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The emergency first aid responder system model: using community members to assist life-threatening emergencies in violent, developing areas of need

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ABSTRACT

Background As many as 90% of all trauma-related deaths occur in developing nations, and this is expected to get worse with modernisation. The current method of creating an emergency care system by modelling after that of a Western nation is too resource-heavy for most developing countries to handle. A cheaper, more community-based model is needed to establish new emergency care systems and to support them to full maturity.

Methods A needs assessment was undertaken in Manenberg, a township in Cape Town with high violence and injury rates. Community leaders and successfully established local services were consulted for the design of a first responder care delivery model. The resultant community-based emergency first aid responder (EFAR) system was implemented, and EFARs were tracked over time to determine skill retention and usage.

Results The EFAR system model and training curriculum. Basic EFARs are spread throughout the community with the option of becoming stationed advanced EFARs. All EFARs are overseen by a local organisation and a professional body, and are integrated with the local ambulance response if one exists. On competency examinations, all EFARs tested averaged 28.2% before training, 77.8% after training, 71.3% 4 months after training and 71.0% 6 months after training. EFARs reported using virtually every skill taught them, and further review showed that they had done so adequately.

Conclusion The EFAR system is a low-cost, versatile model that can be used in a developing region both to lay the foundation for an emergency care system or support a new one to maturity.

As many as 90% of all trauma-related deaths occur in developing countries, with the majority of these deaths occurring in the prehospital setting.[1] Over the next few decades, these countries will experience even greater rates of death and injury from emergency incidents as the countries develop further, urbanise and industrialise.[2–9] As a result, emergency care will play an increasingly critical role for global health.[1 10]

The impending rise of emergencies is largely due to the inevitable development of low-income countries.[2–7 11 12] As impoverished nations develop, their cities will modernise and industrialise—becoming attractive to rural populations seeking employment, means and a more comfortable lifestyle. This leads to mass migrations towards urban centres, which typically result in massive slums and shanty towns that breed unregulated crime, accidents, poor sanitation and violence.[5] Once these urban centres increase dramatically in size and concentration, individuals become more exposed to gangs, drugs, weapons, machinery and diseases than before.[4 5]

To meet this emergency need, many nations are developing emergency care systems. A current popular strategy is to model the system after that of a Western country, particularly that of the USA.[13] However, Western models are often too taxing on the scarce resources of a low-income country, and they often push the developing nation to distract too many of its crucial resources towards a system that it cannot sustain and that may be ineffective for the country.[13]

As a result, a new strategy is needed to help establish emergency care systems in developing areas, and to support them until full maturity. One component of this solution may be the employment of first responders:[14] community members trained in the most basic prehospital emergency procedures. Because they are already dispersed throughout a community, they are able to be the first medically trained persons on a scene. Ideally, they are able to keep a patient alive until further help is available, using no specialised medical equipment and being able to work at an instant's notice—studies have already found that first responders can be effective at reducing morbidity and mortality.[15–17] In addition, training first responders is relatively easy because they are primarily volunteers without political red-tape, and governments can avoid violating obligations to businesses that work within the country's formal healthcare system.[18]

However, not enough work has been done with first responders,[18–22] and to date they have been mainly imposed as a standalone health intervention. We aimed to design a first responder system model with the intention of having it be able to integrate into and support young emergency care systems (or to lay the foundation for an entirely new emergency care system in a developing area).

METHODS

Target area

To set up a first responder model, we targeted the community of Manenberg, an area of approximately 55 000 residents that sits just outside of Cape Town, South Africa.[23] Manenberg is notorious for its high rates of assault, accidents and crime violence, and it has 'long been synonymous with gangsterism in the public mind'.[24] In addition, residents report that the severely overwhelmed ambulances are typically delayed arriving on scene,

and that patients often die while waiting for an ambulance. The Cape Town METRO emergency medical services (EMS) official statistics indicate that in the greater Cape Town area only 65% of life-threatening emergencies are responded to within 15 min, with approximately 250 life threatening incidents per day and up to 25 000 total life-threatening and non-life-threatening calls per month (SD Vries, personal communication, 2011). However, Manenberg residents report that in poorer areas, such as Manenberg, response times are almost always delayed and can sometimes take hours, even for critical patients.

