

RESUSCITATION TRAINING & DISASTER PREPAREDNESS

Col Tariq Hayat Khan

INTRODUCTION

Disasters are the result of a vast ecological breakdown in the relations between man and his environment, a serious and sudden event (or slow, as in drought) on such a scale that the stricken community need extraordinary efforts to cope with it, often with outside help or international aid. Synonym: catastrophe. No nation or geographical area on the earth is immune to disasters. Natural disasters have been there from the time immemorial in the shape of earthquakes, volcano eruptions, typhoons or floods; but the intensity and the capacity to destroy vast areas and kill millions of human beings have been the gifts of the present day scientific progress. To illustrate we may suffice to give the example of Hiroshima and Nagasaki nuclear bomb explosions by the Americans during WW-II.

Whatever the cause may be, the disasters leave the capability of local health facilities far behind to provide effective coping mechanisms. The recent past has witnessed explosive insights into the subject of disaster preparedness in the developed world. National level programmes have been implemented with an emphasis on preventive aspects as well as preparedness. Resuscitation of cardiopulmonary arrest victims has been included in all life supporting first aid training programmes, as it has pivotal importance in dealing with the mass casualties within

the first few moments of finding and extraction of a victim, during transport as well as at base or advanced level healthcare facility.

In the 1970s, Peter Safar and his colleagues first began to formulate questions regarding the resuscitation potentials in disaster events through the use of retrospective, unstructured interviews of survivors and responders following earthquakes in Peru (1970)¹ and in Italy in 1980.² It became apparent that there was a need for more organized, systematic, and quantifiable research methodologies specifically designed to assess the timeliness and adequacy of life-saving efforts (professional and non-professional emergency medical responses) to disasters. This concept of resuscitation potential in a disaster (disaster reanimatology) culminated in the hallmark studies conducted by an interdisciplinary, inter-cultural research team following the 1988 earthquake that devastated a large area in Armenia, and according to official figures, resulted in more than 25,000 deaths and more than 32,000 persons injured.^{3,4} These studies, for the first time, incorporated techniques into Disaster Medicine research that are used commonly in the social sciences.⁵

WHAT IS A DISASTER?

There are many definitions of a disaster, and these definitions have been discussed in detail by Al-Mahari and Keller in an issue of *Prehospital and Disaster Medicine* (Volume 12, number 1)⁶. The definitions used seem dependent upon the discipline using the term. Thus, no definition of "disaster" is accepted universally. In the course on Disaster Management published in *Prehospital and Disaster Medicine*⁷⁻¹⁷, Frederick C. Cuny defined a disaster as: "a

For correspondence:

Col Tariq Hayat Khan

Editor 'APIC'

Consultant Anaesthetist and Pain Specialist

Asst. Prof of Anaesthesiology, IIMC, Rawalpindi (Pakistan)

Email: tariqhayatkhan@hotmail.com

situation resulting from an environmental phenomenon or armed conflict that produced stress, personal injury, physical damage, and economic disruption of great magnitude.” (1) Perez and Thompson in their series on Natural Disasters, define a disaster as: “the occurrence of widespread, severe damage, injury, or loss of life or property, with which the community cannot cope, and during which the affected society undergoes severe disruption.”¹⁸ (2) These definitions note that a disaster disrupts the infrastructure of the society stricken by the event. Furthermore, Cuny stresses that the event resulting in a disaster does not comprise the disaster: it is what results from the event, not the precipitating event itself.¹²

From a medical point of view, a disaster needs only two criteria: victims and a discrepancy between the number and treatment capacity. Disasters can then be classified utilizing various parameters; man-made versus God-made, the radius of the disaster site, the number of dead, the number of wounded, the average severity of the injuries sustained, the impact time, and the rescue time. By attributing 0, 1 or 2 to each of them, increasing with intensity, number or time a scale can be produced varying between 0 and 13, which is called the Disaster Severity Scale.

A good practice is to divide the disasters according to the number of casualties into three stages;

MCI – Multi-Casualty Incident - by definition not a disaster. Total No. of casualties 15-30.

Mass Casualty Disaster - Regional resources required. Total No. of casualties 30-300.

Catastrophic Casualty Disaster - State and Federal resources required. Total No. of casualties >300.

GLOBAL STATISTICS OF DISASTERS FROM 1995

Disasters continued to make headlines the world over throughout the last decade.

From 1995 to 2004, 5,989 reported disasters

killed 901,177 people and affected over 2.5 billion people, causing at least US\$ 738 billion in estimated damage.

This compares to 643,418 reported killed and 1.74 billion reported affected by disasters from 1985 to 1994, representing an increase of more than 40%.

More than 7 million people died from hunger in 2005.

One child dies every 5 seconds from hunger and hunger related diseases.

In 2006, Asian tsunami hit Indonesia, Thailand, Philippines, Sri Lanka, parts of India and Singapore with devastating effect.

Earthquakes hit repeatedly parts of Iran, Turkey, Indonesia, Japan and Afghanistan in this decade, killing thousands of people and destroying property worth billions of dollars.

DISASTERS IN PAKISTAN

Historically Pakistan is the land of natural and man-made disasters or disaster-like situations. The memories of massive human displacement in 1947, human sufferings of East Pakistan crisis during 1971, the continuing Afghan refugee problem, the devastating droughts in the Thar Desert region, the recurring loss due to floods and the most recent earthquake on 8 October 2005, are still fresh in the minds of the Pakistani population. This human suffering at a large scale has long dictated the need for disaster preparedness to mitigate and reduce the impact of disaster. Unfortunately little concrete work was done to outline a continuous program to train a sizable number of personnel's from different walks of life. Neither the spirit of volunteerism was created in the people in an organized way. It resulted in repeated shows of lack of coherence and effectiveness in disaster relief operations. Army was a bit lucky in that it had its shreds of command and control structure intact, which let it move at its own pace and carry out some of the desired work; but the civil authorities lacked the vision and the will power to start the

training program at their level. Much is needed to be done, if one intends to minimize the misery and the suffering of the poor citizens of this country.

