Team members must be prepared, too, to respond immediately when called. The dog's health records must always be up to date, including rabies and parvo vaccinations and other pertinent medical records. Dogs must have a thorough physical at least once a year by a registered veterinarian.

Phase III

During Phase III, both dog and handler participate in a mission readiness evaluation. Conducted by the US Disaster Team, this impartial review assesses the ability and effectiveness of the dog and handler as a unit, evaluating their effectiveness and search skills. This test takes place during a simulated disaster, with stresses and distractions created to be as realistic as possible.

Testing is conducted on two consecutive days. Teams that pass on the first day are certified mission-ready for disaster work for two years. Teams that pass after a second day of testing are certified mission-ready for one year. Each must score at least 70% to pass.

During the disaster evaluation, each team works in at least five different search areas, each one of which can reasonably be searched in 20 minutes. One area will require group problem-solving, so that teams can demonstrate their ability to form a cohesive unit and work quickly - even with total strangers - to conduct a search of the area.

There may be one, two or no victims in each search area, and each handler does not know how many victims, if any, there actually are. Each area contains obstacles that the dog must negotiate successfully in order to complete its search of the area.

Evaluation Criteria

Disaster dog teams are evaluated during simulated conditions on the following criteria:

- The dog must be under the verbal control of the handler at all times;
- After the disaster scenario has been explained, each handler may ask questions and has five minutes to assess the situation;
- Before beginning to search any specific area, the handler must inform the area evaluator exactly how the dog will alert since there are several acceptable alert signals; and
- At the end of a 20-minute search period, the handler then gives a verbal report to the evaluator, as well as a rough sketch of the area with locations of alerts.

The dog and handler receive ten points for each victim found and twenty points for a report of "no victims" when there actually are no victims.

Mission Ready Teams

The development of uniform training and evaluation for disaster search and rescue canine teams represents a major step forward for dog teams and those who rely on them.

Aspiring disaster team members across the United States know what skills they must attain. More importantly those who call for help can be assured that the responding teams are competently trained and prepared to meet the challenge.

A MODEL FOR SCALING UP FROM EMERGENCY MEDICAL AID TO COPING WITH DISASTERS

Roel Huijsman-Rubingh
Deputy Chief Medical Officer of Health The Netherlands

INTRODUCTION

The Netherlands is a small country in western Europe. Words which may have a familiar ring to American ears are windmills, bulbfields, wooden shoes and perhaps the names of football heroes such as Cruyff, Gullit, van Basten etc. The Netherlands covers an area of 41,548 square kilometers and has about 15 million inhabitants. It is a flat country and the roads on the whole are good.

AMBULANCE TRANSPORT

Since 1974 ambulance transport has had a statutory basis in the law, the purpose of which is defined as "the establishment of rules for promotion of efficiency in transport by ambulance of sick persons and accident victims."

CENTRAL POSTS FOR AMBULANCE TRANSPORT (DISPATCH CENTER)

Each province is subdivided by the provincial authority into a number of regions, each of which has a Central Post of Ambulance Transport (CPA) or Dispatch Center responsible for coordination of activities. There is a closed network comprising 45 CPAs (Dispatch Centers). The original intention was that these CPAs should cover an area with 400-700,000 inhabitants, but this has not yet been achieved and it will be several years before the goal is reached. Half of the CPAs are located in and/or integrated with public health services on fire-brigade alarm posts. It may not be immediately obvious to the reader why these organizational differences are a source of considerable problems. Location in or integration with public health services means that the post is staffed with nurses who have had further training in intensive care or coronary care nursing and are

experienced in provision of emergency medical help on the ambulance; location in or integration with a fire brigade alarm post, however, the post is staffed by people who are fully trained fire fighters but whose only "medical" qualification is a first aid diploma.

AMBULANCES

The number of ambulances in the Netherlands amounts to at least 700: these are available for both emergency and "bespoken" (non-emergency and interhospital) transport. About 40% of them are owned by the ambulance divisions of public health services, with the other 60% owned by private firms. Each of the public health services has 5-15 specially licensed ambulances; the private firms have no more than 3 ambulances each. Most transports are performed by the public health services; each of their ambulances carries a specialized nurse and a well-trained driver. The privately-owned ambulances have a driver and an accompanying person whose qualifications can vary from a first aid diploma to a basic life-support training or even to a postgraduate nursing training. The number of trips per year per team is as a rule much greater for the public health services than for the private firms.

LICENSING

An ambulance service receives a permit to put an ambulance on the road if there is a demonstrable need for it (efforts are under way to reduce the number of ambulances). The vehicle must conform to specifications laid down by law. These specifications relate to stretchers, oxygen supply and ventilation, provision for intubation, blood pressure measurement, supplies, drugs etc. The law also stipulates that every ambulance that is used for emergency transport must arrive within 15 minutes at the place where the victim is. If necessary two patients can be transported at once, but this is not usual.

LOTT

In recent years the Netherlands passed a law on the establishment of "LOTT,", the national organized trauma team. Teams consist of an anesthesiologist, a surgeon, and two nurses with experience in emergency and/or intensive care. Of the 45 CPAs (Dispatch Centers), five have been chosen to function as Sector CPA. If a major accident or a minor disaster shows the need for such a team an alarm is transmitted to one of the five Sector CPAs which then must ensure that one of the 25 hospitals able to do so sends out its trauma team, with car and packaged equipment, with police escort if necessary, to the site of the accident. Most of the 25 hospitals able to provide a trauma team are also willing to send out a crash team consisting of one doctor (who may be either an anesthesiologist or a surgeon) and one nurse.

HELICOPTER TRANSPORT

Up to now helicopter transport has not been used much in the Netherlands, except for transport of patients and injured persons from the islands and offshore to hospitals on the mainland, or to take premature or seriously ill infants to a special neonatologic center. In this case the helicopter first picks up the neonatologist from the center and then the baby to be taken to the center.

COPING WITH DISASTERS

Following World War II, the organization Bescherming Bevolking (abbreviated BB, meaning literally population protection, more or less equivalent to Civil Defense) was set up during the 1950s. This was a paramilitary organization responsible for looking after the population under exceptional conditions.

The BB turned out to be too expensive, and in the period when we ceased to believe that "the sky's the limit" efforts were made to see whether it might be possible to connect up disaster preparedness measures with existing emergency services organizations. The first organizations to come to mind were the fire services and the public health services.

The fire service was eventually given responsibility for the total disaster preparedness organization as defined in the disaster law of 1985; the public health service in turn will be responsible for the medical aspects, in the new law on "Medical Help in Disasters," a law that is still at the outline stage but is expected to be in place before the end of this year. This law also stipulates that in the case of a disaster the basic health services must call in the aid of such organizations as the Red Cross and first aid volunteers. If the disaster assumes such proportions as to amount to war-like condition, that is, to be of national proportions, the Mobile Column Corps (KMC), a military organization, can also be called upon to help.

TRANSPORT OF INJURED PERSONS

Three categories of transport for disaster victims are recognized:

- From the scene of the disaster the victims are taken (by the firefighting or the rescue team) to "nests" of wounded. The victims will mostly be carried or transported by stretcher by non-medical personnel;
- After this the victims are collected from the "nests;" this may be done by ambulance personnel directly, or by the Red Cross if they have been called in. The victims thus collected are taken by stretcher to a Red Cross or other vehicle and transported to a casualty clearing station (if it has been decided to establish such a station); and
- Finally the victims are taken from the "nest" or clearing station by civilian ambulances to hospitals. Only this last transport is coordinated by the CPAs.

In order to meet expectations as well as possible, the CPAs have mutual aid agreements for help in emergencies.

The number of ambulances required (V) can be calculated from Macpherson's formula:

$$V = \frac{G \times t}{T \times g}$$

G = Number of injured persons to be transported;
t = Average time for a return trip;
T = Total time required for evacuation of victims;
g = Average number of victims to be transported per ambulance.

Attempts are made to limit the distance to the hospital to 50 kilometers. On the basis of the medical treatment capacity of the hospitals in the region a plan for distribution of victims can be made and it is possible to estimate the time within which the victims can be taken to hospitals (or whether additional arrangements have to be made).