Training

To design the first responder training curriculum, we consulted with doctors and nurses at Manenberg's GF Jooste Hospital's emergency centre as well as the primary care clinics located nearby. At these locations, we undertook a preliminary assessment of what types of medical and traumatic emergencies are most common, and which are the most fatal. In addition, because the proportion of injuries treated at the clinics may be different from that of the injuries inflicted on the streets, we also consulted with local Manenberg community members on their perceived experiences. We held multiple discussions with the Manenberg Health Committee, a local non-governmental organisation (NGO) composed of representatives from other Manenberg NGOs, and also assembled several focus groups consisting of individuals not on the committee.

Between the expressed concerns of the Manenberg people and the official records of the emergency centre and clinics, we identified the most frequent and most serious injuries in Manenberg and tailored the course to address these identified needs. The resultant curriculum was accredited by the University of Cape Town Division of Emergency Medicine. A certified trainee was referred to as an emergency first aid responder (EFAR).

Model design

We designed the model for EFAR service delivery by consulting with local community leaders, who instructed us to assess already existing community-based services in Manenberg (such as the neighbourhood watch, or the HIV/AIDS awareness campaigns) that were the most effective and how they were delivered. We modelled a basic EFAR service delivery after these services for a baseline, basic foundation.

We added to the model's design by adding an additional layer: an advanced EFAR system that was a community-based version of the local METRO EMS. After designing both layers of the EFAR system model, we identified the appropriate governing bodies that could oversee these levels and integrate them with the greater Cape Town METRO EMS.

Monitoring the programme

All basic EFAR trainees were given a pretraining exam and a final exam to test for learning. Trainees who scored at least 75% on the final exam were certified as EFARs and were re-tested at 4 and 6 months to test for retention. At 4 and 6 months, certified EFARs were also surveyed for usage of their skills. Patient care report forms were also collected from EFARs, who were encouraged to fill one out after every incident. EFAR reports of skill usage at 4 and 6 months were carefully reviewed to prevent double reporting of the same incident.

Ethics

Data entries were stripped of identifiable markers and stored on secure Excel files and computers. Ethics approval was granted by both the University of Cape Town and Stanford University.

RESULTS

Basic EFAR training curriculum

We identified four major categories of need, which became the basis of the four modules of the course: emergency scene management; unconscious patients; violent injuries and medical emergencies (see table 1).

In order for a trainee to qualify for certification, they had to score a minimum of 75% on the final exam. Upon qualification, students received a personalised certificate and an ID card to use at a scene. Both the certificate and ID card were valid for 2 years.

The course lasted 1 day and was PowerPoint based with practical sections. Because a laptop and LED projector were not always available, we created a lecture on DVD in which the instructor only needs to facilitate and run the practicals. Also, when qualified, local community members were used to instruct the course. Trainees appeared visibly to be more comfortable and to have higher comprehension rates than when foreigners or Cape Town doctors taught the course.

Aside from the projector and other presentation equipment, the materials used to run the course included the handout, the

Table 1 Basic EFAR training needs assessment and curriculum design

Module	Needs assessment	Curriculum design
(1) Emergency scene management	Interviewees reported emergency incidents as usually chaotic with mass confusion. In addition to untrained individuals attempting to help, there are frequently a number of people panicking and people attempting to exploit the patient—such as robbery, taking pictures, or blackmailing. Also, knowledge of emergency phone numbers was extremely low.	Responsibilities of an 'emergency first aid responder', scene safety and control (SAF-T), calling for help/ambulance, mass casualty incidents, overview of ABCs. Extrication methods were excluded.
(2) Unconscious patients	Choking and unconsciousness were a frequent occurrence. Drowning cases were minimal.	Shock, choking, lay-person CPR, recovery position. There was both a lecture and a practical section.
(3) Violent injuries	Gunshots, stabs and traffic accidents are rampant in Manenberg and are the most recognised emergencies. Community members almost universally identified both drugs and gangs as the main causes of all traumatic injuries.	Handling trauma patients, spinal management, bleeding control (DeEP), bandaging burns and bloody wounds, evisceration, impalement, amputations, splinting. There was a lecture, a practical and a case study section.
(4) Medical emergencies	Interviewees reported drug and alcohol abuse, seizures, diabetic shock, heart attacks and stroke as the most prevalent medical emergencies. Anaphylactic shock, animal attacks/bites/stings, hypothermia and hyperthermia were reported as minimal. Midwives are readily available in the area, and so infant delivery was not included.	Drug and alcohol overdose, seizures, diabetes, dehydration, heart attacks, stroke, abdominal pain and shortness of breath.

