CHAPTER 11: MEDICAL RESPONSE TO THE ARMENIAN EARTHQUAKE

INTRODUCTION

The Armenian Earthquake

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During the past twenty years, earthquakes have caused more than a million deaths worldwide. Better knowledge of the causes of death and the type of injuries and illnesses caused by earthquakes is clearly an essential requirement for determining appropriate relief supplies, equipment and personnel needed to respond effectively to such catastrophic events. At 11:41am on December 7, 1988, an earthquake registering 6.9 on the Richter scale hit the northern part of the Armenian Soviet Socialist Republic, resulting in thousands of deaths and injuries. This section features authoritative authors from several different countries who had first-hand experience in responding to the Armenian earthquake. They include Soviet physicians (Drs. V Fedorov and Alexander Michalov), foreign relief workers (Drs. Richard Aghababian, Philippe Hrouda, Dr. Vartiter Kotcholosian, and Brendan P Ryan) and members of international health agencies (Drs. Marie Farrell and Andrei Kisselev). Despite their different nationalities, organizations and priorities, all of the authors were forced to contend with an unwieldy set of agencies, logistical obstacles and an array of health care problems. Their observations in the following series of papers bring a fresh look to how postdisaster analyses might be used to help prepare for future disasters. The papers illustrate many of the major problems in providing international disaster relief, including the difficulty in providing timely medical care, the narrowness of the time window for immediate life-saving for victims of building collapse and less than optimal communication and distribution of information. Earthquakes in particular, have characteristic medical problems such as crush syndrome, hypovolemic shock, wound infections and sepsis for which the health authorities responsible for vulnerable communities must be made aware of and trained to handle. These highly topical papers provide a valuable contribution to all those concerned with earthquake-related health problems, including members of search and rescue teams, onsite medical or paramedical personnel and officials responsible for predisaster planning and management of relief operations.

MEDICAL MANAGEMENT OF THE ARMENIAN EARTHQUAKE EFFECTIVE DISASTER RELIEF DURING THE POSTIMPACT PHASE

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Disasters that have resulted in multiple casualties and injuries have varied considerably in magnitude. Small scale disasters are characterized by the following response phases.

PHASES OF DISASTER RESPONSE

Activation Phase

1. Notification of initial response; and
2. Organization of command and scene assessment;

Implementation Phase

3. Search and rescue;
4. Victim triage, initial stabilization and transport; and
5. Definitive management of scene hazards and victims;

Recovery Phase

6. Scene withdrawal;
7. Return to normal operations; and
8. Debriefing.

These disasters usually involve victims numbering in the hundreds and are effectively managed within a few days. Disasters of largest magnitude involve injuries and the displacement of entire populations. The resulting destruction far exceeds the ability of local medical and government agencies to respond. The people and their political structure are overwhelmed by the situation. In such a disaster the phases of medical response are better described as:

1. Rescue Phase;
2. Post Impact Phase; and
3. Long Term Recovery Phase.

The Armenian Earthquake of December 7th, 1988 was a natural disaster of the greatest magnitude because of it's devastation to that small Soviet Republic.

In addition to the impact on citizens, the earthquake destroyed many health care facilities and killed or injured many health care providers. The number of survivors capable of providing definitive medical care was therefore reduced. Health care providers from other parts of Armenia and from neighboring Republics rapidly

mobilized to help the victims within a few days. It became apparent that conditional help would be needed from elsewhere in the Soviet Union and from foreign countries. Aid was requested and the "convergence phenomena" occurred.

Spastic communications from Armenia to the outside world made it difficult to assess the needs of the victims and survivors. Outside disaster relief personnel had to use what information was available to anticipate what would be needed. In addition, consideration of experience in prior earthquakes and knowledge of the seasonal environmental conditions assisted the experienced disaster rescue personnel. Dogs and electronic devices were brought to the impact zone to help uncover buried survivors.

International Disaster Relief remains a developing phenomena with many issues of protocol and procedure as yet unresolved. Nonetheless, organized relief groups fall into 3 categories:

- Diplomatic;
- Military; and
- Volunteer

Certain logistical problems are inherent to volunteer disaster relief efforts, and this was the case for the Armenian Earthquake relief effort. Most of these problems were understandable given the circumstances. For example:

Affected country

1. Political - Maintaining internal security as well as law and order; and
2. Pragmatic - Maintaining communications and providing transportation.