SCALING-UP MODEL

Practice-drill experiences in the development of disaster preparedness organization have generated the wish to improve efficiency by better coordination of help organizations among themselves. The model in question starts from the normal practice of ambulance transport in accidents and goes on to ensure not only that help can be quickly initiated but also that it becomes possible without structural changes to switch over to a system on larger scale.

THE STAGES OF THE MODEL

Stage 0

A major accident: The medical help takes place according to the normal procedure.

Stage 0 plus

An exceptional occurrence: Two or more on-call services are called in; communication between these and coordinated action is necessary.

Stage 1

A disaster as defined in Article 1 of the disaster law. The local mayor installs a disaster staff and a scene-of-disaster command.

Stage 2

A major disaster. The mayor decides to install a regional command.

Stage 3

A disaster under exceptional conditions. At this stage help is available from the mobile units and ambulance teams of the "Korps Militaire Collones" (MC).

The scaling-up model can in fact begin with first aid in the home. Every household has (or ought to have) a first aid kit. It is the custom in the Netherlands to contact the general practitioner (family doctor) first when an accident happens. The first aid kit and the GP are really the first links in the chain.

Stage 0 is reached when the medical assistance activities take place according to normal procedures. The CPA is called and sends an ambulance (or more than one if indicated by the report) to the scene of accident. The first ambulance to arrive at the scene of the accident or disaster does not transport the victims but estimates the situation and reports this to the CPA. This ambulance also estimates the urgency of the need for a crash team or trauma team and coordinates the medical aid while waiting for the doctor. The CPA then tells the responders to which hospital or hospitals the injured are to be taken and also reports to the hospitals the number of injured to expect and the nature of their injuries.

Stage 0 plus is reached when it becomes evident that to deal properly with the accident the help of two or more on-call units is needed, and/or that assistance may be required from other than local services. On the basis of information supplied by the staff of the first ambulance, the CPA calls the medical coordinator. The CPA arranges for the transport of the injured according to the distribution plan. The CPA can also ask for extra ambulances from neighboring CPAs, in accordance with the mutual aid agreement. If necessary the CPA can send a transportation coordinator to the scene of an accident; this person will then decide on a distribution plan and supervise the transport to hospitals.

Stage 1 is reached when the nature and extent of the calamity are such that coordinated action of services and organizations is required by Article 1 of the disaster law. Activity is then initiated according to the local (municipal or rural council) action plan, and the mayor's "disaster staff" comes into action. The mayor will then appoint a "disaster-site command" for operational direction of activities on the spot. On behalf of the director of the public health service (who is a member of the mayor's disaster staff) a "medical leader for the disaster site" will take part in on-site activities and will be responsible for medical activities there.

Within the context of medical assistance, the director of the public health service has operational responsibility

for the coordinated activities of the medical services and organizations including the transport of victims from the scene of disaster to the hospitals. The CPA is responsible for the actual coordination of transport.

Stage 2 is reached when the mayor (or possibly the mayors of several communities) decides that the nature and/or extent of the disaster is such that operational direction has to be placed in the hands of a regional command. The director of the public health service (a regional organization covering populations of about 250,000) joins the regional command and is charged with the operational direction of medical assistance. He is assisted by the staff functionary for disaster control as coordinator of medical activities. The operational direction of the performance of the medical assistance on site is, as already noted, in the hands of the medical leader for the disaster site, plus an assistant if necessary.

Stage 3 stands for exceptional circumstances (war). In such a situation the KMC stands prepared for action and the regional command can call on the mobile columns and rescue, medical and ambulance companies to support the civilian response. Our ministry of health ensures extra bed capacity for hospitals by utilizing extra equipment from its stores. At this stage the provincial director of hospital organization is responsible for planning for the distribution of patients. Implementation of the plan is in the hands of the sector head for medical matters. The provincial director of hospital organization informs the national director, who can reserve certain hospitals for military casualties.

ALLOTMENT OF TASKS IN MEDICAL CARE FOR THE INJURED AT THE DISASTER SITE AND TRANSPORT TO HOSPITALS

According to the location, nature and extent of the incident, the victim may be taken to a "nest" of wounded. This is the first place for collection of victims from the scene of the incident. Here, first aid and/or supplementary first aid are given, and from here transport for further treatment takes place. This may, for example, be a casualty-clearing station. Outside the immediate area of the disaster; victims are collected here, and organized responders carry out a further triage to decide on the urgency of treatment and evacuation. Here too, life-saving and limb-saving measures are carried out and the patient is prepared for further transport to a hospital. If necessary the regional command can ask for help from the army or call upon the KMC (Mobile Column Corps).

If the number of injured is large, it will be necessary to distribute them to a number of hospitals due to limitations of capacity of individual hospitals for reception and treatment. The number of victims to be taken to a given hospital depends on the number of victims that this hospital can treat per hour (medical treatment capacity = MTC). MTC is largely dependent on the number of specialists, nurses and operating theaters.

Another limiting factor is the "restricted" transport distance. It is medically necessary to restrict the duration of transport in view of the influence on the results of treatment and because transport can of itself constitute a trauma. The present limit for motor vehicles is 50 kilometers. Our government is now developing plans for use of helicopters in major disasters in peacetime, so that injured persons can be transported over greater distances.

DISASTER CONTROL PLANS

Each mayor is responsible for drawing up a disaster response plan for every reasonably possible kind of disaster within his/her area, for which the place, nature and extent are foreseeable. Disaster response plans are scenarios with clear, concrete instructions that must be followed if such a disaster occurs. They are a kind of coordinated "plan of attack" like those of the fire services and the police. Such a plan has to provide answers to the rhetorical questions, Who? What? Where? When? and How? The scenario gives specific directions for warning and alarm, response, and evacuation. It also specifies location of staff and equipment as well as casualty collection points.

The general community disaster plan serves as a guide. The administrative measures needed and the general organizational rules and provisions should be included as far as possible in the general disaster plan. To keep the specific disaster response plan as short as possible, routine regulations should be given as instructions.

If a community should suffer or be threatened by a disaster, the mayor must decide not only whether to put the general plan into action but also whether to order partial or total performance of one or more disaster-control plans.

SUMMARY

The organization is not yet by any means perfect. Since the abolition of the BB (Civil Defense), a reorganization has been initiated which makes the fire fighting and public health services responsible for establishment of an efficient organization.

Real disasters, other than large-scale accidents, have so far not occurred in the Netherlands. Practice-drill experience has given rise to the wish for a smooth switch-over from normal emergency medical help to other organizations for dealing with disasters, such as the Red Cross and the paramilitary KMC. The development is still continuing.

The scaling up comprises five stages:

0 (a major accident)
0+ (an exceptional occurrence)
1 (a disaster)
2 (a major disaster)
3 (a disaster under exceptional conditions)

The scaling-up model highlights the need for a rapidly available medical aid unit to work together with ambulance teams and trauma teams or crash teams to provide life-saving first aid. At least one such unit per region is envisaged. It is uncertain who will provide the rapidly available chain of medical assistance, the existing ambulance services? The Red Cross?

MANAGEMENT OF LIMITED RESOURCES TO COPE WITH DISASTER SITUATIONS

Dr. Hussein El Hussein

This report reflects the work of IARA (an indigenous non-governmental organization, or NGO) during the Khartoum flood disaster. The report includes: a review of the poor general living conditions, with emphasis on the periphery of Khartoum among the shanty settlements; and the sanitary and environmental conditions prior to the floods. IARA's Health centers (40) are concentrated in these areas. Full account of the human and material loss is also included.

The report reflects the rearrangement of the available human (486 permanent and voluntary staff) and material resources (four tons of essential drugs and the stored supplementary feeding program stocks) to cope with the disaster situation. Eight extra temporary camps were erected. Coordination with other indigenous (8) and international (4) NGO's was established. 250,000 patients were treated and 3000 children were vaccinated against typhoid and measles. Thirty clean water tanks were continuously refilled. Bread, milk powder and vegetable oil were distributed. An emergency environmental health program was designed and executed in collaboration with other NGO's, the government, and the international community. Results of the efforts are analyzed.

