

**Essential trauma management for internally displaced people of eastern Burma: Scaling up the workforce and diversifying health workers' skills to address service delivery needs of communities in active conflict zones.**

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## **Abstract**

### **Background**

In response to traumatic injuries, particularly those caused by landmines, a community-based organization in eastern Burma's conflict zone mobilized to upgrade a select group of health workers' skills in order to provide high-level care in the field.

### **Methods**

Community-based health organizations in eastern Burma have trained over 700 health workers. Since the late 1990s healthcare leaders established specialized health worker trauma teams to augment the care provided by the existing health structure. This has subsequently developed into a more formal program, the Trauma Management Program (TMP). Skills learned in the trauma courses also apply to injuries incurred by gunshot wounds, stab wounds, blunt trauma, falls, and environmental injuries.

### **Results**

Due to their mobile nature, these health workers were able to respond to patients within 48 hours for the vast majority of cases, which resulted in high survival rates. In addition, the program is beneficial for the entire community enduring the civil conflict, as it boosts the moral of the community and contributes to their empowerment to care for themselves.

### **Conclusions**

Equipped to attend to patients in remote areas, these mobile health workers have documented their ability to increase survival rates and address the morbidity and mortality associated with traumatic injuries in their setting. Lessons learned in training of these health workers and implementation of a mobile trauma team program in this setting can be applied to similar conflict or remote settings. This report illustrates a method to increase skill sets and to address the health needs of remote communities, particularly rapid response to traumatic injuries.

## **Background**

For decades, Burma, particularly the border regions, has experienced prolonged civil conflict. While much attention is rightfully paid to the situation of infectious diseases and a failing healthcare system into which the junta puts less than 3% of their annual budget expenditures<sup>1</sup>, attention must also be paid to the widespread use of landmines. Burma is among the countries identified in the 2006 Landmine Monitor report that has experienced an increase in the number of landmine casualty rates in 2006, almost exclusively due to conflict. While no official statistics exist for the country, in 2006 a total of 243 new casualties were reported, up from 231 in 2005 with an estimated 10,605 survivors total.<sup>2</sup> These statistics, however, likely reflect severe underreporting. Mortality surveys conducted in an Eastern Burma conflict zone in 2002 demonstrated that 4% of all deaths were attributable to landmines; given the crude mortality rate of 25, this means that approximately 1 per 1000 persons per year in this population dies from landmine injury.<sup>3</sup>

The reason for these high rates is multi-fold. Although landmines are placed by both military regime forces and non-state armed groups for military purposes, the UN Special Rapporteur on Human Rights stated his concerns about the use of landmines against civilians in his report to the UN in 2007: "Among the most appalling features of the military campaign in ethnic areas is the disproportionate effect on civilian populations...In addition to the heightened risks posed by anti-personnel mines, the killing, terrorizing or displacement of civilians is often part of a deliberate strategy to separate ethnic armed groups from their

civilian populations.”<sup>4</sup>

Karen Human Rights Group has documented villagers’ reports of “atrocities demining” whereby the Burmese Army forces villagers to walk in front of soldiers as human minesweepers, often as porters and sometimes dragging a heavy log across the path.<sup>5</sup> In addition, the Thailand Burma Border Consortium stated that mines are often placed near rice fields to prevent villagers from cultivating the land and to aid in the displacement of these civilian populations.<sup>6</sup> Finally, a survey of human rights violations in eastern Burma found that households that were forcibly displaced were four times more likely to have a household member become a landmine victim.<sup>7</sup>

Landmines in these areas usually require only 6 kilograms of pressure to be triggered, ensuring that even a child or animal can cause an explosion. Child victims are more likely to die from their injuries as a result of their vital organs’ closer proximity to mines and their inability to survive resulting blood loss. However, for the significant proportion of adults and children that survive the initial blast, rapid access to care is critical. Beyond initial stabilization, higher-level care is essential, as the vast majority of survivors require amputation.

For landmine victims, the access to care in conflicted areas of eastern Burma, otherwise known as “black zones”, is bleak. The Burmese government’s so-called ‘Four Cuts Policy’, which cuts off the supply of food, funding, information, and recruits to ethnic minority insurgents, also prevents access to government and international forms of humanitarian assistance. By 2004, there were over 500,000 internally displaced persons (IDPs) in eastern Burma<sup>8</sup> living in these areas without any formal healthcare infrastructure or formally-trained healthcare providers such as physicians and nurses.

In response to these severe needs, community-based organizations have mobilized to address the most pressing health problems. We describe the development of a trauma management program to scale up the number and skills of community health workers to address the high rates of landmine injuries.