Relief Personnel

1. Political - Obtaining visas and credentials; rapidly procuring supplies; and
2. Practical - Language barriers, not familiar with local customs, housing and transportation.

Our Massachusetts-based relief effort began by amassing supplies in a hanger at the Boston airport. Aided by existing liaisons through the Cambridge, Massachusetts and Yerevan, Armenia sister-city program and by the prior effort of Medical Outreach to Armenia we were able to select our supplies, find transportation and leave for Armenia after completing appropriate public relations in Boston.

Upon arrival we met with officials from the Republic of Armenia, explained to their credible representatives what our intentions were, and then found suitable housing. We then developed a work plan for our mission, which was to distribute the supplies to individuals who could use them to treat and care for the most needy victims and survivors. It was our intent to teach physicians how to most properly use the equipment and pharmaceuticals we had with us. Secondly, we wished to identify ongoing problems that we could clearly understand during our stay and assist with during future efforts. Examples were:

- Pediatric amputees;
- Temporary housing and medical facilities; and
- Large scale psychological stress.

We met with other international relief workers, Armenian doctors caring for disaster victims, and with government officials. We also toured cities within the impact zone. We were constantly amazed by what the Armenian health care professionals were able to accomplish with the severely limited resources they were left with after the earthquake. They worked quietly and tirelessly to restore their community to order and calm.

My current wish is to identify a group of volunteer medical professionals in the United States who would be willing to respond to a future international disaster involving large numbers of injured and displaced victims. I would like to see countries interested in international relief identify volunteer personnel in advance. These individuals should have the diplomatic support of their country. One or two representatives from each team could participate in a coordinating committee that would meet annually to prepare protocols and procedures for international disaster relief efforts. The United Nations, Red Cross, or other interested diplomatic and volunteer agencies could jointly support this coordinating committee.

Additional objectives for the committee would be to define:

1. Terms of support by cooperating agencies;
2. Equipment and supplies to be used;
3. The credentialing process for relief workers; and
4. Other items to be determined.

Our goal is clear: To provide assistance to populations that have been devastated by large scale disasters and to help these people restore their dignity and stability.

The following exhibits were presented and discussed at the Conference:

TABLE 1

Phases of Medical Response Following Disaster

Rescue Phase:
Extrication, stabilization and initial treatment, removal from further contamination or risk;

Postimpact Phase:
Protection from starvation, exposure to the elements and epidemics;

Long-term Recovery Phase:
Rehabilitation for complicated medical problems, rebuild permanent structures, reopen closed schools and businesses;

TABLE 2

Armenian Earthquake December 7, 1988 Vital statistics

25,000	Bodies Recovered
15,000	Extricated Alive
12,000	Hospitalized
500,000	Homeless
150,000	Refugees From Azerbaijan
600	Amputees

TABLE 3

Convergence Phenomena

Agency Administrators
Formal Delegations
Inexperienced Volunteers
Publicity Seekers
Spectators

TABLE 4

Medical Needs of Disaster Survivors

Injuries
Illnesses
Exposures

TABLE 5

Impact of Earthquakes on Buildings

Structural Damage:
Stresses of varying amplitude cause distortion on load carrying parts of buildings. Some parts of structures are unable to tolerate significant distortion.

Non-Structural Damage:
Furniture, fixtures, glass and unsecured equipment are thrown from their positions by the impact.

TABLE 6

Disaster Specific Medical Problems

EARTHQUAKE	Fractures, amputation, soft-tissue injuries, Head injuries, Subsequent infectious epidemics, Crush Syndrome;
VOLCANO	Volcanic ash inhalation, Inhalation of toxic or heated gases, Traumatic injuries form projectiles;
WINTER STORMS	Frostbite, Hypothermia, Carbon Monoxide Poisoning;
MASS GATHERINGS	Crush Injuries, Penetrating Injuries;
FIRE, EXPLOSION	Burns, Smoke Inhalation, Blast Injuries

TABLE 7

Medical Complaints and Problems Following a Major Disaster

1. Stress related complaints - anxiety, fatigue, insomnia, listlessness;
2. Persistent pain - headaches, chest pains, epigastric, pain;
3. Dyspepsia;
4. Productive cough; and
5. Inattention to chronic medical problems - asthma, diabetes.

TABLE 8

Psychological Stresses of Major Disasters

1. Fear of recurrence;
2. Fear of separation from family and friends;
3. Fear of hunger and exposure to the elements;
4. A sense of worthlessness; and
5. Long-term behavioral changes.