Background Situation

In 1984 thousands of displaced persons from drought stricken areas in Western, Eastern and Southern Sudan have sought refuge in urban areas throughout the Sudan, particularly in the Khartoum province. Even though many of these people returned to their home areas in 1985/86, a good number stayed on.

Additional migration into urban areas is created by the ongoing civil war and its resulting effects in Southern Sudan and increased insecurity in adjacent Northern regions (Blue Nile, South Kordofan and Darfur). It is estimated that Khartoum's population has increased by more than two million in the past three years.

This, of course, has overtaxed the resource availability of the municipal authorities, who try to prevent further settlement in these shanty areas by refusing to supply basic services such as water, rubbish disposal, basic medical care, security, even going as far as denying the existence of these squatter areas.

Most of these migrants are illiterate and used to rural or pastoral life. Few of them plan to return to their areas due to fears of insecurity and lack of support during their journey back and during their rehabilitation phase. There is no readily available or applicable government policy to offer a real alternative away from urban areas. Different options are being discussed, but no plans have materialized as yet.

This results in real distress for the hundreds of thousands of migrants, many of whom have no visible means of support. Squatters are willing to accept any menial task as unskilled laborers. In most families, one member manages in this way to earn between 100 - 250 £ Sud. per month. In the compound, a twelve to sixteen square meter room built from mud or dried mud bricks within a walled compound, shared by other families costs between 60 - 100 £ Sud. And water can cost up to 30 £ Sud. per barrel (44 gallons).

But the majority of habitats are of mud blocks or cartons and empty sack. Half of Khartoum's planned areas houses were not designed to resist extreme climatic conditions.

A recent survey has shown that over 30% of young females of school age seek employment as house girls. Others try to supplement their family income as street vendors. The same study found that of 100 school age boys only 28% stayed with their parents; the other 72% loitered in the city center. None of the young people in the sample attended school. Promiscuity and child abuse are suspected to exist and may pass undetected.

The staple diet in the shanty areas is "assida" (porridge) made from sorghum or a mix of sorghum/wheat/millet, sometimes supplemented with a soup made from dried okra and onions or sour milk. Other relatively cheap staples, salads and fruits, are too expensive and meat is reserved for special occasions like marriages. There are no food distributions to vulnerable groups because this would further accelerate the influx. Small amounts of food are available in the selective feeding programs only.

The Disaster Situation

On the night of August 4, 1988, and during the following days torrential rains fell on Khartoum and the surrounding areas. 220mm were registered in the capital area, more than twice the normal annual rainfall. These very heavy rains fell on soil which was not permeable, causing considerable flooding. The roads quickly became impassable as they were covered with water and mud. The electricity system broke down, the main radio station was cut off, and the water supplies were damaged. Shops, offices, schools, and workplaces were unreachable.

The disaster resulted in 76 dead and 200,000 houses and 760 schools destroyed. 500,000 people were left homeless. The great majority of the worst affected people were in the outer belt of Khartoum. These were squatters, the illegally settled displaced victims of the drought and the civil war. On the sixth day into the disaster, the Sudanese government announced a state of emergency and appealed for international aid. Twenty-four hours later, the first planes were landing at Khartoum airport.

The Plan of Action

1. Setting up of a dual information system (listing the needs and priorities).
2. Assessment of the human and material resources.
3. Direction of all emergency resources to be used in the field, prioritized as follows:
   a) Supply of clean water;
   b) Treatment of cuts, wounds, fractures, and so forth;
   c) Management of communicable diseases by use of essential drugs;
   d) Vaccination of children against typhoid and measles;
   e) Supplying basic food needs (bread, powdered milk, and vegetable oil) to needy groups;
4. Coordination with the government and NGOs working in the field to maximize benefits and to minimize wastage and duplication of effort; and
5. Setting up of an emergency environmental health program which included:
   a) Health education using the radio, television, national newspapers, churches and mosques, congregations, groups, and individual contacts;
   b) Drainage of the pools and stagnant water;
   c) Disposal of rubbish and human excreta;
   d) Eradication of mosquitoes and flies;
   e) Management of existing communicable diseases;
   f) Vaccination of children against measles and typhoid;

Activities

IARA has already established 40 Public Health Centers (PHC's) in the poverty areas around Khartoum. Staff in the field headquarters include a manager, a medical director, a PHC program coordinator, 50 CHWs, 40 part-time doctors, and 20 community midwives. We have called for volunteer assistance and we received an unbelievably positive response (200 doctors, 250 nurses, 152 medical students, 254 paramedical personnel). IARA has set up a 24-hour emergency room service and eight more temporary centers have been erected.

Every morning, vehicles loaded with staff, essential drugs, and food items depart headquarters for the peripheral centers. Larger water tanks, seconded from the army, distribute clean water to permanent tanks in the field. At the end of the day, convoys return to headquarters with their reports, which are then analyzed. Needs are looked into on the basis of this information. By the third week, conditions were more or less under control. This was due primarily to the intensified, concerted efforts of government, national and international voluntary aid.

It was evident that the environmental conditions were poor beforehand, and that the problem was compounded by stagnant water, flooding of pit latrines, and lack of clean water. It was clear that Khartoum was heading towards a disastrous situation. We therefore took the initiative and presented an emergency environmental health program. Students, youth organizations, governmental health authorities, NGOs, and the international community were involved. Activities ranged from simple health education through drainage of stagnant water pools to aerial insecticide spraying. This program took nearly four weeks to execute. The cholera kit emergency program was now ready, but no case was observed or reported.

Review Of Work

Food items worth 500,000 £ Sud. were distributed. Analysis of the 250,000 patients treated showed 23.4% to have had malaria; 21.1% had dysentery; water diarrhoea was observed in only 2.7% of the cases. Broncho-pneumonia in children and acute bronchitis in adults were observed in 10,3% of the cases; 13.7% of patients visiting clinics had purulent conjunctivitis; and 11.3% had infected wounds. Chloroquine resistant malaria was reported for the first time in Sudan, but the clinical response to medical treatment of dysentery was satisfactory.[15]

The community voluntary response and participation in the environmental health program was excellent; this took the form of garbage collection, drainage of stagnant water, and compliance with health instructions. The media's role in health education was also satisfactory. However, the response of the official health authorities regarding supply of insecticides, sprayers, and so forth was poor if not actually negative. International NGOs, especially the League of Red Cross and Red Crescent Societies, have filled this gap.

Saudi Arabia responded swiftly by seconding their Hajj facilities in spraying Khartoum by airplane; but the basic fact is that only social, economic and public health development can safeguard against such events. Provision of healthy planned housing, maintenance of a healthy environment, and availability of basic services are mandatory. This may seem to constitute a heavy burden on an already jeopardized economy; however, serious efforts in such a situation are never wasted.

CREATING AN EMERGENCY MEDICAL SERVICES SYSTEM DISASTER RESPONSE PLAN - THE VIRGINIA MODEL

Deborah MacArthur Kelso and L Benjamin Young

INTRODUCTION

Armenia, Bhopal, Mexico City, Dallas-Ft. Worth, Ramstein Air Base, all of these names conjure up images of recent mass casualty events. The Commonwealth of Virginia has been spared a major natural or manmade disaster in the past two decades even though mass casualty incidents occur with alarming frequency. With burgeoning population and economic growth in the center of major American north-south, east-west transportation routes, Virginia cannot escape the inevitability of major mass casualty incidents occurring within her borders.

In July of 1987, Governor Gerald L Baliles requested the Secretary of Human Resources and the Secretary of Transportation and Public Safety to form a State Task Force on Emergency Medical Response Disaster Planning to study the disaster response capabilities of the state's emergency medical services (EMS) system. Composed of fifty-six representatives of EMS agencies, hospitals, fire departments, police departments, local governments, industrial concerns, the military, and state agencies, the Task Force divided into six work groups to complete its deliberations over the course of the year allotted by the Governor. The Work Groups studied: Risk Analysis/ Needs Assessment; Incident Command and Integrated Management; Hospital Disaster Preparedness; Resource Inventory; Communications; and Training and Evaluation.