MAJOR FLOODS IN PAKISTAN

Over the past 50 years Pakistan has seen 15 major floods, costing more than 100 billion rupees, more than 8000 lives lost, and thousands of villages affected. This trend is likely to continue till effective measures are undertaken to store and control floodwaters.

AFGHAN REFUGEE PROBLEM IN PAKISTAN

During the Afghanistan war from 1979 to 1987 millions of Afghans fled their country into neighboring Pakistan and Iran. As a result of the momentous changes in Afghanistan after Sept. 11, 2001, around 3.5 million Afghan refugees in Pakistan and Iran have returned home. Nevertheless, despite the colossal return movement – the biggest in UNHCR's history – well over 2 million Afghan refugees remain abroad, the vast majority of them being in Iran and Pakistan. Even though more than half of all

Afghan refugees have now gone home, they remain the largest refugee group in the world, with the exception of the Palestinians.

Afghan refugees mainly in Pakistan are living in deplorable state. They are facing innumerable problems relating to proper shelter, health, sanitation, food supply and education. Their huge number has multiplied the problems for the local people as well; for instance, population explosion, price hikes, drug abuse and law and order situations. Although the brunt of the refugee problem has to be born by NWFP, areas of Punjab and Rawalpindi-Islamabad were also not spared.

DROUGHTS IN THE THAR REGION OF PAKISTAN

For the people living the Thar Desert region (Tharparkar) of Sindh, drought is a frequent threat and one of the major causes of poverty and deprivation. Devastating droughts have occurred in 1951-56, 1962-63, 1968-69, 1979-81, 1985-87 and 1999-

2001. This region, which spreads across the border with India, is perpetually affected by drought. Periodically, droughts are severe and large numbers of poor families must migrate to the canal fed irrigation areas to the west of Tharparkar until the end of the dry season. Measured by a range of social indicators, this region is one of the poorest in Southeast Asia.

TRAIN / ROAD SIDE ACCIDENTS

Pakistan enjoys one of the highest rates of train accidents, due to its aging rail traffic control systems, poor staff training and high ratio of wasted earnings. Every year hundreds lose their lives in these accidents. In addition, thousands perish annually in road traffic accidents on Pakistani roads. Mass casualty situations often arise in both categories of accidents but especially in train accidents, which commonly happen at remote places away from quotable health facilities.

RECENT EARTHQUAKE IN NORTHERN PAKISTAN

On 8 October 2005 a major earthquake measuring 7.2 on Richter scale struck northern areas and Pakistani held Kashmir. It was classified as catastrophic casualty disaster. In the span of a few minutes. It rocked entire regions of Azad Kashmir and parts of NWFP. The earthquake has underscored the importance of building safe hospitals and schools in disaster-prone areas. Many schools were razed to the ground due to the earthquake and children were buried alive under the rubble. There is no denying the fact that the earthquake was of an exceptional magnitude; in fact, it was the strongest in Pakistan's history. However, one must note that the Himalayas, where the epicentre of the quake was, are located on a tectonic plate and have long been identified as a high-risk region by earthquake experts. Our policymakers and planners should have kept this warning in mind. Within a span of a few minutes:

More than 75,000 died and more than 70,000 injured

3.3 million people (2 million in Azad Kashmir and 1.3 million in NWFP) rendered

homeless
\$5 billion damage to infrastructure
25,000 sq. miles of area badly affected
Jehlum Valley and Neelum Valley were the most affected areas

Percentage of population affected in hardest hit areas:

Muzaffarabad – 80%
Hattian – 70%
Bagh – 80%
Dirkot – 80%
Athmuqam – 60%
Alal Valley – 60-70%
Haveli – 65%
Balakot – 90%
Mansehra – 40% and
Batgram – 20%

15,000 villages directly affected

8,000 schools destroyed and turned into graveyards of the students

THE 72-HOUR RULE

For years, local, state, and federal agencies have preached the “72-hour Rule,” which requires citizens to be self-sustaining for 3 days after a disaster. The 72-hour rule requiring citizens to be self-sustaining on their own is no longer realistic. Even the famous “Golden Hour” has been reduced to a few minutes. It takes approximately 6-8 minutes before permanent ischemic damage and worsening neurological outcomes occur in the brain.¹⁹ Data vary, but some studies show ischemic damage to the epicardium as early as four minutes into the arrest. This definitely puts primary responders in a very valuable position. Both CPR teaching at all levels in the community and the recent introduction of automatic external defibrillators provide more tools for primary respond-

ers. Disasters of the magnitude we just witnessed during the previous few years will continue. When it comes to human needs, we must create solutions in advance that will provide continuity for life-sustaining necessities, and this continuity must persist until organized relief can arrive. Everyone should take action now, whether we’re in the public or private sector, to be a part of that solution. The phrase “plan today...survive tomorrow” has never been truer than now. Planning for disaster preparedness must cover large-scale life supporting training at public level to enhance the overall potential of layperson resuscitation.

THE IMPORTANCE OF RESUSCITATION

Since the pioneering works by Russian academician Vladimir A. Negovsky, who is widely regarded as the father of reanimatology or the science of resuscitation, the foundations of modern concepts of resuscitation were laid at his laboratory at the Institute of Neurosurgery in Moscow to start studying dying and revival. That was the first resuscitation research laboratory in the world. Later on Peter Safar joined the ranks, and both of them collectively contributed a lot to the new science. Since those times continued research has enriched the subject and now almost every country on the globe has resuscitation councils.