TABLE 9

Organized Relief Groups

Diplomatic
Military
Volunteer

TABLE 10

Logisitcal Problems Associated With Volunteer Disaster Relief

- Assembling supplies and appropriate personnel;
- Transportation to the impact zone;
- Housing and warehousing of supplies especially perishable supplies (most are in extreme weather);
- Visas;
- Language barriers; and
- Understanding local customs.

TABLE 11

Problems Common to Major Disasters

1. Inadequate rescue personnel and supplies for the initial few days;
2. Inadequate medical equipment, medical personnel and hospital space;
3. Inadequate food, clothing and shelter for victims and the displaced population;
4. Inadequate communications, assessment of victims' needs and initial on-site coordination;
5. Difficulties with assembly, transportation, storage and distribution of relief supplies;
6. Reuniting separated families;
7. Caring for orphans and the elderly;
8. Identification and burial of the dead; and
9. Arranging and coordinating national and international relief efforts.

TABLE 12

Disaster Medical Supplies - How to Distribute

- Arrange warehousing in advance;
- Arrive with your supplies;
- Maintain possession until your distribution plan is completed;
- Teach professionals that you identify how to use technical equipment and medications that are not available in the area;
- Deliver your supplies to the individuals you train;
- Leave behind written instructions in a language they can read;
- Bring all needed accessories; and
- Plan for subsequent technical support and resupply.

TABLE 13

Medications

Antibiotics
Antianginal medications
Antiinflammatory agents
Antianxiety medications
Antacid-H2 receptor antagonists
Hemorrhoid preparations
Asthma medications
Antihistamines and decongestants
Anticonvulsants
Topical dermatological preparations
Ophthalmology medications
Antihypertensives
Vaccines (cholera, hepatitis)
Toxoids (DT)
Scabicides
Vitamin supplements
Other

TABLE 14

Supplies

Wound bandaging material
Splinting Material
Burn dressings
Sterile disposable surgical trays
Variety of surgical instruments
EKG machine and paper (proper voltage)
Sterilizer
Bacteriology equipment (mini-lab)
Suture material
Stabilization/resuscitation kit
Variety of endotracheal tubes, chest tubes,
IV medications and fluids
Other

TABLE 15

Disaster Medical Relief

RESCUERS SHOULD:

1. Bring the right stuff;
2. Bring the right staff;
3. Plan to be self-sufficient;
4. Control your own supplies and avoid careless distribution;
5. Maintain accurate records, logs, and photo documentation to verify your efforts;
6. Prepare for periods of loneliness, separation, anxiety, and a sense of isolation;
7. Respect those whom you are helping. Help them regain their dignity and self-confidence; and
8. Remember that:
   - The first people you meet are probably not the ones who need your help;
   - The very young and the very old are most severely affected; and
   - Disasters will occur, sometimes in the same place.

TABLE 16

Assure the Safety and Wellbeing of Rescue Personnel

Transportation
Proper clothing
Housing
Hygiene
Food
Medical needs (anticipated and unanticipated)

TABLE 17

Medical Needs of Volunteers Involved in International Disaster Relief

- Antibiotics for traveler's diarrhea, upper respiratory infections, urinary tract infections and skin infections;
- Antiinflammatory and antipyretic medications;
- Wound care kit;
- Topical dermatologic preparations;
- Antihistamines and decongestants;
- Antidiarrheals;
- Antacids;
- Medications for existing chronic medical problems;
- Antimalarials (if indicated);
- Water purification;
- Vitamin supplements;

TABLE 18

Medical Needs of Volunteers Involved in International Disaster Relief

Suggested Immunizations

Polio vaccine - complete series mumps, measles, rubella Vaccine;
Hepatitis B vaccine;
Immune globulin - for Hepatitis A exposure;
HBIG - for Hepatitis B exposure*;
Cholera - if indicated by CDC;

* if immunization status is unclear

TABLE 19

International Disaster Relief

Volunteer groups should communicate with each other and agree on:

1. The type of aid that should be offered from the international disaster relief network;
2. The means by which communication will be maintained. The modes and routes of transport of supplies and personnel that will be used;
3. Which agencies will serve as liaisons for the distribution of:
   a. food, clothing, and temporary housing;
   b. medical aid; and
   c. long-term economic recovery; and
4. Plans for public relations and verification of relief efforts.