## **Methods**

The two main organizations involved in the Trauma Management Program (TMP) are the Karen Department of Health and Welfare (KDHW), and the Backpack Health Worker Team (BPHWT). KDHW manages 33 mobile clinics providing care for over 100,000 internally displaced persons (IDPs) and war-affected residents of Karen State. The clinics are “mobile” in the sense that they are based in bamboo structures and can be moved quickly in case of attack. They are staffed by 5-10 health workers each. BPHWT is a multiethnic organization (Karen, Karenni, Mon, and Shan) that has 90 teams of 3-5 health workers per team providing care for over 150,000 IDPs. These mobile teams serve more unstable areas, where it would be impossible to

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have even semi-permanent clinics. These teams refer more severe patients to clinics where they are available.

In total, the 711 KDHW and BPHWT health workers are a diverse group. They range in age from 19 to 55 years old, with 54% male and 46% female. They have received training from a variety of sources including KDHW, BPHWT, Mao Tao Clinic, IDP camps in Burma, and refugee camps in Thailand. Training for a health worker ranges from 4 to 18 months. A subset of these health workers return to the Thai border on a six-monthly basis to receive further training, to exchange data, and to resupply.

Since the late 1990s healthcare leaders have worked to establish specialized teams of health workers to augment the care provided by KDHW and BPHWT, which has subsequently developed into a more formal program, the Trauma Management Program (TMP). Although the impetus to establish trauma teams was the prevalence of conflict related trauma due to landmine injuries, skills learned in the trauma courses also apply to injuries incurred by gunshot wounds, stab wounds, blunt trauma, falls, and environmental injuries. The TMP boosts the moral of the community and contributes to the empowerment to care for themselves.

The TMP had as its predecessor the War Casualty Management Training Course (1993-1996) run by the Trauma Care Foundation (TCF) / Tromsø Mine Victim Resource Center. Beginning in 2000, a four-day trauma course for health workers was established by the Global Health Access Program (GHAP) in conjunction with KDHW to teach basic competencies to care for trauma victims. The course has occurred every 6 months for the last 8 years and has evolved over time. Current class composition of approximately thirty students is two-thirds health workers without prior trauma training, and one-third with prior training and experience in trauma management. The course is taught by GHAP volunteer physicians, nurses, and pre-hospital care personnel, together with the more experienced health workers. A Training of Trainers program is included in the current course, in which the experienced trauma health workers serve as mentors, small group leaders, and lecturers during the bi-annual course thus increasing their capacity as trainers within their health care system.

The trauma course content draws from resources developed by the TCF, the International Committee of the Red Cross, Dr. Maurice King's book series of primary surgical care, and a variety of other sources. The curriculum covers the evaluation and management of the trauma victim with an emphasis on resuscitation, recognition and management of shock, wound care, and prevention of sepsis and organ failure. Recognizing that injury of the extremity is the most survivable major trauma, the course focuses on the early and aggressive management of limb injuries including control of bleeding, wound care, fasciotomy, amputation, fracture and dislocation management, splinting, and casting. Other skills taught include: resuscitation, basic and advanced/surgical airway, tube thoracostomy, venous cut down, intravenous fluid therapy, blood transfusion, nasogastric and urine catheter use, suturing, anesthesia and analgesia, and preoperative, operative, and postoperative care such as monitoring, hygiene, infection prevention and treatment, psychological care of the trauma patient, and rehabilitation. A short focused lecture followed by a clinical activity is the typical teaching pattern. Activities include role-playing, skills labs, and case reviews.

In the last 12 months, senior trauma health workers have developed advanced and basic curricula for field training for the larger number of health workers who remain in the field and make up most of the healthcare infrastructure. In addition, KDHW and BPHWT also provide basic "first responder" health training for local villagers in their respective target populations ("Village Health Workers" or VHWs). A total of 333 VHWs have received training from 1 week to 2 months duration in first aid and primary care. VHWs live in the villages where trauma often occurs, and training this group as trauma first responders is underway as a critical link in the trauma chain of survival.

These trauma providers work in a field-based setting and rarely have the opportunity to send their patients to

a hospital. They are trained to be members of a mobile, effective, and self-reliant team. The TMP has secured the funding to provide each trauma team with a standard set of supplies including stethoscopes, surgical instruments, headlamps, files, amputation saws, and modified tourniquets. Other basic supplies include gloves, gauze, ace wraps, tape, suture, tubing for airways and chest tubes, irrigation supplies, injection and IV supplies, rapid diagnostic kits and transfusion supplies, and antiseptics. Medications include basic oral and IV antibiotics, analgesics and anesthetics.