Resuscitation has been shown to prevent thousands of lives of victims of cardiac arrest. The statistics vary widely from author to author, but it is generally regarded that about 12% victims survive to leave hospital after having a cardiac arrest and being resuscitated. In fact patients who have had witnessed cardiac arrests outside the home are nearly 4 times more likely to receive bystander CPR, and are twice as likely to survive.^{20,21}

More survivors are found in VF/VT with more likelihood to survive, who receive bystander life support as compared to those who do not receive it.²²

Recently, a new dimension has been added to

the basic life support techniques. It is automated defibrillation. It is emphasized that for patients who suffer out-of-hospital cardiac arrest, the time from collapse to initial defibrillation is the single most important factor that affects survival to hospital discharge. Early resuscitation and prompt defibrillation (within 1-2 minutes) can result in >60% survival.²³

LIFE SUPPORT & DISASTERS

Immediately after a disaster such as an earthquake or terrorist attack strikes in a densely populated area, large numbers of people can be expected to suffer serious or life-threatening injuries or illnesses. The survival rate for these individuals declines rapidly unless prompt emergency medical assistance is provided within minutes to a few hours of their injuries. While the pattern and extent of injuries and illnesses will vary depending on the type and magnitude of the disaster, most disaster response experts agree that the main window of opportunity for saving lives of the critically injured but treatable victims is the first few hours. Unfortunately, no matter how well prepared is the community, expected and unexpected problems arise that hamper the response effort causing delays in the treatment of victims. These barriers to prompt response are usually related to infrastructure damage (i.e. roadways, lifeline, communications, community services, etc.), which are directly caused by the disaster, contributing to the disorganized or haphazard delivery of medical and health care. This fact coupled with poor pre-planning, organization, and coordination of mass casualty management can further impede the ability of medical assistance from within or without the stricken region to deploy, set-up, and begin to treat casualties in time to impact on survival. As a result, a second disaster unfolds. This is an important difference that distinguishes a disaster from other medical emergencies. It is at this point when the role of first responders is highlighted. It has been advocated that laymen survivors in a disaster can make a difference between life and death for many victims. Stiell et al from Division of Emergency Medicine, Department of Medicine, and Ottawa Hospital Loeb Re-

search Institute, University of Ottawa, Ontario, Canada, in their paper in *Annals of Emergency Medicine* stated²⁴ that, "This represents the largest multicenter BLS-D study of prehospital cardiac arrest yet conducted and clearly indicates that patient survival may be improved by optimization of EMS response

In catastrophic disasters such as major earthquakes in densely populated regions, effective Life-Supporting First-Aid (LSFA) and basic rescue can be administered to the injured by previously trained, uninjured survivors (co-victims). Administration of LSFA immediately after disaster strikes can add to the overall medical response and help to diminish the morbidity and mortality that result from these events. Widespread training of the lay public also may improve bystander responses in everyday emergencies.²⁵

It has been estimated that fewer than 30% of out-of-hospital resuscitation attempts are initiated by lay bystanders in advanced countries. The numbers of lives saved have remained sub-optimal, in part because of a weak or absent first link in the life support chain. Hence it was recommended that

LSFA should be part of basic health education. LSFA self-learning laboratories should be set up and maintained in schools and drivers' license stations. The trauma-focused steps of LSFA are important for 'buddy help' in military combat casualty care, and natural mass disasters.²⁶

Since, by definition, a disaster inflicts injury or illness sufficient to overwhelm the local ability to respond, reinforcements must be called in from outside, and some of the injured must be removed to unaffected areas. Response usually takes place at the lowest possible (local) level, because there are less logistical hurdles to overcome, and also because immediate, lower-level care is more effective in saving lives. For example, data from Emergency Medical Services (EMS) Systems in the United States suggest that the more rapidly and effectively the application of initial life supporting first aid (LSFA) by unin-

jured bystanders and Advanced Trauma Life Support (ATLS) by professional rescuers, more lives are saved and less expensive are the medical consequences in terms of reduced morbidity, mortality, and long term disability of patients. But because of the large number of casualties requiring immediate care simultaneously in a disaster or because of the destruction of the health care infrastructure, professional search and rescue and the pre-hospital response is hampered. This is a key distinction between a medical disaster and a multi-casualty incident (MCI).

Well-equipped first responders (EMS, Police, Fire) and other emergency health workers and services capable of rapid deployment and field operations in the local community must thus be well trained in life support practices. These will later on supplement significant proportion of the civilian population (>30%) knowledgeable in what to do in disaster and trained in life supporting first aid. In addition, an organized citizen response component such as the Community Emergency Response Teams (CERT), volunteers trained in providing effective support to EMS operations will be capable to boost overall efficiency of the operation. In every disaster the first 24 hours have the greatest potential for life-saving, Table 1.

Table 1: Framework for Mass Casualty Management

Phases	Activities
Initial (the first 24 hours): Period of greatest lifesaving potential	Alert and notification Search and rescue (Detection and evacuation of victims) EMS response
Intermediate (1-12 days)	Heavy rescue (victims trapped under heavy rubble) Public health measures (post disaster epidemic surveillance, vector control, etc.)
Final (>12 days)	Continuation of Public health Measures Rehabilitation of injured Reconstruction of affected community

The basic unit of medical response in a disaster is the local pre-hospital EMS/trauma and hospital

system. In large-scale disasters where the local community is overwhelmed, health services are backed-up by regional, state or federal resources, depending on the magnitude of the needs.

In general terms the phases and concomitant activities and the timing of the delivery of emergency medical services will vary according to disaster type. In sudden-impact disasters such as earthquakes or in terror attacks using conventional weapons such as in the 9/11 event the following phases and medical services are commonly observed:

DISASTER PREPAREDNESS & RESUSCITATION

Russian academician Vladimir A. Negovsky, is widely regarded as the father of reanimatology or the science of resuscitation. He set up a laboratory under his supervision at the Institute of Neurosurgery in Moscow to start studying dying and revival. That was the first resuscitation research laboratory in the world. During the Second World War, in the spring of 1943, he formed front-line resuscitation teams and achieved effective resuscitation of a number of soldiers who were in clinical death, mostly from exsanguination. Vladimir Negovsky and Peter Safar first met in Vienna in September 1962 at the First European Congress of Anesthesiology. This encounter initiated life-long lasting friendship, communications and collaborations between their groups, which prevailed throughout the cold war up to today. Peter Safar visited Negovsky's laboratory first in 1963 and 6 times afterwards and Negovsky came to Pittsburgh 4 times, initiating numerous associated visits.