TABLE 20

Disaster Management

Summary

1. Everyone should have personal, family and community plans;
2. Plan to be self sufficient immediately after a disaster;
3. You can best help others affected by a disaster by doing what you do best; and
4. Preparing for disasters can reduce loss of property, injury and the number of deaths.

The needs of the many outweigh the needs of the few or the one. - Mr. Spock

THE WORLD HEALTH ORGANIZATION'S RESPONSE TO THE EARTHQUAKE IN ARMENIA

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The response and subsequent actions taken by the European Regional Office of the World Health Organization (EURO) are revised. Focus is placed on "health" rather than "medical" issues and on "preparedness" rather than "relief".

The actions taken underscore the nature of the relationship between the Soviet Union and EURO, the concern for long-term planning and the sensitivity to the impact of the disaster on those responsible for the on-going health of the population.

This disaster situation was the second major incident in the region involving the Soviet Union; both experiences provided opportunities for learning in several areas, including the mental health aspects. On-going activities in this field will be presented.

Specifically the effects of the event on health care providers during the rehabilitation phase will be analyzed. Some of these experiences challenge conventional notions about exclusive reliance of local people, who themselves have requested support.

EXPERIENCE OF SURGICAL HELP ORGANIZATION IN PEACE TIME MASS DISASTERS

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There were several disasters which affected large numbers of people in 1988-1989 in the USSR (eg., earthquakes in Armenia and Tadjikistan, railway crushes). Simultaneous affection of hundreds of persons, or thousands in the case of earthquakes require great efforts on the part of medical services and the development of principles of medical help organization. These principles should cover necessary equipment and treatment in such extreme situations aggravated by destruction of medical institutions together with their staff, as was the case in some districts in Armenia. In such cases, the situation is also aggravated by the destruction of transportation and communications, and impairment of water and energy sources.

All these situations may destroy the ability of local health facilities to provide medical and surgical treatment. It may be necessary to quickly deploy a mobile hospital of the "marquee-type" in an open area and transport medical staff and necessary equipment to this temporary facility.

During the first hour after the disaster in Armenia, 20 medical ambulance brigades from the nearest districts affected by the earthquake were working there. 100 more such brigades joined them later (in the first hours). During the first day, more than 1200 doctors arrived, among them 98 from Moscow. Up to 10,000 hospital beds were set up within 100 km of the earthquake to treat patients evacuated by air or ground transport. Already during the first day, 130 flights from the region of the earthquake were made to evacuate patients to medical institutions in Yerevan. All in all, from the first day more than 5000 doctors from Armenia took part in caring for patients. During the following 2-3 days, more than 1000 doctors from Moscow, Leningrad, Kiev, Tbilisi, Rostov and other cities joined them.

From December 11, (the 4th day after the earthquake) specialists from other countries (417 medical workers in total) and also equipment and medicines from 33 countries started arriving. It should be mentioned that a great role was played by well-equipped and highly skilled rescue brigades from France and other Western countries.

Inaccuracy of information was caused by communications failures in the center of the disaster. This resulted from objective difficulties of informers to give immediate assessment of the extent of damage, including the number of human losses. These difficulties were sometimes aggravated by emotional trauma of the informers themselves who for that reason either exaggerated or diminished the extent of the disaster.

Organization of surgical treatment in disasters is impeded by several factors including the simultaneous affection of large numbers of people, difficulties to reach the center of a disaster, destruction of local institutions and by not always timely and precise information on the extent of damage and number of victims.

As a result, there may be a 1-2 hour or more delay in mobilization of regional medical services and even more of a delay before all-national medical services can be deployed. Such delays considerably lower the ability of antishock and surgical resources to help those most critically injured. Even in cases of relatively small railway crushes where 200-300 people are affected, and despite the close proximity of large population centers, it may take several hours for necessary medical assistance to arrive in the center of a disaster. This time is spent in gathering medical workers, equipping them with the necessary supplies and equipment, transporting them to the disaster site and setting up an emergency facility near the disaster region. In cases of remote or isolated regions where transportation may be difficult, even more time is lost before surgical and intensive care of patients in mass disasters can take place.