CPR, cardiopulmonary resuscitation; EFAR, emergency first aid responder.

final exam, the certificates, the ID and splints and bandages. As community bystanders do not have access to professional equipment, the splints and bandages used for training were made from items readily available in the community, including cardboard, cling wrap, blankets, sweaters, coat hangers, sticks and newspaper. Expenses are explained later.

The emergency first aid responder system model

Once community members are certified as EFARs, they are integrated into the general emergency system as the most basic, community-level emergency personnel. Their purpose is to fill the current gap between emergency patients on scene and the rest of the emergency system, thereby reducing the time until first medical contact and keeping patients alive until more formal emergency care is available (see figure 1). Each EFAR starts off as a basic EFAR, with the option of receiving further training to become an advanced EFAR.

The difference between basic and advanced EFARs is that basic EFARs are spread throughout the community with at least one per region (which we defined as an area where the inhabitants recognise one another). They are mostly accessed by already being present at an emergency scene or being nearby and recognised by the locals as a certified EFAR. Due to their high number and prevalence throughout the community, the basic EFAR response is almost instantaneous.

Advanced EFARs are a part of our model design, and we are currently in the process of establishing their part of the system. They will be formally posted in strategically placed stations throughout the community, will be notified by dispatch when the ambulance is called, will have access to more advanced medical equipment at the station, and will be trained in extrication and oxygen tank delivery methods. We expect that advanced EFARs will typically arrive more slowly than basic EFARs, but because they are already in the community, and are specialised for extremely quick response to their regions, they should arrive on scene before the METRO EMS ambulances. Both types of EFARs will work together to arrive on scene before the ambulance does, and either keep the patient alive until a METRO EMS ambulance arrives or properly transport the patient themselves to the nearest hospital if necessary. In addition, each basic EFAR region will be grouped together into a greater area that is served by one EFAR station. The advanced EFARs who staff this station will be responsible for overseeing and supporting their corresponding basic EFARs.

Basic EFARs are invited to a monthly support group meeting where they are organised, re-stocked and provided with additional advanced training. The meetings are open to the public but are primarily for the EFARs. When the advanced EFARs become available they will also be invited.

In Manenberg, the running of the system required the partnership of an academic or official institution for accreditation and quality control, a community-based organisation to manage the system and a body of instructors to implement it. The academic and official institution for us was the University of Cape Town, the community-based organisation was the Manenberg Health Committee, and the body of instructors comprised both locals and medical professionals.

The cost of running the system is minimal. For a full summary of the Manenberg basic EFAR training costs see table 2. The following estimates are based on 100 expected trainees a month, with a 75% pass rate. We have also included all optional expenditures in the cost, such as a laptop, LED projector and first aid kits (these prices were contingent on the local prices and needs of the Cape Town region). First aid kits for our basic EFARs included a semi-occlusive chest seal, two bandages and a pair of gloves packaged in a key-ring pouch. More advanced medical supplies for the advanced EFARs are much more variable and will depend on the available resources of the area; mobile phones for EFARs were not needed as almost all adult residents in Manenberg already own such phones or can easily obtain one.

Learning, retention and usage of skills

In the first 6 months, 628 individuals took the training. The mean score for all trainees was 28.2% before the training, and 77.8% for the final exam, confirming improvement ($p<0.0001$). Four hundred and twenty-three individuals (67%) qualified for

