to the shortage of demining activities in these regions.^{16,17} According to Islamic Republic of Iran Mine Action Center (IRMAC; Tehran, Iran) reports over one year (March 2004–2005), approximately 528 square kilometers of border regions of Iran were cleared and 252,383 anti-personnel mines, 37,522 anti-vehicle mines, and 1,478,508 UXOs were discovered and destroyed.¹⁸

The results of this study suggest different patterns of injuries based on the survivor's gender, in which amputations and multiple injuries were more prevalent among male survivors. This can arise from cultural differences in which boys are more involved in outdoor activities and girls stay in and play at home. Similar results were found in other studies, such as in Cambodia, where (87%) of survivors of landmines were males. In Afghanistan, 73% of victims were males between 16 and 50 years old and 20% of them were boys.^{19,20}

A high percentage of injuries (60%) occurred among the victims who lived in the rural areas, and the majority of them were injured while working at the farms. The International Committee of the Red Cross (ICRC; Geneva, Switzerland) estimates that residents of rural areas are at a higher risk of mine injury.^{21,22} This may be attributed to more vigorous demining activities and the availability of landmine-risk training in urban areas.

Approximately 10% of survivors mentioned the house as the scene of explosions. Many residents of border areas left their

homes and moved to other areas during the war; after the war, however, they returned to their homes or built new houses in the contaminated lands, but they did not know about landmines inside their houses.

Child casualties sustaining three or more injuries are found to have a higher rate in urban residences. This may be attributed to the survival biases in which the victims with multiple injuries from rural areas were more likely to die from injury before reaching the clinics or hospital, whereas in the urban areas, they had arguably better access to medical care.

In this study, the majority of child casualties suffer from upper extremity amputation and ear and eye injuries that may suggest that children are more likely to be injured while playing with or handling explosive devices. In an epidemiological study that was done on 356 people who have suffered from landmines or UXOs in Cambodia, 49.2% of adults have had amputations in lower limbs while 50% of children had an amputated upper limb.¹⁹

According to the most recent data provided by Landmine Monitor, nearly two-thirds of child casualties are caused by UXO, whereas UXO caused just 20% of adult civilian casualties. However, in this study, landmine explosions caused more than two-thirds of child casualties. Unexploded ordnances are more visible than landmines and the contaminated areas are easier and cheaper to be cleared. Landmines last longer and are planted to be invisible, and therefore, they pose a higher risk to children. Similar results were reported in previous studies in Afghanistan and Turkey.^{23,24} Therefore, risk awareness activities for children must be oriented toward the danger of minefields, and demining activities should be emphasized in areas with higher child occupancy.

Limitations

Since the end of Iraq-Iran war in 1998, Western and Southwestern borders of Iran have been contaminated with an unknown quantity of mines and UXOs. Over these years, a landmine victim survey has not been undertaken, and many accidents involving victims go unreported. This study is based on the registry data from the Iranian National Veterans Registry at the VMAF, in which the process of registrations are initiated by injured individuals who approach the authorities and register themselves. In addition, children who were not living in those areas, or injuries to child victims who were traveling and transferred or left the areas after the injury, may not be included in this study. Considering the fact that VMAF is the responsible party for

providing care and support, the authors assumed all the victims were included in this study. However, this may increase a potential for a selection bias on under-recruiting victims who were not registered in this surveillance registry. In addition, cases with acute injuries that did not result in disability and had a complete recovery may not necessarily have been included in this registry.

Furthermore, this study aimed to identify the epidemiological patterns and risk factors for injury due to landmines and UXO in an age-specific group of children of 18 years old and younger with sustained injuries related to the landmine/UXO at the time of study. However, the number of children killed and maimed by mines and UXO would be significantly higher if victims who may have entered adulthood since being injured as children, or who were killed as a result of injuries as a child, were included.

Conclusions

The results of this study suggest that landmines and UXOs are still a major threat to the safety of children in Western and Southwestern cities of Iran. While the demining-action response has improved considerably, more efforts and resources are needed to further enhance the demining activities in the mine-affected areas to a level that is commensurate with the threat posed to civilians and children. Landmine-risk education in children should be expanded and more effective methods of prevention should be initiated. Age-specific risk training for children in different ages toward different types of explosives is necessary. Implementing novel initiatives in training and demining the living areas to prevent further civilian and children injuries is crucial. Further studies to assess the needs of children with mine injuries will assist in initiating support efforts to refer victims to existing services and receiving proper medical care and rehabilitation.

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