That is why we think it necessary first of all to conduct a quick objective assessment of the character and the degree of affection of the population involved in the disaster. This assessment should include characteristics of the cause of the disaster, geographic and climatic conditions, remoteness from medical centers and other things. On the basis of this integrated information assessment, and according to analysis of past disaster experience, decisions can be made regarding the following:

- Specific types of medical workers and facilities to be enlisted;
- Particular methods of transporting these medical workers and facilities to the center of a disaster;
- Notification of nearest medical institutions;
- Methods and means of evacuation of victims; and
- Provision of rescue and reconstruction work.

Medical brigades from the nearest regions, and republics as well as from the center of the country arrived in the earthquake-affected part of Armenia in the first 3 to 12 hours. At first, their equipment did not completely meet the work requirements. During the first few days, there were not enough marquees to set up mobile operation and hospital complexes, and there were few means to obtain necessary the energy and water supplies. Air transport, however, worked well in bringing relief workers and facilities as well as evacuating the wounded.

Due to good organizational work and public compassion to the victims, during the first 2-3 days it was possible to give medical assistance to all the victims (Table 1). Almost 11,000 of these victims were able to be taken to hospitals in connection with their critical state, thanks to the local organizational system and the timely arrival of large numbers of medical workers, including general surgeons, anesthesiologists, intensive care specialists, neurosurgeons, and traumatologists. Patients requiring more specialized surgical treatment and intensive care, as well as practically all the critically-injured patients were quickly evacuated by air to large hospitals in Yerevan and other cities in the USSR.

The news of the disaster inspired many medical workers and other specialists in our country, as well as others to go to Armenia. This wish of different groups and public organizations to help, including national organizations of the Red Cross and a number of Western companies, made a great contribution to the treatment and rehabilitation of the victims. Since no single, European country, including the Soviet Union is able to give simultaneous medical assistance to a large number of people who have critical wounds, supplies, medical equipment, and drugs were most important, particularly for combination trauma, complicated by wound infection, crush-syndrome and its consequences (Table 2).

There was a great demand for renal dialysis in patients with crush-syndrome combined with fractures, infected wounds and other injuries. Hemodialysis, plasmapheresis, hemabsorbtion, and ultrafiltration were also used in such patients. Invaluable assistance was provided by foreign organizations and our colleagues who specialize in the equipment of these methods for mass application.

The arrival of a large number of volunteers in Armenia from different parts of the Soviet proved to be excessive in the long run. A number of colleagues who arrived were not satisfied with the little work that needed to be done and conditions of life due to the arrival of a large number of other specialists who carried out rescue and reconstruction work.

On the basis of our analysis of the medical assistance rendered in a number of past disasters, among which the largest and most tragic was the earthquake in Armenia, we became convinced that the quantity of medical workers and facilities should be restricted to only those

necessary for the work at hand. For this purpose, the Ministry of Health decided to establish a scientific-practical coordinating center on medical assistance to people affected in mass disasters at the AV Vishnevsky Institute. The aims of the center are:

1. The study of the organization and the results of medical help in disasters which took place earlier in the USSR and abroad;
2. The development of optimal programs of disaster assistance organization in accordance with the character and extent of disaster conditions, and the condition of health care service which have escaped destruction, etc.;
3. Mobilization and coordination of all the necessary medical resources using specially formed medical brigades and equipment on the basis of analysis of information coming from the disaster region;
4. Providing mobile, easily transported equipment for each standard medical brigade which can be duplicated depending on the extent and character of disaster. Such equipment will be immediately sent to the disaster region; and
5. Development of medical doctrines of surgical treatment for the victims of mass disasters.

We believe that the organization of such a center, which has at its disposal special on-duty medical brigades (surgical and anesthesiological) with the corresponding equipment constantly ready to be sent to the place of an accident will considerably improve survival opportunities and efficiency of surgical help to the victims of a disaster. This service will also be available to assist other countries in the event of mass disasters.

We will discuss the organization of surgical help to the victims in Armenia later. The conditions of the on-the-spot treatment (first stage) consisted mostly of antishock measures, immobilization of fractures and amputation of extremities. Most of the amputations were the result of limbs crushed by large building fragments which were not possible to move because of the lack of lifting machinery.

During the second stage, critical patients were moved to large medical institutions in Yerevan, mostly by air transport. Sorting and distribution of patients were carried out at as follows:

- Patients with crush-syndrome were sent to one specialized hospital;
- Patents with critical brain-cranial trauma to another;
- Patients with critical wounds and fractures to the 3rd;
- Patients with injury to internal organs to the 4th.

Still the majority of those taken to hospitals had combination injuries, which resulted in the presence of such patients with mixed injuries in all the medical institutions.

