

Background

The Burmese government directs less than 3 percent of its budget annually towards health care, resulting in scant services for its people.¹ In the border regions, access to both governmental and international non-governmental sources of health care resources is worse than the rest of Burma. This is largely a result of civil conflict and government restrictions which have persisted for decades. While much attention is rightfully paid to the problem of infectious diseases and a failing health care system in Burma, attention must also be paid to the widespread use of landmines. The 2007 Landmine Monitor Report identifies Burma as one of the few countries experiencing an increase in the number of landmine casualty rates in 2006, reporting 243 new casualties, up from 231 in 2005.² These statistics, however, likely reflect severe underreporting as most injuries occur in areas where data is not routinely collected. Mortality surveys conducted in an Eastern Burma conflict zone in 2002 demonstrated that 4% of all deaths were attributable to landmines.³

The reason for these high injury and mortality rates is multi-factorial. Although landmines are used in combat by both government forces and their adversaries, 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..."⁴ Karen Human Rights Group has documented villagers' reports of "atrocious demining" whereby the Burmese Army forces villagers to walk in front of soldiers as human minesweepers.⁵ 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.⁶ 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.⁷

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.

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 many survivors require critical actions including amputation.

Yet for landmine victims in conflict areas of eastern Burma, there is little or no access to care. The Burmese government's so-called 'Four Cuts Policy', which aims to cut 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 living in these areas with virtually no access to hospitals, physicians, or nurses.⁶

In response to these needs, community-based organizations (CBOs) have mobilized to address the most pressing health problems. Two organizations involved in trauma care in eastern Burma are the Karen Department of Health and Welfare (KDHW), and the Backpack Health Worker Teams (BPHWT). KDHW is the health department of the Karen National Union, the Karen State (Eastern Burma) government in exile of the ethnic Karen people. 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. Five to ten health workers staff each clinic. BPHWT formed in 1998 to deliver health care services to the most remote areas within the conflict zones of eastern Burma. BPHWT is a multiethnic organization (Karen, Karenni, Mon, and Shan) that has 90 teams of three to five health workers per team providing care for over 150,000 IDPs. These mobile teams serve more unstable areas, where it would be impossible to have even semi-permanent clinics.

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, IDP camps in Burma, refugee camps in Thailand, and Mao Tao Clinic (MTC). MTC was established in 1988 by Dr. Cynthia Maung in Mae Sot, Thailand and is the largest training and treatment center for Burmese exiles that have fled to Thailand from Burma, yet whom are not living under refugee status. Training for a health worker ranges from 4 to 18

months and includes intensive training in basic primary care, infectious disease, maternal child care, first aid, and public health. A subset of these health workers returns to the Thai border every six months to receive further training, to exchange data, and to resupply.

Since the late 1990s health care leaders have worked to improve the capacity of health workers trained in trauma care to augment the services provided by KDHW and BPHWT, which has subsequently developed into a more formal program, the Trauma Management Program (TMP). Although the impetus to establish the TMP 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.

We describe the development of a trauma management program to scale up the number and skills of community health workers to address the health care needs of landmine injury victims. We describe the training program including curriculum, training workshops, personnel, and resource utilization. We also describe outcomes of training and trauma victim data.

Methods

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 as well as trainings lead by individual trauma care experts. Beginning in 2000, a four to six day trauma course for health workers was established by the Global Health Access Program (GHAP) in conjunction with KDHW to teach basic competencies in caring for trauma victims. GHAP is a US based non-profit non-governmental organization (NGO) providing health-related technical assistance and capacity building for CBOs. The course has occurred twice a year for the last 8 years and has evolved over time. In the last three years Australian Aid International (AAI), an Australian based health care and disaster assistance NGO has partnered with GHAP and KDHW in the trauma training workshops. Class composition of approximately thirty students