Cross-fertilization of ideas between the two leaders and their associates have been important in the development of: modern CPR methods, research into cerebral resuscitation, the multi-disciplinary specialty of critical care (intensive care) medicine, mobile ICU ambulances, emergency medical services (EMS), ethical considerations about resuscitation medicine, and disaster medicine. The Moscow and Pittsburgh research programmes were the first with

globally integrating approaches to resuscitation medicine (which Negovsky calls reanimatology). In the 1970s Safar and Negovsky helped Rudolf Frey of Mainz to initiate the World Association for Disaster and Emergency Medicine (WADEM), which promoted research into resuscitation potentials in mass disasters.

Disaster preparedness is the aggregate of measures to be taken in view of disasters, consisting of plans and action programmes designed to minimize loss of life and damage, to organize and facilitate effective rescue and relief, and to rehabilitate after disaster. Preparedness requires the necessary legislation and means to cope with disaster or similar emergency situations. It is also concerned with forecasting and warning, the education and training of the public, organization and management, including plans, training of personnel, the stockpiling of supplies and ensuring the needed funds and other resources. Training of all healthcare workers in basic techniques of resuscitation is mandatory part of disaster preparedness. As we seen earlier, the first responders have the prime duty to do whatever they can, to sustain the life of the victims of a disaster regardless of the magnitude. Many victims will require basic life support, those non-invasive measures (such as elimination of airway obstruction, cardiopulmonary resuscitation, hemorrhage control, wound care, and immobilization of fractures) as to preserve life of ABC-unstable patients. Those victims effectively resuscitated and transported to base health camp may require advanced life support, which includes those invasive measures (such as intubation and ventilation, infundation and thoracic drainage) as to preserve life of ABC-unstable patients. This is the responsibility of the level of medical officers. Every medical officer, from residents to consultants, must be adequately trained to perform ALS, when its need thus arises.²⁷

BLS VS ALS

A lot of controversy arose about the role of BLS in disasters. Some experts emphasized the importance of ALS thus downgrading BLS, until some scientific

studies clearly proved that ALS had no edge over BLS. DL Isenberg and R. Bissell in their literature review, searched Electronic medical databases to identify articles that directly compared ALS versus BLS care. They found a total of 455 articles. They concluded that

“ALS showed little, if any, benefits for urban trauma patients. Cardiac arrest studies showed that ALS did not provide additional benefits over BLS-defibrillation care, but more research was needed in that area.”²⁸

This conclusion was shared by various other authors, including a convenience cohort study by J. S. Eisen and I. Dubinsky, which proved that there was no beneficial impact on the measured patient outcomes found in association with the provision of ALS vs BLS field care in Metropolitan Toronto for patients who were brought to a nontrauma center.^{29,30}

GENERAL OUTLINE OF PRE-HOSPITAL RESPONSE

Once a disaster has occurred preventive measures are inoperative and emergency medical services and public health measures remain the only means to reduce morbidity and mortality. The management of the injured or ill casualties of disaster in the pre-hospital setting requires, at minimum, the prompt delivery of the following 16 emergency support functions. Medical disaster plans at local, regional and state levels should be standardized in format and content to define when, who, and how the following services will be provided.³¹

1. ALERT/NOTIFICATION/COMMUNICATION:

Involves the process of alerting local, and if judged necessary regional, or state authorities to the fact that a disaster situation is unfolding. It includes the communication network and back up systems needed to ensure rapid notification.

2. ESTABLISHMENT OF THE EMS INCIDENT COMMAND:

The incident command system (ICS) is the man-

agement structure through which EMS response to a disaster is organized and carried out in an orderly manner.

3. NEEDS ASSESSMENT:

The mechanism through which disaster responders become informed of the health and medical needs generated by a disaster. Also, it is the amount of material and manpower resources required to effectively meet demand.

4. CASUALTY IDENTIFICATION, CLEARING, EVACUATION (SEARCH AND RESCUE):

Is the process through which victims of a disaster are located, identified, and evacuated from the disaster area.

5. CASUALTY TRIAGE AND STABILIZATION:

The method by which the type, extent and severity of injuries sustained by disaster victims is prioritized for treatment. Perform Casualty Triage. During this time initial treatment is provided to casualties in order to prevent further or rapid deterioration in the patient's status, and in the case of weapons of mass destruction perform decontamination in pre-designated areas to prepare the victim for transportation to a treatment facility and to protect rescuers and other individuals from toxic or infectious substances.

6. CASUALTY COLLECTION:

The process of gathering patients from a hazardous location or scene of injury to a staging area near the disaster zone where further harm is avoided and from which patients are prepared for transport and loaded onto transport vehicles Casualty Collection Points. First aid is initially applied at these areas.

7. FIELD MEDICAL CARE:

The provision of emergency medical or surgical care to patients at collection points whose severity of illness or injury preclude safe transport to a treatment facility

A- BYSTANDER LIFE SUPPORTING FIRST AID (PUBLIC):

Involves the delivery of basic first aid by uninjured co-victims and is aimed at initiating the trauma life support chain. Life supporting first aid entails the following basic maneuvers: calling for help; maintaining a patent airway; controlling external bleeding; positioning for shock; rescue pull, and; CPR (if indicated).

B- BASIC TRAUMA LIFE SUPPORT (EMT/PARAMEDICS):

Constitutes the second step in the life support chain and involves the administration of advanced first aid in the form of airway control, hemorrhage control, immobilization of unstable limb fractures, wound dressing, burn treatment, among other life-saving maneuvers by trained first responders.