During the first and second stage of surgical treatment, more than half of all the victims received medical assistance in dispensary facilities; the rest were taken to hospital (more than 11,000 patients). The majority of them were operated on during the first 12 hours from the moment of hospitalization. Those who were trapped in the ruins, went to the operating theater 2-3 days after the earthquake. Primary surgical treatment of wounds, amputation of extremities, thoracotomies, laparotomies, and cranial trepanation were performed.

One of the most serious surgical errors made at that stage was the underestimation by some surgeons of the degree of wound infection and the local changes that occur in crushed tissue. As a result, there was often relatively economic debridement of traumatized soft tissues, small skin incisions and application of primary wound closure. The latter led to serious septic processes. Perhaps wider incisions and debridement of non-viable tissues should have been performed after amputation and primary surgical treatment of wounds.

The 3rd stage of treatment was characterized by the worsening critical state of many post-operative patients (eg., 4-6 day after trauma) because of the onset of crush-syndrome and progressing septic processes in wounds. The latter included the development of typical combined non-clostridial and clostridial infections, and deep myositis, despite massive anti-bacterial therapy. During that period, it was necessary to make repeated wide surgical incisions of wounds with debridement of large quantities of non-viable muscles and other tissues and the institution of afferent methods of treatment for crush syndrome (eg., hemabsorbtion, plasmapheresis, hemodialysis).

For partial relief of the overwhelmed medical institutions in Armenia, some of the most critical patients (393) were transferred to clinics in Moscow. Thus, 71 patients were treated in the AV Vishnevsky Institute of Surgery, among whom 40 had crush-syndrome, combined with large septical wounds and fractures (16), and large burns (9) (Table 3). According to clinical and laboratory data, 31 patients had anaerobic non-clostridial wound infections, in most cases combined with aerobic flora, and in 4 patients combined with clostridias.

We became convinced that primary surgical debridement which is not wide enough, despite correct overall surgical treatment, is fraud with undesirable consequences. In such cases it may not be possible to save the extremity and sometimes even life itself.

Careful analysis of the results of treatment of 47 patients (Table 4) showed that the frequency of amputations, reamputations and mortality is much higher in the group where patients had economical, ie. non-

radical primary surgical debridement of wounds. Most of these patients developed progressive anaerobic non-clostridial and clostridial (4) wound infections.

Questions still remain regarding the effectiveness of "stripe" cuts for severely crushed limbs with edema. One group of surgeons consider them necessary at any stage of treatment. This group is opposed by others who associate stripe cuts with the development of serious septic processes. A third group believes that the edema can be prevented and effectively treated with plasmapheres.

In summary, the establishment of a National Disaster Medical Service in concert with experienced international disaster agencies will provide rapid direction and organization at the disaster-affected site, and specially trained and equipped medical brigades. The actions of such brigades must be subjected to scientifically-grounded medical doctrines, which determine the character and extent of help at each stage of evacuation and treatment.

TABLE 1
Data on the Earthquake in Armenia

Number of people who received medical assistance: About 19,000

Number hospitalized: About 11,000

Severity of injury of those hospitalized:

Critical	20.9%
Serious	29.7%
Moderately serious	33.3%
Satisfactory	16.9%

TABLE 2

Character of Injuries

Fractures of lower extremities	12.8%
Fractures of spinal cord	7.8%
Traumatic amputations	5.7%
Crush-syndrome	About 30%

(strongly expressed in 843 patients)

TABLE 3

Distribution of Patients According to the Character of Injury (AV Vishnevsky Institute of Surgery)

Type of Injury	Number of patients	
	No.	%
Septical wounds + fractures (without crush syndrome)	12	16.9
Crush-Syndrome		
+ septic wounds	34	47.9
+ septic wounds and fractures	16	22.5
+ burns	9	12.7
Total	71	100.0

TABLE 4

Comparative Evaluation of the Results of the Treatment of Two Groups of Patients Involved in the Earthquake in Armenia

Assess. of adequacy of primary surgical treatment	# of patients	Amps of exarculation	Reamps.	Mortality
Radical primary surgical treatment	24	3	-	2
Incomplete surgical treatment and/or application of tight suture	23	10	9	5
Total	47	13	9	7

THE ARMENIAN EARTHQUAKE

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Armenia today is the smallest (30,000 sq km; population 3.3 million) of the fifteen Soviet Socialist Republics (250 million) and is located in the Transcaucasus, bounded by the Caucasus Mountains on the north, the Black and Caspian Seas on the west and east, the Araxes River and Iran on the south. Armenia's immediate neighbors are the Republics of Azerbaijan (population 7 million), Georgia (5.5 million), Iran (45 million), and Turkey (52 million).