has been two-thirds health workers without prior trauma training, and one-third with prior training and experience in trauma management. KDHW leaders have selected student participants with the goal of creating integrated trauma teams of experienced and less experienced health workers. Course instructors have included GHAP and AAI volunteer physicians, registered nurses, nurse practitioners, and pre-hospital care personnel, together with the more experienced trauma health workers. Volunteer physicians have included emergency medicine physicians, general surgeons and orthopedic surgeons. A Training of Trainers program is embedded 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 curriculum covers the evaluation and management of the trauma victim with an emphasis on resuscitation, stabilization, recognition and management of shock, wound care, and prevention of infection, sepsis and organ failure. The trauma course content has drawn 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 authoritative sources. 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: suturing, anesthesia and analgesia, and preoperative, operative, and postoperative care, monitoring, hygiene, psychological care of the trauma patient, rehabilitation, basic and advanced/surgical airway, tube thoracostomy, venous cut down, nasogastric and urine catheter use, intravenous fluid therapy, blood typing, and blood transfusion. A short focused lecture followed by a clinical activity has been the typical teaching pattern, within a three-hour teaching block each morning and each afternoon. Activities include role-playing, skills labs, and case reviews. Each course has been designed to cover the basic core content, but with some new concepts added to each subsequent course for the benefit of returning experienced health workers. Assessments of the health workers is done throughout the course by the faculty. A pre course and post course written quiz is administered on core concepts. Observation of skills during role-playing trauma drills and skill labs are performed and feedback is given to student health workers throughout

the course in real time.

In the last 12 months, senior trauma health workers have developed advanced and basic trauma curricula for field training for the larger number of health workers who remain in the field and make up most of the health care infrastructure. In addition, KDHW and BPHWT also provided 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 is underway as a critical link in the trauma chain of survival.

Health workers trained in trauma care work in their assigned clinics or backpack teams. In addition, specialized teams of these health workers based at clinics can be “activated” or called to a village in the case of a trauma patient that cannot be transported. Health workers often function in remote jungle and village settings, and thus are trained to be members of mobile and self-reliant teams. These teams consist of experienced and less experienced health workers in each geographic area of coverage, a practice that fosters teamwork, mentorship, and results in the transition from junior to senior trauma health worker status over time. Senior health workers teach, supervise, and informally evaluate junior health workers within each field team.

The TMP provides trauma teams 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 for HIV and blood typing, blood 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. Data collection began in June 2005. Health workers complete

each form in the field while they are conducting patient care. Data fields include patient name, age, sex, date and time 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. Trauma health workers are not activated for deceased victims and excluded from the Trauma Care Registry is any patient who died prior to health worker 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 considered highly likely to survive this injury upon health worker departure. Unstructured interviews with health workers, trauma registry inputs, and photo/video documentation were all used to determine what trauma procedures were performed in the field.

Results

Approximately 40 new health workers per year have received trauma training since 2000 in essential trauma management skills. Approximately 10 specific individual health workers have been attending all or most workshops on a recurring basis during this same time interval. The majority of the trauma course students are from Karen State. Health workers from Mon, Karenni, and Shan State have also participated. Real time course observations and feedback by trauma course faculty to health worker students have been the main measure of student comprehension of course content.

In 2007, after the formation of field curricula, trauma health workers had conducted four Village Health Worker First Aid Training Course, and one Basic Field Trauma Health Worker Course. Limitations to expansion of training inside include security constraints in moving health workers from one area to another within the conflict zone of Karen State and the costs of training.

From June 2005 to June 2007, these trauma health workers provided services to over 200 patients recorded on the trauma registry. Although adequate comparison data upon which to judge efficacy is lacking, the data that was collected can serve as an estimate of what types of injuries are being seen and what type of care is being given. 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 was alive at the time of last contact.

Sixteen patients (9%) treated by health workers ultimately 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.