The joint public-private structure of the Task Force provided for a broad range of participation from emergency response disciplines. After reviewing EMS disaster planning around the United States, it appears that this joint public-private method of developing a statewide emergency medical disaster response is the first of its kind anywhere in this country. We believe that the findings and recommendations presented by such broad-based representation will serve as a model for the rest of the nation.

Incident Command and Integrated Management

The most effective method for organizing emergency response to mass casualty incidents has proven to be the Incident Command System (ICS). Originating in California in the late 1960s as a response to massive forest fires, the ICS has been adopted in varying degrees across the nation, primarily by fire suppression services. In recent years, however, it has gained increasing acceptance in the EMS community, particularly within urban and suburban environments like Los Angeles, Chicago, Phoenix, and Fairfax County, Virginia.

The Work Group reviewed incident command plans from around the nation in its attempt to design an EMS incident command model for Virginia that would satisfy the diverse needs of the Commonwealth. The resulting "Virginia EMS Model for Mass Casualty Management and Response" is a document that was reviewed line by line by the Work Group. It attempts to standardize EMS control functions, function identification, triage protocols, and mass casualty response protocols in order to eliminate confusion among EMS agencies in the event of a disaster. The model, through the "Virginia Mass Casualty Operational Procedure", also places emphasis on the fact that the process of mass casualty response must be integrated with other public safety agencies as well as the hospital component of EMS response.

Mass casualty response also involves the necessity of formal written mutual aid agreements. A draft mutual aid plan for statewide disaster mobilization of EMS resources was submitted to the Office of the Attorney General. The concept was legally reviewed and incorporated into the Virginia Emergency Operation Plan.

Experience in the actual operations of these plans is limited by the infrequency of mass casualty incidents in most areas of the state. In addition, Virginia does not currently have the resources necessary to train every provider for mass casualty response. To address this problem, the Work Group proposed the development of 22 incident management cadres around the state to provide technical support and management expertise to both the EMS Control and the Incident Commander at the scene of a mass casualty incident.

HOSPITAL DISASTER PREPAREDNESS

The Hospital Work Group concentrated its efforts on developing community-wide hospital-based disaster plans that would allow the dispersion of victims from a mass casualty incident following predetermined and efficient guidelines. Such plans also allow for predetermined mutual aid pledges in the event of a facility evacuation. Actual plans were developed for the Richmond, Lynchburg, and Northern Virginia communities. Using the method of a "memorandum of understanding" the Task Force staff worked with administrators from appropriate hospitals to develop a plan for mass casualty distribution and evacuation mutual aid.

To our knowledge, the resulting agreements are the first of their kind in the nation. The casualty distribution plan is a more detailed Medical Control Hospital plan than those which currently exist in the US, and the hospital evacuation mutual aid agreement is unique. With hazardous materials transportation accidents being Virginia's number one risk, virtually all hospitals in the state are vulnerable to the necessity for evacuation at any time of the day or night. The evacuation mutual aid protocol has tackled, prior to the incident, the problems

surrounding uninsured patients, physician privileges, and medical records.

Tangential concerns raised by the planning groups spawned the first ever meeting of the state's Level I Trauma Centers for disaster planning purposes. From this forum, recommendations were offered to create a regional lead hospital system and the enhancement of hazardous materials victim decontamination and treatment capabilities in the state.

COMMUNICATIONS

Individuals involved in disaster or mass casualty response activities agree that the most crucial part of any response system is its communication capabilities. Communications failure is the number one problem cited by responders after an incident is over. The Task Force report emphatically stated that if the proposed plan were to be truly effective, we need to ensure that there is a statewide, standard communications network which will not break down in the midst of an incident.

To accomplish this objective the Task Force recommended that a statewide communications plan should be developed which would supplement and support, but not replace, local dispatch facilities. State support would take the form of a statewide communications network featuring Regional Communication Centers which any Basic Life Support (BLS) or Advanced Life Support (ALS) ambulance would be able to contact while traveling anywhere in the state.

The Task Force report emphasized three main points for an effective, comprehensive communications plan which covers each phase of communications from the level of citizen access emergency aid to state coordination of emergency response:

1. Enhanced 9-1-1 implementation statewide;
2. The development of Regional Communication Centers; and
3. Creation of a statewide Communications Network using standardized equipment and procedures among the agencies, hospitals, and Regional Communications Centers.

TRAINING AND EVALUATION

With Virginia's EMS system composed mainly of volunteer agencies, training proved to be the most difficult issue for the Task Force. All EMS providers need to have knowledge of triage procedures and EMS control, but such training programs could not require additional time or certification beyond the basic EMS program. In addition, training in the Virginia Mass Casualty Operational Procedure is needed for hospital and allied service personnel as well.

Training activities were developed for eight learner groups: prehospital EMS providers; squad leaders from each prehospital organization; dispatchers; local disaster management cadre members; hospital-based administrators and EMS personnel; local and regional emergency services coordinators; industrial representatives; and allied emergency services providers (fire suppression, law enforcement, military, medical examiners, funeral industry, Red Cross, amateur radio operators, and waste management officials). Creative teaching strategies were developed that incorporated lecture, discussion, table-top drills, and the use of personal computers for gaming and simulations.

Crisis and disaster situations require unique personnel and logistical management activities. Fortunately, actual disasters are infrequent. The infrequency of their occurrence, however, limits the learning opportunities for disaster managers. The Task Force recommended the creation of a "Virginia Specialized Training Institute". Such an institute would be modeled on the California Specialized Training Institute and would develop and teach specialized programs on disaster management for both multiple and individual disciplines. Teaching strategies would include traditional didactic approaches as well as computer simulations, automated decision support and analysis technologies, and drills.

Disaster Drills had all but stopped in Virginia by 1988. The Task Force recommended a drill schedule which, within a three year period, would require local, regional, and statewide drills. This schedule provided a process by which EMS and emergency services agencies could assess their ability to fulfill the expectations of the Virginia Mass Casualty Operational Procedure. The schedule also allowed for the implementation of the concepts contained in the Mass Casualty Operational Procedure in a manner which gradually increased the complexity of response activities.

RESOURCE ALLOCATION

Throughout the year the Task Force looked for ways in which automation and advanced technology could improve disaster response activities. Using funds donated by the Allied/Signal and DuPont Corporations, the Task Force purchased a statewide geo-relational database for disaster resource deployment assistance. The Emergency Information System (EIS), developed by Research Alternatives of Rockville Maryland, has a rudimentary expert system to prompt emergency services managers during both simulated and real disaster situations.

The Task Force developed resource survey instruments for EMS agencies, fire departments, law enforcement agencies, mental health community service boards, and industrial facilities. Over 1500 surveys were distributed and we received a 59% return rate. The survey results served as a starting point for the development of the comprehensive statewide disaster response resource inventory.

EIS relates descriptive data and display maps. The package is currently in use in several countries and other American states. The maps can zoom, or become more detailed, so that we can go from a statewide view of a map, to a map showing Central Virginia, to a map showing the City of Richmond, to a map of specific area of the city. Once fully developed, we will be able to zoom to specific floors in individual buildings where hazardous materials are produced and stored.

From the beginning we expected our resource inventory database to do two critical things: assist in resource location and allocation, and provide hazardous materials information management assistance. EIS provides us with aggregate listings of prehospital agencies in the Richmond area and detailed specific information about an individual agency. It provides us with a listing of all Richmond hospitals and indicates the numbers and types of casualties they have agreed to accept by injury-severity category and specific contact and casualty allocation information for each individual hospital.

Emergency services and EMS providers also need general information concerning hazardous materials they may encounter during a disaster...special hazard-specific fire fighting and rescue precautions needed, and physical and health hazards known to be associated with those substances. To minimize the public health impact of exposure to hazardous materials, this database allows us to correlate the site of the exposure, the prevailing weather conditions, and the physical properties of the hazardous material to predict the probable dispersion pattern or plume of the accidentally released material.