The TMP has created data collection tools to facilitate the process of patient care, resource management, and trauma patient outcomes analysis. Health workers complete each form in the field while they are conducting patient care. Data fields include patient name, age, sex, date of injury, mechanism of injury, region of body injured, date and time of health worker arrival to patient and departure from patient, treatment given, referral information, and survival information. Excluded from the Trauma Care Register is any patient who died from their injuries prior to medic arrival. Included are all other patients who the trauma team was activated to see including blunt, penetrating, and blast injured patients. Survival is defined as a patient who had signs of life on trauma health worker arrival, and was alive and considered stable when the health worker left the patient.

## **Results**

Approximately 20 new health workers per year have received training since 2000 in essential trauma management skills. From June 2005 to June 2007, these workers have provided services to over 200 patients recorded on the trauma registry. Demographic characteristics of the population are shown in Table 1. The majority of trauma victims were young (mean age of 30) and male (89%).

A wide variety of trauma mechanisms were reported, including weapons-related, accident, and animal attack. The majority (72%), however, were a result of weapons-related trauma. Landmine injury was the most common type, followed by gunshot wounds. A few additional cases of stab and mortar/RPG injury were reported. Of all patients receiving care by the health workers, the vast majority (91%) survived and were alive at the time of last contact.

Sixteen patients (9%) expired as a result of their injuries. Characteristics of patients who died are shown in Table 2. Compared to the overall population, patients who died were more likely to have suffered weapons-related trauma (94% of injuries). Landmine and gunshot wounds accounted for fifteen deaths, with one patient dying after falling from a tree. All deceased patients were male, with ages similar to the overall population. Compared to survivors, those who died had a much higher rate of injury to the head and torso, the same as would be expected in a high-resource medical care system.

Health worker response times were reported for the majority of cases. Overall, the health workers arrived to the patient within 48 hours (80% of cases). Among patients who expired, response times were slightly faster, with 92% of patients receiving care within 48 hours.

A wide spectrum of treatment modalities were used in the care of trauma victims. Evidence acquired through interviews with health workers, trauma registry inputs, and photo/video documentation, suggests that procedures taught during training workshops were implemented effectively in the field. In the treatment of

severe extremity injuries, amputation was commonly performed. Ketamine was typically used for procedural sedation with intravenous fluids used in resuscitation before, during, and after the procedure. The most commonly used antibiotics used were ampicillin and gentamycin. Splinting was performed using either plaster or bamboo.

## Discussion

Trauma continues to be a significant source of morbidity and mortality in the conflict regions of Eastern Burma. One in 50 households reports exposure to combat-related violence, with land mine death or injury affecting 13.3 per 10,000 population annually.<sup>8</sup> In addition, Hougen, et al, interviewed 188 Burmese refugees living in Thailand, and found that 23 were landmine survivors, the majority civilians.<sup>9</sup>

In this report, we demonstrate that mobile health workers in a low-resource setting, with no immediate access to hospitals or other well-resourced referral centers, can be trained and equipped to treat life-threatening injuries. Overall, trauma victims survived in 91% of cases. Of landmine patients, the largest group, 90% survived initial treatment and were considered stable at the time of last health worker contact. These numbers are notable considering that treatment was provided in a jungle conflict zone, with limited shelter, no electricity, and equipment limited to that which could be carried by foot to reach victims that might be several hours or days hike in distance. Additionally, health workers worked in a hostile environment where they themselves were at risk of becoming victims of conflict related trauma.

We lack data on trauma mortality prior to the initiation of the TMP, making it is impossible to quantify benefit with our data. However, we have reasonable belief that survival rates have improved due to the TMP. First, in many cases, amputation was performed to prevent life-threatening infection, hemorrhage, and to improve functional outcome. Intravenous fluid resuscitation and blood transfusion were given to patients in hemorrhagic shock. Wound debridement, irrigation and antibiotics were used to treat and prevent infection from highly contaminated wounds. It is likely that many of these patients would have died without treatment.

Second, our measured survival rates compare favourably to those reported by other pre-hospital trauma programs in low-resource settings where trauma teams have been shown to improve mortality. Husum, et al, reported the implementation of a low-cost pre-hospital trauma care system in North Iraq and Cambodia.<sup>10</sup> Of 708 land-mine victims, the overall mortality rate was reduced from 26% to 12% during the four-year implementation period. Excluding patients who were found already dead at the scene, mortality of initially living victims was 4.3%. The lower mortality as compared with our data is likely multi-factorial, but may relate to the fact that these study patients in Iraq and Cambodia had significant access to hospital-based trauma centers after initial field resuscitation.