C- ADVANCED TRAUMA LIFE SUPPORT (PHYSICIANS):

The administration of lifesaving emergency medical or surgical care to critically injured patients by physicians and usually includes the following:

Intravenous fluid resuscitation

Pleural drainage

Endotracheal intubation

Mechanical ventilation

Wound suturing

Other lifesaving medical/surgical interventions

8. TRANSPORT WITH LIFE SUPPORT (LAND, AIR, RAIL, OR SEA):

The evacuation of disaster victims from the scene of injury to treatment facilities accompanied by health care professionals with, at minimum, basic trauma life support capability.

9. DEFINITIVE MEDICAL/SURGICAL CARE (MEDICAL FACILITY):

The delivery of specialized in-hospital medical or surgical care by physicians, nurses, and other health care professionals for the purpose of correcting or reversing life-threatening illness or injury and/or to

prevent long-term disability.

10. MEDICAL AND PHARMACEUTICAL SUPPLY MANAGEMENT:

The process by which medical supplies, equipment, drugs, and other pharmaceuticals are delivered to treatment areas.

11. PERSONNEL MANAGEMENT:

The process of assigning manpower resources.

12. VOLUNTEER MANAGEMENT:

The process of assigning and supervising the roles and responsibilities of lay bystanders and others not directly involved in disaster response efforts but who have needed skills and to avoid convergence of excess personnel and chaos at the site of a disaster.

13. PLANNING AND EVALUATION:

The activity of preparing for and assessing response to disaster so as to improve the efficiency of future disaster response operations

14. EDUCATION AND TRAINING:

The activity that involves the transfer of knowledge, experience or skill to another individual for the purpose of facilitating the application of a learned set of facts or adequate performance of a given task or set of practical skills to achieve a desired objective.

15. CRITICAL INCIDENT STRESS DEBRIEFING (CISD):

Stress management through psychological support of disaster-affected response personnel.

16. WORKER SAFETY/SECURITY:

Providing a safe workplace for and ensuring safe access to victims by response personnel.

HOSPITAL SETTING

Basic life support is equally important at hospital level.

a. Casualty reception and triage area (ER and adjacent areas). Many casualties will succumb to their injuries or hemorrhages after a non-smooth transport to a hospital. Thus staff in casualty reception area and triage area must be fully trained in BLS.

b. Decontamination area (in the event of casualties of weapons of mass destruction). This is another very vulnerable area due to inherent risk of contamination to the medical staff. They must be capable to provide life support in that setting.

c. Area for the diagnosis, treatment or stabilization of patients who have life-threatening conditions (Acute care areas such as OR, ICU).

d. Area for the diagnosis, treatment or stabilization of patients having urgent conditions who will be referred for follow-up care.

g. Alternative treatment area (outside the hospital) in the event the hospital cannot provide services

HOW FAST IS FAST ENOUGH IN A DISASTER?

The prompt initiation of resuscitation is critical. The famous "Golden Hour" has been reduced to a few minutes. ABC-unstable victims (T1) should be stabilized as soon as possible; at least within one hour following injury.

It takes approximately 6-8 minutes before permanent ischemic damage and worsening neurological outcomes occur in the brain. Data vary, but some studies show ischemic damage to the epicardium as early as four minutes into the arrest. This definitely puts primary responders in a very valuable position. During Friedrich's time, that is first 4-6 hours following sustainment of mechanical injuries, T2 victims may become ABC unstable when untreated. It is therefore important to provide first-aid measures within this period of time. Both CPR teaching at all levels in the community and the recent introduction

of automatic external defibrillators provide more tools for primary responders. In Kobe earthquake, out of 5,411 fatalities more than 80% of patients died within three hours. There were statistically significant differences in survival/dying patterns among causes of death. Thirteen percent of victims experienced a protracted death, which could have been prevented with earlier medical or surgical intervention.³²

Currently, many well-developed urban EMS/Trauma and hospital systems in the US are able to cope with the demands of daily urban trauma that result in multi-casualty incidents not exceeding 5-10 critically injured casualties at any given time (a bus or train crash). However, casualties exceeding this number will require, in most communities, outside help to handle the extra demand. One of the major problems in disaster operations is how to swiftly and accurately determine the quantity and quality of the medical care needed, know when local resources are exceeded, or when to ask for outside help. These decisions are the responsibility of local authorities (i.e. the Mayor or his designee, the incident commander) in conjunction with health officials. The incident commander, however, may not always have the expertise to rapidly assess the level of medical response needed (needs assessment) in order to request appropriate support in a timely manner. Delays in performing needs assessments cause further delays in the delivery of emergency care and, as a result, predisposes to preventable deaths and disability.

Normally EMS systems at the community/local level are designed to provide cost-effective emergency medical care to critically injured casualties within a defined time frame namely, the 'Golden' hour of trauma. This is based on outcome studies showing improved survival of trauma patients when definitive treatment is provided in this time frame. Definitive treatment encompasses all components of the life support chain from the scene of injury and pre-hospital response, to transport, stabilization and initial care in the emergency room, and surgical treatment in the operating room and intensive care, if necessary. This is an example of a critical pathway

for the treatment of trauma patients. It has become the standard of care for trauma patients under normal conditions. (Table 2)

Unfortunately, the standard of care for victims of a disaster varies tremendously according to a number of limiting factors including the availability of medical resources, which is dictated by the number of casualties and the severity of their injuries, and other logistical limitations, such as the ability of responders to match resources with needs in an efficient manner.

Table 2: Critical time to treat different types of injuries.