The database, which is run on a personal computer, is housed in the Department of Emergency Services and a second copy resides in the Division of EMS. Over a dozen municipalities in the state have purchased the system as have many industrial and manufacturing concerns.

CONCLUSION

The Virginia Model for the development of a statewide EMS Disaster Response Plan should be considered by individuals contemplating the creation of such a plan for their state or locality. Many areas have tried to develop such plans using a voluntary, grassroots approach only to find that years pass and a final product never materializes. The strength of the Virginia approach was that the Governor mandated that the work be done, defined the time period during which the plan would be developed, and named the participating individuals and agencies. Two full time staff members, borrowed from existing state agencies, were assigned to manage the process and ensure its timely completion. The resulting plan and work products reflect a broadly-based process of consensus building among disciplines that must work together during real disaster situations.

There were two major deficiencies with the Virginia Model. The first was the failure to fund the Task Force beyond the personnel costs. The staff members were compelled to raise $100,000 for operating expenses from private sources, a time consuming task. The second deficiency involved the predictable problems associated with the centralized production of such a major plan. It is anticipated that it will take from two to four years of continuous effort on the part of EMS leaders to get the word out to all of the EMS providers in the state about the plan. The Division of EMS has secured a Disaster Coordinator position and this individual will be responsible for seeing that the plan is disseminated and understood at the individual provider level.

Participants in the Task Force and providers throughout the state share the opinion that the benefits of this approach to plan development and production far outweigh the costs.

DISASTERS AND EMS DELIVERY IN THE NEXT CENTURY

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INTRODUCTION

Using our extensive past and ongoing field research on the delivery of emergency medical services (EMS) in natural and technological disasters (see Quarantelli 1983) we project what kind of disaster EMS will be needed as we move into the 21st Century.

Our three themes are:

1. The future will be worse than the present insofar as the delivery of EMS in future disasters. concerned. In part this is because there is every reason to think there will be quantitatively and qualitatively more demanding disasters in the decades to come. The disaster EMS of the future will have to cope with the different patterns of future disasters.

2. The typical present day disaster EMS delivery system is not best suited even now for the handling of large mass casualty situations. The problems stem from the fact that existing and developing medical technologies are not very relevant for disaster purposes. Better disaster related technologies and social organizations are needed.

3. Whatever the future will bring, it will not be a homogeneous world. There are both cross-societal differences in medical technological uses and capabilities, and in vulnerabilities to disasters. A major goal therefore ought to be the development of alternative models of EMS systems which can be used in different societies to handle the more numerous and complicated disasters of the future. One model will not be enough.

FUTURE DISASTERS

Even if everything in the planning and the response of disaster EMS were now perfect (and it is not, Tierney and Quaranteilli, 1989), we would still have to be concerned about the future. This is related to the virtual certainty of the occurrence of more and worse disasters in the decades to come. There are at least five sets of conditions that contribute to this bleak outlook.

1. Old kinds of natural disaster agents will simply have more to hit or impact. While such physical agents as hurricanes and earthquakes are probably not increasing (at least on any observable human time scale), what they can socially impact has and is changing. For example, there are more people and settlements than ever before in riverine flood plains. Where in the past there was marsh or swampy lands, there are now housing complexes and industrial parks. The same is true of earthquakes, hurricanes, tornadoes and volcanic eruptions; there is simply more they could impact. Where empty space might have been hit in the past, increasingly there are more persons and developments to impact in the future. There is practically no reverse pattern-permanent abandonment or withdrawal of humans living in dangerous areas.

2. Technological accidents and mishaps can lead to disasters. To the so-called acts of God there are now increasingly added the disasters resulting from human error and collective mistakes of groups. There are the risks associated with the production, transportation, and use of dangerous chemicals. The toxic chemical disasters in Bhopal, India and in Seveso, Italy or the Rhine River pollution are merely the forerunners of what might be anticipated to increase in future decades. Even localities which in the past had few risks from natural disaster agents are now vulnerable to toxic chemical spills, explosions or fires if they have any roads, railways, or navigable waterways. There are also risks associated with nuclear power. Three Mile Island suggested the potential; Chernobyl presented the reality. Apart from in-plant nuclear plant problems there is the danger that will be generated by the transportation of hazardous wastes, nuclear and others.

3. Technological advances are resulting in risks which add complexity to old threats. For example, fires in high rise buildings, in combination with the highly combustible and toxic construction and furnishing materials we currently use, have brought an additional threat dimension. We prevent people from being burned by raising the probability of their being asphyxiated. The MGM fire in Las Vegas or the Dupont Plaza hotel fire in Puerto Rico are but examples of what is more likely to occur in the future.

4. There are new versions of old or past threats. For example, droughts were once thought of as a rural problem, but increasingly urban and metropolitan localities have found themselves faced with shortages or reduced water supplies. One day there will be a disaster if a major part or all of an urban area runs out of water or has enough only for the most necessary of water needs. This is most likely to occur in combination with the collapse of a major tunnel, pumping station or other critical facility. There is an increasing risk associated with the deteriorating physical and public works infrastructure of lifeline systems in a large number of older American cities.

5. Various kinds of new risks and hazards are developing. For example, there are the certain disasters that are going to be produced by biotechnology, especially genetic engineering (DNA). Our ability to custom design living organisms almost ensures that one day there will be some almost Frankenstein-like bacteria, plant or animal let loose on the world. Then there are all the disastrous consequences that can be seen inherent in the computer revolution. Increasing dependence on computers will magnify future disasters and turn some minor emergencies into major disasters.

THE NEED FOR INNOVATION

As research has established, there are serious flaws and problems in present day EMS systems (Taylor, 1977; Butman, 1982; Quarantelli, 1983; Tierney, 1985). If what is in place now is not good enough, it will be even less suited for future disasters.

The need for innovations in medical technology to some extent is created by the newer kinds of disasters that will become more prevalent. For instance, the newer technological types of disasters can be qualitatively more medically demanding than certain other kinds of disasters. Thus chemical poisonings and radiation contaminations often require complex and sophisticated kinds of medical treatment. They can and frequently do put much more of a strain on EMS than the "ordinary" disaster. Often in these kinds of newer disasters, many material things such

as equipment and even land can be polluted and contaminated in different ways than usual. The cleanup is not only more costly but requires more specialized knowledge than is the case after more traditional disasters such as hurricanes or floods. In some instances there are second order effects. For example, health consequences can surface years later. There might be cancer cases which would not be the kind of long run results of most natural disaster agent. So qualitatively, these types of disasters can be rather different in that they seem to require the use of more and better medical technologies.

If any technology is to result in any improvements in disaster EMS, the innovations must be created by those who are interested in actual field use, not simply in more advanced technology. Head-imaging devices, for example, be they improved CAT scanners, MRI units, or PET and BEAM machines, can undoubtedly be developed. Bigger and more complex devices are not needed for use in field disasters. If the intent is to improve diagnoses and treatment, the new technologies have to be of the kind into which field information can be fed, assuming that the disaster EMS system model moves in a direction which we have suggested elsewhere (ie., out from the hospital in the initial stages; Quarantelli, 1983).

There is an interesting paradox here. Many recent improvements in medical technologies are markedly less applicable in disasters than in everyday medical care. Such technologies are very good for everyday use (in medical diagnosis and treatment). But they are too costly, too unwieldy, or require too specialized knowledge and personnel to be quickly and efficiently used at times of massive casualties. The new is not necessarily better than the old. The newer technologies are probably better in some absolute sense, but that does not mean that they are relatively as useful in disaster situations.

Developing a disaster EMS system is not just a matter of technological innovation or adoption, or even solely of medical knowledge. It is a question of how resources can be organized, of how planning can be instituted, and of how response can be made more adequate. There are matters to which social and behavioral scientists, especially disaster researchers, can contribute. Much EMS planning in the United States, for example, often conjures up an ideal situation of how the EMS system could operate in a disaster. Unfortunately, this ideal situation is one that will seldom appear in an actual disaster. There will, for instance, be loss of control of the EMS system of entry of patients into the system. Good disaster EMS can be no better than the assumptions which are made about organizational and group behavior at such times. Working together, social science disaster researchers and medical and technological experts can assure that the assumptions will be valid ones.