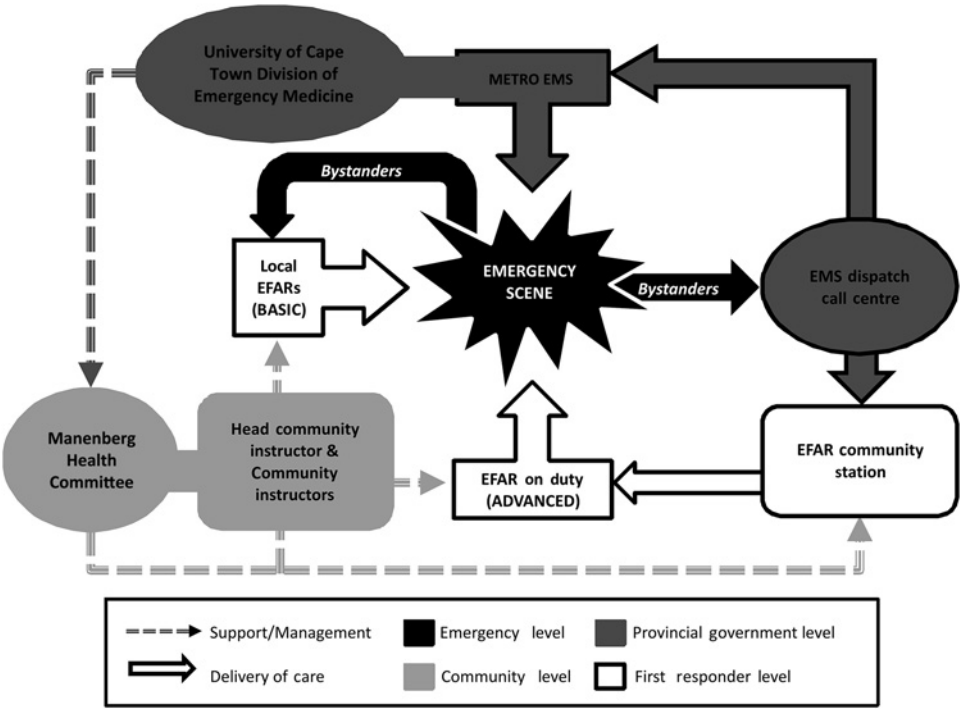

Figure 1 The Manenberg emergency first aid responder (EFAR) system model. During an emergency, bystanders are able to personally contact a nearby basic EFAR for a near instantaneous response. Bystanders can also call an emergency number which will activate both local advanced EFARs and METRO EMS ambulances, with advanced EFARs typically arriving much quicker. All EFARs are supported by an official, academic body and an organization within the community. EMS, emergency medical services.

Table 2 Total potential costs of the basic EFAR training

Basic EFAR training	Items	Cost	Recurrence	Expected total
Start-up costs	Netbook laptop	US$300	ONCE	US$700
	LED projector	US$400	ONCE	TOTAL
	Splints/bandages	US$000	ONCE	
Ongoing costs				
Instructor's wages	Per course taught	US$60.00	4 per month	US$3120
	Per additional day	US$20.00	1 per month	per YEAR
Course costs	Per handout	US$00.25	100 trainees per month	US$3450
	Per final exam	US$00.25	100 trainees per month	per YEAR
	Per certificate + ID	US$00.50	75 trainees per month	
	Per first aid kit	US$02.00	75 trainees per month	
	Extra costs	US$50.00	1 per month	

EFAR, emergency first aid responder.

certification; 179 (42%) of those certified were followed up 4 months after certification. They averaged 28.3% before training, 85.8% after training and 71.3% 4 months later, indicating that certified EFARs retained a large proportion of the training. One hundred and sixty-nine (40%) of those certified were followed up 6 months after certification. They averaged 31.3% before training, 82.0% after training and 71.0% 6 months after training, which was similar to the scores of those tested at 4 months, and suggests that skill loss after training is not continuous (p=0.9004). Seventy-four trainees were present for both follow-up sessions. They averaged 31.4% before training, 88.8% after training, 74.8% 4 months after training and 77.0% 6 months after training, again suggesting that skill loss after training is not continuous (p=0.3351 between 4 and 6 months).