Injury type	Critical time to Treat (hours)
Crush:	
Limb	6-12
Chest/Abdomen	0-1
Head	0-0.1
Uncontrolled External Hemorrhage:	
Arterial:	0-1
Venous:	1-6
Uncontrolled Internal Hemorrhage:	
Arterial:	1-6
Venous:	0.5-1
Visceral:	3-8
2nd/3rd Degree Burns (>45% BSA*)	1-6

* BSA= Body Surface Area

In order to maximize lifesaving efforts in disasters emergency care should be provided as early as possible and certainly within a critical time period. This period of time can be defined as the 'critical time to treat', which translates into the amount of time an injured or ill patient in a disaster can wait before complications can be expected. This critical time to treat will vary for each individual and is determined by the severity of the injury or illness. For example, table 1 estimates 'critical time to treat' for injury types and mechanisms most commonly ob-

served in earthquakes or building collapses from any cause, such as crush injury and hemorrhage. Delays in definitive treatment beyond the critical time to treat may cause complications such as loss of limb, other disability, or death.

How difficult is it to execute an organized and coordinated emergency medical response in time to prevent unnecessary deaths and disability? Normally, the response effort is guided by medical needs, and medical needs are based on types, numbers and severity of injury/illness. Initial casualty figures are determined based on the total affected population, injured and dead. Information on injured and killed in the early stages of a major disaster is incomplete. There is no method to immediately and accurately determine the numbers and severity of the injured. Needs assessment takes time to perform. A recent review of morbidity and mortality statistics in major disasters from 1970-2000 (unpublished data) found that the distribution of dead, seriously injured, and uninjured is relatively constant in most major disasters: 1/3 dead, 1/3 with severe injuries requiring hospitalization and intensive care, and 1/3 sustaining no injury or mild to moderate injury. Hence a reasonable estimate of expected numbers of critically injured could be extrapolated based on the total population in the immediate disaster affected area. This estimate could be linked to a level of response (Table 3).

Table 3: Classification of disasters

Total Casualty Estimate	*Critical	Level of response	Incident/disaster
15-30	X 1/3 = 5-10	Local (city, county)	**MCI
30-300	= 10-100	Regional (>2 counties)	+Mass
>300	= 100-1000	State/Nation	++Catastrophic

* Requiring Intensive care bed

** MCI - Multi-Casualty Incident (by definition not a disaster).

+ Mass Casualty Disaster (regional resources required)

++ Catastrophic Casualty Disaster (State and Federal resources required)

CITIZEN RESCUERS

In our nation, today, the average citizen has little

knowledge of what to do or how to provide help to others in a disaster. In order to ensure proper and safe citizen response, public education programs and training must be developed and implemented by federal, state and local authorities. This should be done in conjunction with private and public educational organizations, who are experts in teaching bystander first response. Even in developed nations the inadequacy of BLS training to citizens has been suboptimal, and at present, fewer than 30% of out-of-hospital resuscitation attempts are initiated by lay bystanders. The numbers of lives saved have remained suboptimal, in part because of a weak or absent first link in the life support chain.³³

A simple but effective way of accomplishing this task would be to provide all citizens of the country, ages 9-92, the option of receiving (free of charge) a 2-hour life supporting first aid (LSFA) training course. These courses are currently administered in elementary, middle and high school, in selected communities of advanced countries. They could be offered to all students, and to citizens seeking motor vehicle licensing, and other target groups of citizens at mass scale. But we must start from the top of the medical chain and descend lower down in a graded and control manner as outlined elsewhere.

ANESTHESIOLOGISTS & RESUSCITATION TRAINING

Anesthesiologists have contributed significantly to the dramatic changes in the field of resuscitation over the past 30 years and continue to play an important role in modern resuscitation. In France and other countries, it is the anesthesiologist who first responds to an out-of-hospital arrest. In the United States, anesthesiologists have a critical role in the management of in-hospital cardiac arrests. The initial survival rate from an in-hospital cardiac arrest in the United States is approximately 40-50 percent, and about 13-18 percent will survive to be discharged from the hospital.

Most residency programs have anesthesiology residents responding to all in-hospital arrests. Although the residents' primary role is airway manage-

ment, it is my belief that this role can be expanded to include more leadership in arrest management. We, as anesthesiology residents, are well-trained in the areas of physiology, pharmacology and critical care medicine. This knowledge, in conjunction with our unparalleled skills in airway management, make us masters in the management of the "ABCs" of cardiopulmonary resuscitation (CPR). Anesthesiologists also have a vital role in the exciting field of disaster medicine, providing not only resuscitation and airway management but also sedation and pain control to facilitate extrication of victims.

The ability of anesthesiologists to more effectively participate in emergency medical care in disasters is enhanced by the acquisition of competency in Advanced Trauma Life Support (ATLS), basic principles of mass casualty and disaster management (as described above), and knowledge of the anesthetic methods, techniques, and equipment commonly used outside the operating room environment.

PRESENT STATUS IN PAKISTAN

We South Asians in general, and Pakistanis in particular as a society believe in reactive planning. We wait for crises to happen and only then try to undertake post-crisis management. Our ruling class has its own style of going about business in crises. Instead of investing money in removing the likely cause of an accident, the rulers announce monetary compensation. It is an extremely cumbersome process to receive compensation and more often than not these are only political announcements that never materialize. Even if monetary compensation is delivered, it cannot be a substitute for rescue operation. A rescue operation in mature societies consists of more than just pulling out dead bodies and removing the debris.

Unfortunately, we do not think of crisis-management beyond pulling out dead bodies. We never give attention to preparedness, thus forcing people to remain dependent on external help. Disaster management and rehabilitation has never been a priority in Pakistan's national policies. The five-year plans,

in place since 1957, remain silent on preparedness and management of natural calamities. In Pakistan, the United Nations Development Program (UNDP) has proposed a five-year program to the federal government, to be executed by the National Disaster Management Agency (NDMA) within the structure of the Emergency Relief Cell. It was in this context that UNDP commissioned an independent review of disaster management policies and systems in Pakistan.