CROSS-SOCIETAL DIFFERENCES

The disasters of the future and the development and use of medical technologies are not all going to be the same everywhere around the world. There are now, and increasingly will be, cross-societal differences in these two matters. One implication of this is that we will need different types of models of disaster EMS delivery for such different social settings.

For example, not all societies are equally subject to disaster risks, whether natural and/or technological (Sapir and Lechat, 1986). Differential societal vulnerabilities are probably a fact of life for a long time to come. Clearly, social systems subject to more and different disaster agents will have to have better disaster EMS planning.

It is probably in the medical technology area that societal differences will be most marked. Currently there are huge gaps between medically and technologically rich societies and poorer societies. This kind of gap probably will widen even further in the future. To compound the problem, many of the more disaster vulnerable countries in the world are also those that are low on a medical/technology scale.

In fact, we can categorize all societies as falling into one of four types according to their disaster vulnerability (high or low) and their medical/technology status (rich or poor):

STATUS OF MEDICAL TECHNOLOGY

	Rich	Poor
High	++	+-
Disaster Vulnerability		
Low	-+	–

The point of the chart is to highlight the obvious, for example, societies that fall in the second quadrant (+-) must plan and prepare for disaster EMS in somewhat different ways than societies which fall in the first (++) or the third (-+) quadrants. Studies by the Disaster Research Center have found that the handling of massive burn cases in some developing countries reflect a lower standard of care than treatment of similar cases in societies with more medical resources. The principles of treatment may be universal. But the practice of treatment reflects the capabilities of the societies involved. This is simply another way of saying we cannot expect to develop only one model of disaster EMS. There has to be the development of alternative models of EMS which reflect not only disaster vulnerabilities but also the resources which can be brought to bear.

We must recognize that no solution is ever final or perfect. Even now we can project different kinds of EMS needs and problems in the future. There are also usually

different options for attaining efficiency and effectiveness in service delivery. It is important that at present we look in the past to see how and where we can improve so we will do better in the future. However, past experiences should not be our sole guide. They can only serve as starting points. We also need to plan for the future, which we can be certain will be different from the past. Imagination is needed for that kind of projection. We have tried our hand at that in this paper. Our effort in that direction may not eventually prove totally correct, but we hope to have at least provided some clues.

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TECHNICAL AIDS TO DISASTER MANAGEMENT

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A number of critical disaster problems - both predictive and responsive - are amenable to macro and micro computer systems. Over the last seven years we have been assembling hardware and software already in place which can and, in some cases, do form the components of national and global disaster networks.

Both macro and micro systems are applicable to a large number of common elements found in disparate disasters. Among the components are geosynchronous, polar, and eccentric orbit satellites which carry remote sensing devices; space-to-ground and ground-to-ground stations which currently carry digital data, data bases, and ad hoc consultation subsystems. All of these provide inputs to ongoing disaster research, specific models, and global real time status of stockpiled equipment.

The extent of disaster destruction and other information can be given to response and recovery managers via truck-borne ground stations. Versatile laptop computers can be used to inventory incoming supplies and their designated distribution. Furthermore, the significance of artificial intelligence, inference engines, and the rapidly developing neural systems cannot be underestimated. The need is for software to integrate these elements to provide automatic and semiautomatic interpretive, predictive, warning, and other functions.

The benefits of the information revolution, which has been in place for approximately twenty years, have largely been used for business and profit, while in fact they are ideally suited for dealing with emergencies in developing countries.

Local and remote communications are essential to disaster response, but they are often the first victims of a major natural disaster. Telephone lines are particularly vulnerable. The lack of communications deprives the victim area of the ability to specify the resources which they need and to describe the extent of a disaster. Disaster managers lose contact with their field workers and are blinded to ongoing events within the disaster area. Their command, control, and communication activities are impaired or eliminated.

Laptop computers, ground stations, existing satellite communications systems, and other appropriate technology are now available worldwide. Facilities for communication and storage of information during and about disasters are not usually destroyed by the destructive events of natural disasters.

The "glue" that ties the communications systems of the information age together is software programs. Developing countries are rich in the natural resource that produces software, human brains. Neither land nor heavy industry are necessary for computer-telecommunications.

A number of developing countries as well as South Korea and Taiwan are producing the equipment (hardware) inexpensively. We have worked with developing countries such as India in producing the specific software that supplies their emergency needs. In a bootstrap operation, India has developed a computer programming industry which is second to none. Assistance has come from private consultants, from UNESCO and from the international computer communications societies.

In an ambitious and very productive move, the Indian nation worked with the US Space Program to place in orbit INSAT. The INSAT satellite with Indian developed software reaches into the cities, and more importantly, into the remote villages of that vast country. The terminals within the villages of India, or of any developing country, can be truck mounted so that the vehicle powers the voice, data, and in some cases, television transmission. A single terminal and a single literate community health worker, whether he or she be a teacher, nurse, or headman, suffices for a remote village. These computerized satellite routes can thus communicate emergency medical consultation, ongoing education for the reduction of the effects of emergencies, and access to the enormous data bases of the world.

In India, there is now in progress the development of the highest levels of computer communications, expert systems, which will assist the emergency manager and the community health worker in the management of disasters and in the reception of information needed for the diagnosis and treatment of disease. These have been developed by Indian scientists and American volunteers. The essential elements are the intelligent human brain and the cooperation of the international computer communications community.

In Trinidad, we encountered emergency institutions and workers who were devoid of communication links except for the old fashioned telephone wire, which is vulnerable to the earthquakes which besiege Trinidad and Tobago as well as to the multiple disasters which might arise from their developing industrial plants. Working with the Ministry of Health we were in three weeks able to link or patch together a communications system which used human messengers, airport warning systems, fire truck radio units and understanding medical workers. Within two months a "mini-Bhopal" industrial explosion occurred and the Trinidadian disaster officer attributes the saving of many lives to the linkages and knowledge from that three week period.

Existing computer communications, especially those using satellites, have many potential functions which have not been put to work for the emergency manager.

In the predisaster phase, the remote sensing of satellite systems and their atmospheric, ground, and oceanic components provide information as to the direction and the severity of the looming catastrophe.

During the event, a number of technical aids have proven useful. The ad hoc radio networks provided by amateur radio operators have proven invaluable. Satellite communications are available to the victim site by portable ground station transceivers. (UNDRO) has developed an excellent model.) Improved models are being developed under the auspices of the Canadian-US M-SAT system. These terminals provide a robust link with the outside world and its resources. Hand held radios, especially packet-switching radios, give the disaster manager his command, control, and communications capabilities. On site laptop computers can be programmed to record incoming supplies, their suitability, and their eventual destination. Using a bar code or other computer readable labeling, unused supplies can be located and returned to stockpiles. Inappropriate supplies can be set aside so that they will not present a burden to disaster workers.

These technical communication aids have already proven their worth in the postdisaster recovery period. An exemplary model is the STARBRIDGE communications system between the United States and Soviet Armenia established after the devastating earthquake in that country. Consultation on specific diseases and injuries can be transferred by this system via voice, data, and slow-scan television link.

The SARSAT system provides an effective method of locating and rescuing lost and distressed ships and planes and demonstrates the effectiveness of international cooperation.

The most promising technology for everyday and catastrophic emergencies is exemplified by the M-SAT system. It is hoped that in 1992, two satellites will be launched which will provide voice and data communications to stationary and mobile vehicles over large areas of the United States and Canada. For the user, this will be analogous to, but not competitive with, cellular telephone systems. Among the uses are:

- Large area roaming:
  - Interstate transportation;
  - Railroad communications;
  - Aeronautical and maritime communications;
  - Hazardous waste transport;

- Law enforcement/drug enforcement; and
- Coast Guard.

- Unplanned and unpredictable emergency response:
  - Medical emergencies; and
  - Natural disasters: earthquakes, forest and brush fires, tornadoes.

- Planned Temporary Installations:
  - Oil and gas drilling;
  - Mining; and
  - Temporary data collection platforms.

