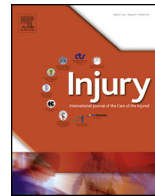




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## Long-term consequences of landmine injury: A survey of civilian survivors in Bosnia-Herzegovina 20 years after the war

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### ABSTRACT

**Introduction:** Bosnia-Herzegovina is one of the most landmine-contaminated countries in Europe. Since the beginning of the war in 1992, there have been 7968 recorded landmine victims, with 1665 victims since the end of the war in 1995. While many of these explosions result in death, a high proportion of these injuries result in amputation, leading to a large number of disabled individuals.

**Objective:** The purpose of this study is to conduct a survey of civilian landmine victims in Bosnia-Herzegovina in order to assess the effect of landmine injuries on physical, mental, and social well-being.

**Methods:** Civilian survivors of landmine injuries were contacted while obtaining care through local non-governmental organizations (NGOs) throughout Bosnia-Herzegovina to inquire about their current level of independence, details of their injuries, and access to healthcare and public space. The survey was based upon Physicians for Human Rights handbook, "Measuring Landmine Incidents & Injuries and the Capacity to Provide Care."

**Results:** 42 survivors of landmines completed the survey, with an average follow up period of 22.0 years ( $\pm 1.7$ ). Of civilians with either upper or lower limb injuries, 83.3% underwent amputations. All respondents had undergone at least one surgery related to their injury: 42.8% had at least three total operations and 23.8% underwent four or more surgeries related to their injury. 26.2% of survivors had been hospitalized four or more times relating to their injury. 57.1% of participants reported they commonly experienced anxiety and 47.6% reported depression within the last year. On average, approximately 3% of household income each year goes towards paying medical bills, even given governmental and non-governmental assistance. Most survivors relied upon others to take care of them: only 41.5% responded they were capable of caring for themselves. 63.4% of respondents reported their injury had limited their ability to gain training, attend school, and go to work.

**Conclusion:** The majority of civilian landmine survivors report adverse health effects due to their injuries, including anxiety, depression, multiple surgeries, and hospitalizations. The majority also experience loss of independence, either requiring care of family members for activities of daily living, disability, and inability to be employed. Further research is required to determine effective interventions for landmine survivors worldwide.

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### Introduction

Civilian injury from landmines is an unfortunate and long lasting peril that results from modern warfare. Anti-personnel landmines are used as a defensive weapon, to slow the enemy, or deny certain areas of terrain to opposing personnel. Their use is controversial because they are indiscriminate, killing soldier and

civilian alike and they leave acres of land inaccessible for decades following conflict [1]. There are an estimated 80 million landmines buried worldwide today, with at least 84 countries affected [2]. Tens of thousands of individuals are injured each year, with the exact number impossible to render from current data. The Landmine Monitor Report 2004 estimates 15,000–20,000 individuals are affected each year [3]. The vast majority of these patients live in the developing world, where access to healthcare and rehabilitation services are often limited [4].

The severity of injury caused by antipersonnel landmines depends upon the type of mine, the proximity of the victim to the

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explosion, and the spatial relationship of the victim's body to the mine at the time of its detonation. Landmine injuries commonly result in loss of limb, disability, psychological disorders, and loss of economic autonomy. Most studies have assessed the consequences of landmine injury on military veterans, despite the fact that civilians constitute 80% of landmine injury survivors worldwide [1,2]. Studies of the long-term health consequences of these devastating injuries in civilian survivors is limited. Data collection in many of the affected countries is either dangerous or poor in quality due to local circumstances in the affected area.

The long-term clinical outcomes of amputations and other injuries are not well-documented. Clinical outcomes following these injuries have typically identified patient populations from combat veterans, both in developed and developing nations [7–10]. Few studies have focused on civilians in developing nations.

Bosnia-Herzegovina remains one of the most landmine-contaminated countries in all of Europe, with 1,218.50 km<sup>2</sup> or 2.4% of the country's total area still suspected of contamination [5]. Since the beginning of the Bosnian War in 1992, there have been 7968 recorded landmine victims, with 1665 injured since the end of the war in 1995 [5]. Some of these explosions result in death of the victim, but many survive with amputations and other mangling limb injuries, resulting in thousands of individuals living with the effects of trauma and resultant physical and psychological impairment.

The purpose of this long-term follow up study was to identify the current health status and economic needs of civilian survivors of orthopedic landmine injury in Bosnia-Herzegovina. We aimed to evaluate the individual's overall quality of life, including physical and mental health, disability, employment, total economic cost to the patient, and access to healthcare.

## Methods

The study was conducted at the headquarters of participating local non-governmental organizations (NGOs) in Bosnia-Herzegovina: RVI, EcoSport, and Landmine Survivors Initiative. Survivors were identified with the help of NGO staff between March 2015 and June 2015. Individuals with a landmine injury were included if

they were 18 years of age or older, or under 18 with parental consent.

The University of Iowa Institutional Review Board as well as the Ethics Committee at the University of Sarajevo Clinical Center (UCCS) granted prior approval. A focused survey was administered, with a cover sheet explaining the consent process. Taking the survey indicated the participant's consent. The survey included both qualitative and quantitative questions regarding demographics; health information; disability and prosthesis use; total economic cost to the civilian; employment before and after injury; access to healthcare and public space. Participants were also asked their opinion on healthcare needs and improving access to care.

The data collection survey utilized in this study was based upon the Physicians for Human Rights handbook, "Measuring Landmine Incidents & Injuries and the Capacity to Provide Care," [11] a standardized method to evaluate the needs of landmine survivors in hospitals and orthopedic centers. While it has been used to measure the effects of landmine injuries upon individuals and communities in other developing nations, the results are often utilized internally for clinical care and results are rarely published. The survey was translated into Bosnian/Croatian/Serbian (BCS) by a certified translator at the UCCS. The survey was then pilot tested with an interpreter and NGO staff members and translated once again into English to confirm clarity of translation.

Paper copies of the survey were distributed to the participating NGOs. Over the period of the study, individuals who utilized NGO resources were invited to participate in the survey. Participants read and filled-out the surveys, and completed surveys were returned to the researchers. Data were collected using paper forms and then entered and managed using REDCap electronic data capture tools hosted at the University of Iowa. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources [12].

**Table 1**  
Demographics of landmine survivors surveyed.

Demographic Variable		Number of responses	Percentage
Gender	Male	37	88.1%
	Female	5	11.9%
Age (current)	18–24	2	4.8%
	25–34	1	2.4%
	35–44	21	50%
	45–54	14	33.3%
	55–64	4	9.5%
	65+	0	
Municipality		Population[12]	
	Doboj	77,223	8
	Donji Vakuf	14,739	1
	Jajce	30,758	1
	Korazska Dubica	23,074	2
	Lukavac	46,731	5
	Travnik	57,543	3
	Trebinje	31,433	5
	Sarajevo	38,911	3
	Srebrenik	42,762	4
	Visoko	41,352	1
Zepce	31,582	1	

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