The report of the review, launched in January 2005, describes Pakistan's disaster management approach in these words. "There are no long-term, inclusive and coherent institutional arrangements to address disaster issues with a long-term vision. For instance, the Emergency Relief Cell is mandated to deal only with post-disaster scenarios. Disasters are viewed in isolation from the processes of mainstream development and poverty alleviation planning. Some of the large-scale development projects are bringing new forms of disaster and adding to the vulnerability of at-risk communities."³⁴

Some of the disaster management agencies in Pakistan include Emergency Relief Cell (ERC), Pakistan Meteorological Department, Federal Flood Commission (FFC), National Crisis Management Cell, Civil Defense, provincial relief, irrigation, health, food, agriculture and livestock departments, Communication & Works, Planning & Development, armed forces, police, Dams Safety Council and SUPARCO.

According to the review report, disaster management bodies in Pakistan lack knowledge in hazard identification, risk assessment and management. The officials of the two important organizations for disaster management, the ERC, headed by the cabinet secretary and FFC are not given adequate training. Disaster and relief departments remain under-resourced and untrained and are not given their due importance. There are no linkages between disaster management, development planning, and environmental management. It states that absence of a central authority for integrated disaster management and

lack of coordination within and among disaster related organizations is responsible for ineffective and inefficient disaster management in Pakistan.

Resuscitation is taught in first two years of MBBS physiology syllabus, but the practical aspect of it is ignored altogether. I have seen consultant level physicians performing BLS in a very erratic and ineffective way, which prompted me to start these courses at service hospitals with borrowed manikins. But due to lack of insight and initiative at command level, I soon realized that running these courses was a futile exercise. It was impossible to persuade higher authorities to spare some money for the purchase of required manikins. Being in a subordinate position, I was unable to develop a systematic cycle of training for our doctors and nursing staff.

Sadly there is even no central body responsible for organizing a national level CPR training programme. During the recent past a few private hospitals and few public sector hospitals have started running BLS and ALS courses for the doctors. This is indeed a good practice, but it has its limitations.³⁵

RECENT CHANGES IN CPR

Recent changes in CPR include new techniques tested in both animal and human populations in order to improve forward blood flow and rapid return of spontaneous circulation. These new techniques include active compression-decompression CPR and interposed abdominal compression CPR. Interposed abdominal compression and phased chest abdominal compression-decompression CPR in animal models show increased survival rates and increased coronary artery blood flow compared to standard CPR.³⁶ Preliminary human trials have shown dissimilar results from animal studies and more human trials are in progress. Not only is CPR changing but advanced cardiac life support (ACLS) guidelines are being constantly reviewed. The routine use of calcium, glucose and bicarbonate is no longer in the ACLS algorithms. New studies in the area of post-resuscitation injury are elucidating the role of oxygen radicals, inflammatory mediators and calcium in this type of

injury. Other exciting changes include the possible addition of new drugs to the existing ACLS algorithms. Amiodarone could be a new addition in the treatment of ventricular fibrillation. Vasopressin, a potent vasoconstrictor, has been shown in animal studies to improve coronary and cerebral blood flow during an arrest compared to standard dose epinephrine.³⁷ Another change could be a redefined role for magnesium sulfate in arrhythmia prophylaxis. In addition to the area of pharmacology, some changes may be seen in the consideration of using hypothermia and anesthesia during resuscitation protocols in order to improve cerebral blood flow, cerebral protection and reduction of oxygen consumption. It is imperative that anesthesiology residents learn and maintain skills in resuscitation.

COST

The cost on large-scale life-supporting programme will comprise of:

Purchase of training manikins.

Purchase of self-inflating bags.

Chest boards.

AED type defibrillators

Cost of hiring training instructors

It is important to recognize that not all of the effects of an event on the population or of the effects of specific interventions can be measured. Measurements require the use of quantitative data techniques to collect such data. Some aspects of the study of disasters can be quantitated, while others cannot be measured directly. However, many aspects of the study of disasters and the responses to them can be assessed using qualitative data collection techniques. Others can be scaled and analyzed using inferential statistical methods. Combining the different methods may provide a whole spectrum of data collection techniques that can be applied to the study of disasters.

Although results of some meta statistical studies are available which show the cost effectiveness

of public training in life support techniques per life saved, no such study has been carried out to calculate the cost per life saved in a disaster situation. Swor and Compton carried out a study in a target area of an American city and showed that the training cost per life saved for a bystander aged $<$ or $=$ 50 years was 313,214 dollars, and that for a bystander aged $>$ 50 years was 785,040 dollars.³⁸

In another study by Groeneveld and Owens in which basic life supporting techniques were combined with training of automated defibrillation as well, and they compared three strategies for training unselected laypersons: CPR/defibrillation training alone, training combined with home defibrillator purchase, and no training, it was shown that training unselected laypersons in CPR/defibrillation is costly compared with other public health initiatives. Conversely, training laypersons selected by occupation, low training costs, or having high-risk household companions is substantially more efficient.³⁹

Although no data is available, it can be stated that with reasonable confidence that even the first two to three stages of a large-scale life-supporting programme will be cost-effective, if its usefulness is measured in terms of fulfillment of a long-standing requirement of such a programme and the lives saved in hospitals, institutions and other public places by availability of trained BLS providers during every day routine life.

PROPOSED TRAINING PROGRAMME

I propose a five stage implementation of a national resuscitation programme. To start with a Pakistan Resuscitation Council should be formed under the executive orders of president of Pakistan. Simultaneously a search for already trained health consultants be made, and they be assigned full time job of running crash BLS instructor courses. These courses may preferably be run at the parent institutions of the selected core instructors. In addition BLS provider courses be started at all medical colleges / nursing schools for the students in first year, and for

all doctors regardless of status in all hospitals (Tehsil HQ level & above). Definitive benefit has been proven by introducing BLS courses at school level even for 6-7-year olds who might well be in a position to save the lives of cardiac-arrest victims.⁴⁰ This system may be later on expanded to down level with the aim to run it on permanent basis at high school and factory level. Media must be incorporated into this training programme, as it has the power to reach and influence millions in short span of time. An outline of the proposed programme is given in Table 4.