There are a number of limitations to this report. First, data gathering was performed using standardized forms, but in some cases, documentation was incomplete. Also, given the difficult and unpredictable conditions in which the health workers work, it is likely that some trauma patients may have been treated, but not recorded in the trauma registry. Second, as mentioned previously, we cannot establish with certainty the degree to which the TMP has improved outcomes, since no data is available prior to program implementation. However, we believe that the available evidence shows that many patients survive and have improved functional outcomes directly due to treatment received by the trauma health workers.

## Conclusions

As trauma is increasingly recognized as a major cause of morbidity and mortality in the developing world, effective health worker trauma training has applicability for other conflict, post-conflict, and low-accessibility areas. This report illustrates the effective development and implementation of a health worker-run trauma care system by community based organizations. Finally, interviews with health workers suggest that skills and knowledge acquired through the TMP have imbued confidence and a sense of empowerment into situations that once seemed hopeless.

## Competing Interests

The authors declare that they have no competing interests.

## Authors' contributions

AR contributed to conception and design of the manuscript, analysis and interpretation of data. CL participated in the conception and design of the manuscript, acquisition of data. MR assisted in composing the manuscript. EK made contributions in data collection and critical revision of the final manuscript for intellectual content. TL participated in the final review of the manuscript. LS conceived of the project and participated in the design and drafting of the manuscript. All authors read and approved the final manuscript.

## Acknowledgements

We thank the Gonda Family Foundation for its generous and ongoing support of the TMP. The authors thank the people of the Karen Department of Health and Welfare, Backpack Health Worker Teams, and Global Health Access Program who have actively served in the Trauma Management Program. A special thanks to Richard Hahn MD who helped develop the trauma training and whom we owe gratitude and respect.

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*Table 1 - table title*

*Table 2 - table title*

Table 1: Demographic Characteristics of the Study Population (N=183)

Variable	Male N(%)	Female N(%)	Total N(%)
<b>Gender</b>			
Male	-	-	163 (89)
Female	-	-	20(11)
<b>Age</b>			
<18	12(7)	4(20)	16(9)
19-24	37(23)	5(25)	42(23)
25-44	88(54)	3(15)	91(50)
>45	20(12)	6(30)	26(14)
Not recorded	6(4)	2(10)	8(4)
<b>Cause of Injury</b>			
Landmine	76(47)	4(20)	80(44)
Gunshot	39(24)	3(15)	42(23)
Fall from Tree	6(4)	-	6(3)
Hit by Tree	3(2)	-	3(2)
Cut wound	8(5)	-	8(4)
Burn	1(1)	4(20)	5(3)
Animal attack	9(6)	-	9(5)
RPG/mortar	2(1)	-	2(1)
Stab Wound	4(2)	3(15)	7(4)
Other	15(9)	6(30)	21(11)
<b>Outcome</b>			
Survived	147(90)	20(100)	167(91)
Expired	16(10)	-	16(9)
<b>Wait in days for medic arrival <i>Mean</i></b>			
	2.35	1.28	2.23

Table 2: Characteristics of subjects who did not survive (N=16)

Variable	N(%)
<b>Gender</b>	
Male	16(100)
Female	-
<b>Age Mean(SD)</b>	
<18	-
19-24	5(31.25)
25-34	8(50.00)
35-44	3(18.75)
45-54	-
55-64	-
65-74	-
75-84	-
<b>Cause of Injury</b>	
Landmine	8(50)
Gunshot	7(43.75)
Fall from Tree	1(6.25)
Hit by Tree	-
PPH	-
Abscess	-
Cut wound	-
Burn	-
Animal attack	-
RPG/mortar	-
Severe Malaria	-
Stab Wound	-
Other	-
Don't Know	-
<b>Wait Time for Medic</b>	
0 Days	8(61.54)
1-5 days	4(30.77)
6-10 days	-
11-20 days	-
21-30 days	-
>31 days	1(7.69)

Joint Special Issue, E.67:

**Essential trauma management for internally displaced people of eastern Burma:  
Scaling up the workforce and diversifying health workers' skills to address service  
delivery needs of communities in active conflict zones.**

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Significance of this submission:

This paper details a trauma program of a community-based organization (CBO) of internally displaced people (IDP) of eastern Burma. The program includes training of medics, supply chain, patient care, and data collection. The care is rendered in a conflict zone. The significance of this submission is two fold:

1. A CBO of IDP medics are capable of rendering live saving health care services to trauma victims within an active conflict zone.
2. The patient survival rates of this medic run trauma system compares favorably to a similar pre hospital system with access to subsequent physician and hospital care.

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