A wide spectrum of treatment modalities was used in the care of trauma victims. Available evidence as acquired through unstructured 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, fasciotomy and amputation were commonly

performed. Ketamine was typically used for procedural sedation and intravenous fluids were used in resuscitation before, during, and after the procedure. Patient assessment, monitoring and basic airway skills were routinely used. Advanced airway and tube thoracostomy skills were rarely used. Blood transfusions were performed for hemorrhagic shock. Wound care was performed and antibiotics (intravenous and oral) were frequently administered. 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.⁷ In addition, Hougén, et al, interviewed 188 Burmese refugees living in Thailand, and found that 23 were landmine survivors, the majority civilians.⁸

In this report, we describe the development of a trauma-training program by and for a CBO of IDPs in partnership with a health care NGO. 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 treated by health workers 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. Although we have no adequate comparison data specific to this setting and these conditions, we believe that 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.

Based on unstructured interviews with health workers, data gathered, and faculty observations, we believe the curriculum and training provided in the trauma workshops has been helpful in upgrading the skills and number of trauma health workers in eastern Burma. The curriculum and course emphasis has been adapted over time due to health worker feedback and data and continues to better reflect the needs of the trauma health workers.

We lack data on trauma mortality prior to the initiation of the TMP, making it impossible to quantify the health outcome benefit with our data. However, based on available documentation, victims of trauma are now receiving care that was not widely available prior to the TMP.

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, we cannot establish with certainty the degree to which the TMP has improved outcomes, since no data is available prior to program implementation.

Conclusions

As trauma is increasingly recognized as a major cause of morbidity and mortality in the developing world, effective health worker trauma training has increasing applicability for other conflict, post-conflict, and low-accessibility areas. This report illustrates the development and implementation of a health worker-run trauma care training and system by a community based organization partnering with an NGO. Finally, in interviews, health workers report that skills and knowledge acquired through the TMP have imbued them with 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.

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References

- 1 International Monetary Fund (2001) Myanmar: Statistical appendix. Washington (D. C.): International Monetary Fund. Available: <http://www.imf.org/external/pubs/ft/scr/2001/cr0118.pdf>. Accessed 29

August 2006.

- 2 International Campaign to Ban Landmines. Landmine Monitor Report 2007: Toward a Mine-Free World.
- 3 Lee TJ, Mullany LC, Richards AK, Kuiper HK, Maung C, Beyrer C. Mortality rates in conflict zones in Karen, Karenni, and Mon States of eastern Burma. Trop Med Int Health. 2006;11(7):1119-27.
- 4 UN Human Rights Council, "Report of the Special Rapporteur on the situation of human rights in Myanmar, Paulo Sérgio Pinheiro," A/HRC/4/14, 12 February 2007, paragraphs 56 and 78.
- 5 Karen Human Right Group. Without Respite. 13 June 2006.
- 6 Burmese Border Consortium (2004) Internally Displacement and Vulnerability in Eastern Burma. Burmese Border Consortium, Thailand.
- 7 Mullany LC, Richards AK, et.al., Lee TJ. Application of population-based survey methodology to quantify associations between human rights violations and health outcomes in eastern Burma. Journal of Epidemiology and Community Health, 2007;61:908-914.
- 8 Hougén HP, Petersen HD, Lykke J, Mannstaedt M, Ussing B. Death and injury caused by land mines in Burma. Sci Justice. 2000 Jan-Mar;40(1):21-5.

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

Variable	Male N(%)	Female N(%)	Total N(%)
Gender			
Male	-	-	163 (89)
Female	-	-	20(11)
Age			
<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)
Cause of Injury			
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)
Outcome			
Survived	147(90)	20(100)	167(91)
Expired	16(10)	-	16(9)
Wait in days for medic arrival			
<i>Mean</i>	2.35	1.28	2.23

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

Variable	N(%)
Gender	
Male	16(100)
Female	-
Age Mean(SD)	
<18	-
19-24	5(31.25)
25-34	8(50.00)
35-44	3(18.75)
45-54	-
55-64	-
65-74	-
75-84	-
Cause of Injury	
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	-
Wait Time for Medic	
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)