Necessary legislation may be carried out along these steps to give the programme legal authenticity and the required force and strength.

It is hoped that within five years, a sizable population of this country will be adequately trained and the coming generations will reap the benefits of the crop that is sown today.

Table 4: Proposed Training Programme

PHASE-I	
Activity	Level
Resuscitation Council	Centre
Resuscitation Officer	All hospitals (Divisional HQ level & above) All medical colleges
BLS instructor courses	At all hospitals (Divisional HQ level)
BLS provider courses	All medical college /nursing school students in first year (Valid certificate a prerequisite to appear in first professional examination) All doctors regardless of status in all hospitals (Tehsil HQ level & above) (Valid certificate a prerequisite to promotion, endorsement in ACR's)
PHASE-II	
BLS provider courses	All nursing staff regardless of status in all hospitals (Tehsil HQ level & above) (Mandatory certificate renewal every six months) (Valid certificate a prerequisite to promotion, endorsement in ACR's)
Resuscitation Officer	All hospitals (District HQ level & above) All universities
BLS instructor courses	All medical colleges All hospitals (District HQ level & above)
PHASE-III	
BLS provider courses	All paramedical staff in all hospitals (Tehsil HQ level & above) All doctors / nursing staff regardless of

	status in all hospitals (Mandatory certificate renewal every six months) (Valid certificate a prerequisite to promotion, endorsement in ACR's)
Resuscitation Officer	All colleges All hospitals (Tehsil HQ level & above)
PHASE-IV	
BLS provider courses	All hospital staff in all hospitals All colleges / universities (Valid certificate a prerequisite to promotion, endorsement in ACR's for staff; entry to examinations for students)
BLS instructor courses	All Universities For teachers at all district headquarters For selected personnel at indexed factory level
PHASE-V	
BLS provider courses	For all personnel at indexed factory level At all colleges / schools (Valid certificate a prerequisite to promotion, endorsement in ACR's for staff; entry to examinations for students)
Resuscitation Officer	All schools All selected indexed factories

RESUSCITATION COUNCIL

Every country with a government genuinely committed to the welfare of the people has a resuscitation council. In Pakistan too, a central resuscitation council should be formed at semi-government level. It should have the authority to organize and regulate all training matters regarding resuscitation; have the responsibility to adopt training guide-lines, authorize and coordinate training activities, guide federal and provincial governments regarding necessary legislation, develop a monitoring and evaluation network and maintain full data of all training and trained persons and liaison with other agencies during disasters. It could be partly financed by federal government, and partly self-financing through training fee and certification fee etc. Detailed account of resuscitation councils around the world is available and can be adopted with convenience.

Although the author formed a Pakistan Resuscitation Society six years back, it lacks solid organisation. Much remains to be done.

RESUSCITATION OFFICERS⁴¹

1. Every institution should have at least one person, the resuscitation officer (RO), who is responsible for coordinating the teaching and training of staff in resuscitation. This person may have additional responsibilities, e.g., audit, or maintenance of clinical equipment.
2. Depending on the size and geographical distribution of the institution, more than one RO may be needed to fulfill training requirements and additional responsibilities relating to resuscitation. Typically, one RO is required for every 750 members of clinical staff.
3. Resuscitation officers should possess a current Advanced Life Support (ALS) provider certificate as a minimum standard; ideally, they should be qualified ALS instructors. Where appropriate, the institution should ensure that ROs also possess certified training certificates in other specialist areas, e.g., paediatrics, obstetrics and trauma.
4. Advice about professional development of ROs should be sought from the Council for Professionals as Resuscitation Officers (CPRO).
5. The RO must have access to a designated training room of adequate size. The room should accommodate comfortably up to 10 people plus all the training equipment required for any teaching session. The RO should have access to suitable electronic teaching aids and projection facilities. There should be adequate space for storing equipment. Separate office space, with a desk and filing cabinets, should also be available.
6. The RO must have adequate secretarial assistance.
7. Equipment for training, including adult and paediatric manikins, airway management trainers, an ECG monitor and rhythm simulator, and at least one defibrillator dedicated for training, should be available. Training

defibrillators should be the same as those used in the clinical areas of the institution.

8. There should be a defined resuscitation budget made available for the RO to maintain, upgrade and purchase new equipment for patient use and for training. Purchasers of health care should be made aware of this when contracts are negotiated and adequate provision should be made. Such financial support for resuscitation services should be taken into account during budget planning by the institution.
9. The RO should be responsible for ensuring that there are systems in place for maintaining resuscitation equipment in good working order. This may mean delegation of routine checking of equipment to other members of staff.
10. The RO should ensure that all cardiopulmonary arrests are documented and audited using a standard pro forma based on the current Utstein template.
11. In order to maintain standards and clinical credibility, the RO should attend cardiopulmonary arrests regularly and provide feedback to team members as part of their continuing training in resuscitation.
12. The RO has a responsibility to maintain his/her own education in resuscitation. This should involve teaching on resuscitation courses outside the institution and attending relevant professional meetings. Attendance at professional meetings should be supported with a budget for study expenses.
13. ROs should not be expected to generate income to provide for their own salary.
14. If the RO is expected to generate income for the institution it should be agreed in writing with the relevant manager. Any income should be directed to improving resuscitation services.

CONCLUSION

BLS trained lay persons can make a difference between life and death for the victims of cardiac arrest, may it be in peace time, or the result of multiple types of injuries sustained during a disaster. We cannot prevent most of the disasters happening but we can evolve a system to mitigate the effects of disasters. Any preparedness system must include a nation-wide resuscitation training programme. Such a programme will also be helpful in saving the lives of millions of victims of every day street or road accidents or industrial accidents. All monumental structures were built by laying down the first brick. Let us lay the first brick of life support training in our country now.

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