In addition, EFARs self-reported using their skills by 4 and 6 months after certification (see figures 2–4). We also randomly selected and assessed 29 patient care reports from certified EFARs. They ranged from minor burns and fractures, to cases of anaphylactic shock and seizures, to violent physical assaults and motor vehicle accidents. Throughout the reports, the EFARs showed deductive skills in identifying what was wrong with the patient, and consistently gave adequate treatment. The EFARs also showed a high degree of understanding and flexibility in dealing with various emergencies, which was evident when the EFARs were able to handle emergencies variant from the textbook examples used during training. Overall, the EFARs gave sufficient quality of care within their scope, and even exceeded our expectations. They handled novel emergencies well, secured their scenes, gave proper treatments, avoided inappropriate interventions, and stayed with the patients until the patient recovered or higher care was available.

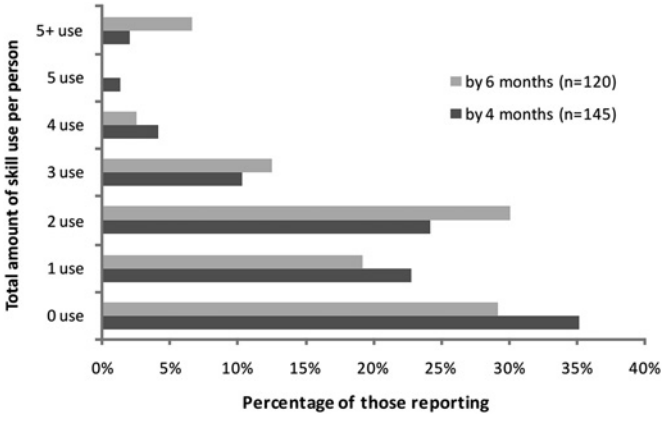

Figure 2 Reported number of times training used by emergency first aid responders.

DISCUSSION

The emergency first aid responder system is a very cheap and easy to establish intervention, and can be adapted to a specific area's needs. The system can be implemented in any area with a high volume of emergencies and inadequate emergency care. Therefore, although our system was in an urban area the system could theoretically also be established in rural locations. To sustain the system, the main requirements are a stable population from which to recruit community instructors and EFARs, a local community organisation to perform day-to-day administration, and an academic or official body to provide accreditation to the training. These roles could also be combined and performed by single entities, depending on the available organisations in an area. In addition, we emphasise that locals as close to the community as possible be used for the majority of contacts. The success of the Manenberg EFAR system was most likely because we relied on the knowledge of local community leaders, and the trust the locals had in them. This was also clear in the training: local community instructors were able to explain concepts in local terms and language, and were much better at engaging trainees, gaining their trust, and producing higher exam scores than local doctors or foreign instructors were able to. Because of this, we recommend using community instructors as much as possible, and having trained professionals present or on call to support the instructor with advanced technical knowledge if needed.

However, before training begins and the system is established, a thorough needs assessment to determine the emergency needs of the area is essential so that the course can be specifically tailored to the community and so the model can be altered to serve the region. In our system, it is evident that certified EFARs are using their training for all sorts of emergencies, continuously over time, and that they are using their training in various settings especially on the streets and in their homes. We believe that the EFARs reporting usage of almost every skill we taught them was no

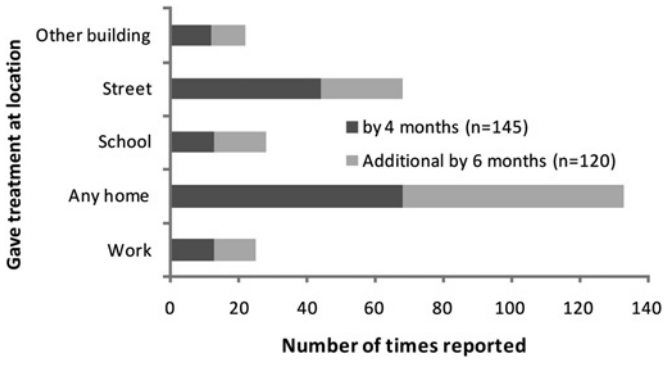

Figure 3 Location emergency first aid responders reported using their training.