The earthquake that measured 6.9 on the Richter Scale on December 7 severely affected forty percent of the country and devastated an area of more than 6,000 sq km in northern Armenia. The tragedy triggered a broad spectrum of response worldwide.

In my case, after numerous calls to Washington to offer my services, it was with the assistance of the Armenian Assembly of America that at 5pm on December 13 I was asked to join the USAID team of twenty-one medical and disaster specialists. The chartered American Trans Air carrier touched down in Armenia at 2:25pm on December 17, and the same evening was to take homeward the first US Search and Rescue team and medical relief personnel who on December 12 had joined their European counterparts in frantic search efforts, and were then instructed to abandon their mission on Friday, December 16, 1988.

The earthquake struck at 11:41am, figuring decisively in the demographic distribution of casualties as the educational and work establishments, as well as the newer substandard high-rise apartments, had become instant graveyards. Had there been four minutes of grace time, thousands of school children and factory workers would have been on their break time and out of doors on that sunny winter Wednesday.

Hardest hit were the Republic's second largest city, Leninakan (population 250,000), Kirovakan (population 150,000), Stepanavan (population 30,000), the epicenter town of Spitak (population 25,000), many small towns, and nearly 100 villages, affecting a population of over 700,000, several thousand of those being part of the 170,000 refugees who had fled to Armenia as a result of a series of recent pogroms against them in neighboring Azerbaijan. Hundreds of winter tents and temporary shelters sprang up in the devastated area for volunteer workers from all over the USSR. The survivors had to fend for themselves or to evacuate. Coffins, however, were provided promptly and in abundance, creating mountain-like heaps.

Singular in terms of injury to death ratio, the earthquake left over 500,000 homeless; no less than 55,000 lost their lives, some 20,000 were badly injured, while the entire local governmental and health care systems were destroyed.

The capital Yerevan, itself devoid of disaster preparedness and shaken vigorously by the temblor, learned of the gravity of the situation by 3 pm, at which time individuals and institutions alike frantically rushed to the rescue, immediately clogging the insufficient roads.

Of Yerevan's more than thirty hospitals, many of the larger ones swiftly evacuated their patients to accommodate nearly 4,000 victims requiring emergency treatment. The injured were transported from as far away as 150 kilometers by whatever vehicles were available, without much first aid or stabilization. Poorly equipped and technologically inadequate hospitals quickly became overcrowded with injured and their fragmented families, overwhelming the dedicated but unprepared medical staff.

Hundreds of patients arrived with complex injures: multiple limb trauma, amputations, pneumothorax, head trauma, abdominal injury, hemorrhagic shock, burn, etc. The most critical cases were flown to Moscow and other Soviet specialized medical centers.

Having met the challenge of acute trauma care, the next phase was marked by the sudden emergency of crush injury manifestations, which demanded prompt diagnosis and treatment by dialysis. Just as the 72 hour delay in marshalling a coordinated rescue effort resulted in the failure to retrieve thousands of victims from under the rubble, so too many died unnecessarily because of the delayed arrival of US and European dialysis systems.

Countless cargoes of lifesaving medications and supplies flew in from all over the world, yet the absence of a central coordinating body hampered their distribution. This was accentuated by a lack of computers to log incoming and outgoing supplies. A major obstacle to adequate medical care continued to be the unavailability of medical technology: bacteriology, biochemistry, sterilizing laboratories; ventilators, respirators, aspirators, cardiac monitors, cardioversion systems, portable x-ray equipment, ultrasound systems, surgical equipment, endoscopes, bronchoscopes, laryngoscopes, otoscopes, ophthalmoscopes, orthopedic systems, and other basic hospital equipment and supplies, as well as specialized computers.

In order to further care for and rehabilitate the surviving population, the standing medical facilities would need to be upgraded, new medical centers built, including prostheses and dialysis centers, as well as a network of trained professionals to deal with the devastating psychological trauma that befell a heretofore productive and proud people, clinging tenaciously to their homes, though in ruin.

The above cited data was assessed in the field by the medical team; a more complete report was submitted on December 20 to the United States International