- Low population density uses:
  - Rural telephones.

- Services:
  - Radio telephony;
  - Dispatching;
  - Alphanumeric messages (data transmission);
  - Position location;
  - Surveillance;
  - Data-base inquiry and response; and
  - Wide-area paging.

Technical aids can also serve the mundane needs of large disaster management organizations. Teleconferencing, electronic billboards, and electronic mail are available to anyone who has a personal computer and a telephone line.

In the 1970s, the introduction of communications technology and a reorganization of rescue systems revolutionized the response to highway accidents and catastrophic cardiovascular events in the United States.

Disaster management now has technical tools available, and the world would be remiss if they were not utilized.

DISASTER PLANNING AT THE KING FAHAD NATIONAL GUARD HOSPITAL

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The King Fahad National Guard Hospital is a 400 bed acute care general teaching hospital in Riyadh, Saudi Arabia. The Emergency Department sees some 60,000 patients annually, with a significant amount of motor vehicle trauma. The hospital is staffed by physicians from North America, Europe and the Middle East, and nurses from North America, the Middle East and the Philippines. Staff are hired by contract and the average length of stay is two and one-half years. The language of the hospital is almost exclusively English. The language of the patients is almost exclusively Arabic.

As a military hospital, it must have a well-organized, practiced disaster plan, adaptable to the needs of the Kingdom of Saudi Arabia. This plan needs to be:

- Adaptable to multilingual staff of various training backgrounds;
- One that can be taught easily to large numbers of new staff; and
- One that is adaptable to a changing and ever-improving environment of disaster preparedness in Riyadh.

This paper will outline the essentials of our disaster plan and its implementation. It is based largely on North American models and has been reviewed and approved by both the JCAHO and the US Army.

The King Fahad Hospital disaster plan consists of a formal document stating goals and objectives. The plan is comprised of an External Plan, which covers disasters occurring in the community and an Internal Plan, which provides for a disaster occurring in the hospital itself. The operational part of the plan is contained in a set of individual Action Cards distributed to the appropriate staff members and departments. This allows for simplification of response and flexibility of the plan. With a general idea of the overall plan, any individual has only to follow the directions on his or her own Action Card.

The plan provides for a phased response depending on the extent of the disaster. A Phase 1 response is activated when the situation in the Emergency Department warrants additional personnel, but not a full-scale mobilization of the hospital. This may be activated by the Emergency Specialist on duty, and is done with as few as ten patients.

The Phase 2 response occurs when there is an overwhelming number of casualties. It is initiated by the Emergency Physician on duty, but is activated on the orders of the Hospital Administrator or the Administrator on call. It involves activation of all hospital personnel as per the plan.

In six years of operation it has not been necessary to call a Phase 2 disaster, other than as a drill; but over the last two years, we have had fourteen Phase 1 disasters.

There are three basic areas of Disaster Management: Prevention, Planning, and Implementation of the Disaster Plan.

PREVENTION

Although prevention should not be overlooked, this paper will deal with the last two areas only.

PLANNING

Organization

There must be a formal overall organization that coordinates the actions of the essential services that are involved in a disaster response. In Riyadh, the organization of the city-wide disaster response is under the direction of the Department of Civil Defense.

The Ministry of Health has direct responsibility for medical response, and chairs a committee composed of representatives of the major city hospitals, the Red Crescent (ambulance), and Civil Defense.

The King Fahad Hospital Disaster Plan is under a constant state of review. This is the responsibility of the Disaster subcommittee of the hospital, made up of representatives of medical, nursing, administrative, and support services.

Leadership

Designated medical leaders are selected from the medical community on the basis of skills, experience with, and interest in disaster planning. Within the hospital, a clear delegation of authority is essential, particularly in those areas that bear the brunt of the assault.

In our plan, a Command Post is set up which coordinates the response of the whole hospital. The Chief Administrator is in charge of the Command Post and functions with the help of the Medical Director, the National Guard Supervisor General, and the Director of Nursing.

In the Emergency Department, the Chairman of the Department is in command. In the Short Stay (holding) Unit, a designated emergency physician is in command, and in the Family Practice clinic, the Chairman of Family Practice.

Personnel

All personnel involved in a disaster situation must be knowledgeable about the disaster plan, and trained to perform and carry out their duties. They must be available within a reasonable length of time and there must be sufficient numbers to cope with the victim load and to provide relief if the episode is prolonged.

A Phase 1 disaster involves the assembling of a predetermined response team in the Emergency Department. This team is composed of:

- Two or three emergency specialists;
- One or two surgeons;
- Two surgical residents;
- One anaesthetist;
- Five or six emergency nurses;
- One paramedic;
- Two or three ICU nurses;
- Two lab technologists;
- Two respiratory therapists;
- Two radiology technicians; and
- One administrator.

Other required personnel are called in as needed. This team can usually be assembled in less than half an hour.

A Phase 2 disaster begins with the assembly of the above team but progresses to a general recall of all essential hospital personnel. A manpower pool is established in the hospital at a designated location. All incoming personnel not attached to a particular essential department report to the pool and are assigned their duties by the Command Center.

Facilities

The size of a hospital and the special facilities that it offers must be taken into account in assigning its role in a disaster response. The central agency directing the response must have up-to-the-minute information on the hospital's capabilities so that it can assign manageable numbers of victims to those facilities most capable of dealing with them.

From the running of our disaster drills, estimates can be made of the capabilities of King Fahad Hospital. Initially, the Emergency Department would be capable of handling ten severely injured victims, fifteen moderately injured, and probably any number of minor injuries.

As the disaster proceeds over a period of time and patients are cleared from the emergency areas, further victims can be processed. The two ICU areas have a total of sixteen beds, but there is a great variation in occupancy rate. The Burn Unit has four beds and has, as well, a great variation in occupancy rate. The hospital as a whole has 402 beds at 85-95% occupancy, but would probably be able to clear 150-200 additional beds of non-critical patients, providing these beds for disaster patients. King Fahad Hospital is well designed as a military hospital, with wide corridors, which could be turned into wards if necessary.

Supplies

The community and hospital should have on hand specifically designated stockpiles of supplies to deal with the most likely types of disasters. These supplies must be easily and quickly available and must be rotated to prevent them from becoming outdated. The Emergency Department keeps on hand fifty prepackaged Disaster Packs containing equipment necessary for the initial stabilization of victims. In addition, a cart containing supplies adequate for another 50 victims is kept in the Department for restocking of the Disaster Packs. There

are additional disaster supply carts kept in Central Supply, the Short Stay (Holding) Unit, and Laundry that are moved to the Emergency Department on the occurrence of a Phase 2 disaster.

Communications

Communications is probably the biggest problem in most disasters. There should be a communications system designated specifically for use during a disaster. It should connect command personnel, site responders, police, fire, and medical facilities.

The normal channels of contact such as telephone and regular police radio frequencies quickly become overloaded in a disaster. The hospital maintains both radio and dedicated telephone lines for communications with the Red Crescent ambulance. Hospital staff recall is initiated using a batched call-out on a beeper system, backed up by a telephone fan-out, and messages on the housing compound closed circuit television. Internally, communications are done via designated telephone numbers, backed up by a separate intercom system, and overhead paging. A runner pool is also set up to provide porters for patients, lab, and x-ray, and may also be used for communications should there be a total breakdown or overload of the other systems.

Security

The disaster site must be made safe for both the victims and the rescuers. Both the site and medical facilities must be accessible to victims and essential personnel. This is a major, and in some cases, insurmountable problem. The use of police, fire, military, and security personnel is necessary to ensure safety of the site, control panic, and maintain traffic flow.
The receiving facilities must be secured against an onslaught and invasion by the distraught public.

King Fahad Hospital is fortunate to have an efficient security operation backed up by National Guard forces. If a site response is necessary, security personnel form part of the initial response team. A Phase 1 response results in placement of a security cordon around the Emergency Department and associated acute care areas. A Phase 2 response results in a cordon around the entire hospital, ensuring that only essential personnel and bona fide patients are allowed access.