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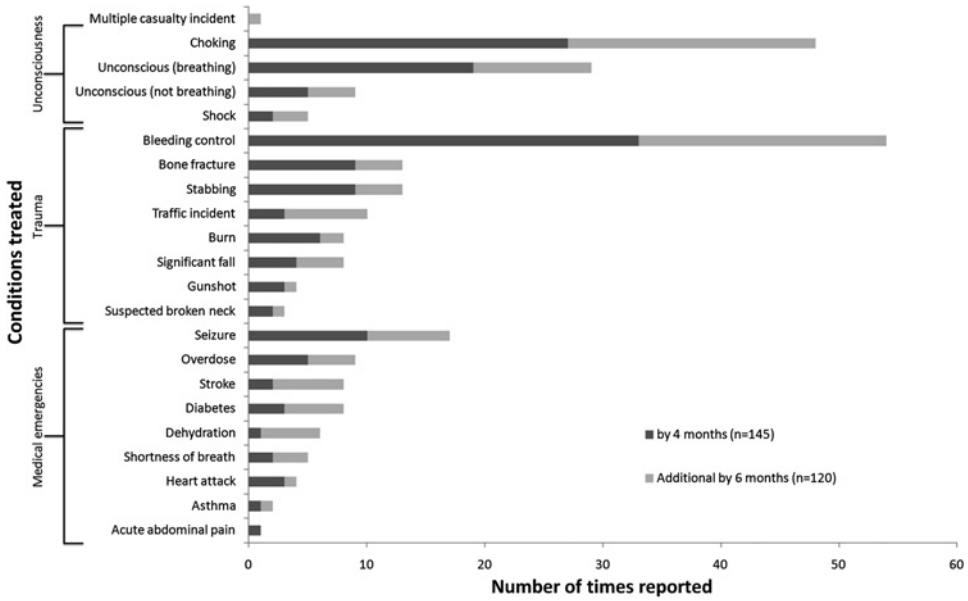

Figure 4 Conditions reported to be treated by emergency first aid responders. By 6 months after training, care for eviscerations was the only part of the training curriculum not reported to have been used.

mistake. We tailored the curriculum to the Manenberg locals' expressed needs, and based the care delivery on NGO and government models already well established in the area.

Even within Cape Town, we are cautious to expand the curriculum to certain townships without doing a needs assessment to determine if our current course is appropriate or should be modified. Of particular importance is the determination of whether emphasis should be placed on the quantity of EFARs trained or the intensity of their individual training. In Cape Town, the major problems were access to the delayed yet en-route ambulances. A highly intense training would have been redundant with the already existing ambulances and emergency centres. Therefore, we focused on training a greater number of EFARs to address the much more prevalent problem of the numerous patients waiting without any medical care. As a result, our course was purposely much shorter in duration than most other first responder training programmes, so that more EFARs could be trained in a shorter amount of time. In rural areas, where ambulances are less available and emergency incidents occur less frequently, it may be that greater training of each individual EFAR is more important than having a greater number of total EFARs.

In addition, we understand that Cape Town and much of South Africa is unique in that it is relatively more developed than other parts of Africa, and so our system had access to resources that other regions will not. If this is the case, we suggest that administrators construct the EFAR system at the basic level first, and then build the advanced level when the technology and supplies become available (this is the order we are taking to establish the complete system, and it is working well as the basic EFARs do not need the advanced EFARs to operate). Sometimes, if the region has no official EMS already in place, the advanced EFARs can be established with the intention of upgrading them to an ambulance system in the future.

Limitations

Current methods of comprehensively assessing the system's effects on morbidity and mortality are too complex for regions that would typically need this sort of intervention. Further research is needed to develop a simpler, less cumbersome methodology to analyse emergency care systems in developing areas.

In addition, further research is needed to test the EFAR system in other locations, and to perfect a universal strategy to bring the system to new places of different contexts and needs.

CONCLUSION

With the system's versatility and low costs, and the evident retention and usage of skills of the EFARs, we believe that the EFAR system model can be a viable supplement to a developing nation's emergency care system that has not yet met the community's needs, or an essential stepping stone to the establishment of an emergency care system where it does not yet exist. Either way, as long as there is an emergency need in a developing community, the EFAR system can potentially save lives.

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Competing interests None.

Ethics approval Ethics approval was provided by the University of Cape Town and Stanford University.

Contributors JS and LW contributed to study design, data interpretation and writing of the article. JS also collected and managed the data, searched for articles, drafted the figures and analysed the data.

Provenance and peer review Not commissioned; externally peer reviewed.

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