Records

In spite of the urgency of a disaster situation, the victims, their condition and treatment must be documented as they progress through the system.

At the site, this is accomplished by the use of standard triage tags coded in the internationally recognized groupings of red, yellow, green and black. On entry to the Emergency Department, the victims are assigned prenumbered prepackaged disaster charts containing medical and nursing notes, lab, blood and x-ray requisitions, and an addressograph card with the disaster number. The number is written on the patient's left arm or forehead and is used for identification throughout the disaster.

Social Support

The victims, and even more importantly the victims' families, will need information and support during this time of crisis, so the Social Services Department plays an essential role in any disaster response.

Personnel are assigned to the Emergency Department and also staff an official information center that releases information to the public and the media. A patient information center is set up in an area of the hospital far removed from the acute treatment areas, to deal with the patients' relatives.

Training and Testing

Any plan can look good on paper, but for it to be functional it must be tested and constantly modified in the light of experience and changing circumstances. All disasters, whether they be real or drills, must be analyzed retrospectively. Within the hospital we have a formal review and quality assurance process that is initiated by the disaster committee after each disaster and drill.

The advantage of utilizing the Phase 1 disaster categorization is that the plan can be implemented for a small number of casualties. This provides excellent practice and opportunity for critique without holding a full scale drill.

The yearly drills themselves act as training tools. All staff are required to view a training video during their initial orientation, and they must review it as part of their annual evaluation process.

IMPLEMENTATION

Most disaster responses follow a certain temporal and spatial pattern that leads from the victim at the scene of the disaster, through various levels of rescue activity, to definitive treatment, and the return of a functioning individual to society.

Notification

The rescue facility may be informed of a disaster by the civil defense organization, the police or the Red Crescent, but in our case, it is most frequently notified by the very arrival of victims.

Response

A field response team consists of an EMT-1 (ALS trained), an EMT-2 (BLS trained), an ambulance driver, interpreter and security officer. From one to three teams may be mobilized, depending on the availability of personnel. A hospital bus is dispatched to transport Green victims. The hospital's fire department may also be mobilized, depending on the nature of the disaster.

Prevention

It is the responsibility of security and fire personnel to neutralize objective dangers at the scene and ensure the safety of both victims and rescuers from further injury.

Extrication of Victims

This is accomplished by the paramedical personnel and is dictated by the nature of the incident, type and degree of injuries, and the numbers of patients.

Command Post/Triage Center

A Command Post and Triage Center is established by the first responding field response team. The victims are collected in a central area where triage and treatment can be initiated and transport organized.

It cannot be overemphasized that the effectiveness of a prehospital disaster response hinges on the establishment of one or more field triage centers and a command post. Ignoring this step can only result in chaos. An organized approach and format must be instituted right from the first contact of the rescuers with the victims. Failure to do this only results in transferring the confusion of the disaster scene to the doors of the hospital.

Primary Triage

One of the most challenging aspects of implementing a disaster plan in a developing health care system is to emphasize the value of primary triage. Separation of victims into groups according to severity of injuries and appropriate tagging must be done:

- RED - Critical;
- YELLOW - Serious;
- GREEN - Minor; and
- BLACK - Dead.

Wider acceptance of the international tagging system will help in this respect.

First Aid

In accordance with the findings of major trauma centers, as little treatment as necessary is done in the field. This treatment consists primarily of securing the airway and ensuring adequate ventilation and circulation. In most cases, this means: endotracheal intubation and ventilation with oxygen, IVs of Ringers lactate or saline and possibly cricothyrotomy or decompression of a pneumothorax. Bleeding is stopped by direct pressure and the patient immobilized with special attention to the cervical spine.

Transport

Transport is based on triage priorities and utilizes ambulances, hospital buses, and private vehicles.

Definitive Care

The patients are transported to medical facilities, where secondary triage takes place. This is a fine-tuning of the primary triage and allows for reclassification of patients whose condition has changed over time. In our system, this is done in the ambulance receiving area by a team of emergency physicians assigned directly to the disaster care areas on the basis of their triage group: Red to the ED trauma bay, Yellow to the Short Stay (holding) area, Green to the Family Practice Clinic, and Black to the morgue. Definitive treatment is begun in these areas and the patients are moved to the ICU, ward, or discharged.

Disposition

Once the life-threatening problems of the patient have been taken care of, it is necessary to provide an appropriate disposition. Red victims may need ICU or other specialized unit care and it may be necessary to use the facilities of other hospitals. Yellow patients may require ward admission.

A designated Disaster Ward is cleared of patients at the onset of a Phase 2 disaster, allowing for disaster victims to be admitted to one area. This permits more efficient use of staff and equipment and decreases disruption to other areas of the hospital. In the event of a disaster of massive proportions, the hospital was designed with wide corridors; easily converted to bed space. Most Green victims can be discharged home with follow-up through outpatient and peripheral clinics.

CONCLUSION

Disaster management in any part of the world presents major medical, political and organizational dilemmas. The disaster plan of the King Fahad Hospital is just one example of the ways in which the problem of

disaster preparedness can be dealt with. The plan has evolved over a long period of time and has been reworked to suit our changing needs. Although it is by no means perfect, it provides a framework that appears to function well in our particular situation.

THE EMERGENCY SOMAGRAM FOR DISASTERS PROASA - PERU

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Common body charts are usually a drawing of an adult, athletic man, and are unsuitable for a precise localization of body lesions. The human body has different shapes for infants, children, teenagers, adults elder; either females or males. Wondering why an adult male should be the human prototype, we found out this current practice was the expression of a male dominated society.

Seeking a chart that would be universally applicable and useful for localizing almost any lesion, we constructed a body shape starting from the anatomic distribution of lesions.

The anatomic distribution of lesions was studied in thousands of emergency patients with injuries produced by aggressions, motor vehicle accidents, labor accidents, falls, domestic injuries, sports, suicide attempts, animal attacks and burns. The frequency distribution of lesions were not proportional to body surface: head, eyes, hands and feet were mentioned in a proportion that exceeded their respective body surface.

The chart we developed was named the Emergency Somagram, from soma (body) and gram (line), it has to provide a source of information that is easy to read and write.

After many artistic attempts, Dr. Ernesto Maguiña (Cartoons and Drawing Specialist) made a final representation to the body surface in accordance with the reported distribution of lesions. Only the neck and genitals were amplified in attention to its particular relevance for morbidity.

The Emergency Somagram is composed of three aspects; front, back and perineal. The lateral aspects, right and left side of thorax, neck and extremities are supposed to be considered in the frontal aspect.

Emergency Somagram[16] is applied to shotgun and politraumatized patients in our Emergency Department and has been accepted by other hospitals.[17]

The Emergency Somagram is a drawing to be completed with lesions detected by physical examination and a form with data about the personal and clinical condition of the patient.

Some characteristics of the Emergency Somagram for disasters are that it:

- Identifies the anonymous patient with his dactilar impression, and the place of procedure;
- Provides reliable, immediate and concentrated information about the type and localization of lesions;
- Uses initials for the lesions simultaneously with easy localization of advantageous photographs thus giving better discrimination of deep lesions, like fractures, volume (hematoma), lesions in different planes, and it gives special care to the most frequent lesions with no illumination or technical problems;
- Identifies lesions in patients with dressings;
- Facilitates patient triage, matching graveness status with available resources;
- With unidentified patients the distribution of lesions could help us to differentiate them easily, (For example, the patient with fractures on right femur and left tibula);
- Enhances supervision by the chief of the team regarding patient management carried out by other members of the health-team, like nurses, interns or others;
- Improves updating of rotative teams;
- Includes important antecedents for management for example: diabetes or hypertension, blood group, etc.;
- Includes an allergy history, especially important in the case of drug allergies; and
- Allows principal and secondary diagnoses useful for a better derivation of patients.

THE EMERGENCY SOMAGRAM FOR DISASTER 3 PROASA-PERU

In disasters, a great number of patients and a limited health teams requires a format for triage that must give the best information of patient status. For this reason we propose the use of the Emergency Somagram for triage in mass-casualties and disasters. Finally, the chart could be adapted for multilingual purposes.