Hospital Plans in Case of Disaster

Norberto Treviño García Manzo
Felipe Cruz Vega
Armando Valle González

Series ***Studies 11***

INTER AMERICAN CONFERENCE ON SOCIAL SECURITY

ICSS

SECRETARIAT GENERAL
AMERICAN MEDICAL SOCIAL COMMISSION

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PRESENTATION

Instructed by Mr. Genaro Borrego Estrada, Chairman of the Interamerican Conference on Social Security (ICSS), the General Secretariat, congruous with the bylaws ruling its organization, develops an editorial program mainly devoted to answer the demands of the Social Security institutions in the Americas for a better knowledge of improvements in areas affecting their daily work. Thus, the working documents are the best evidence.

Within this framework, the General Secretariat of the Interamerican Conference on Social Security published studies and research works useful in theoretical and practical aspects developed by the member institutions. According to this purpose, the General Secretariat, on initiative of one of its technical bodies, the American Medical Social Commission (CAMS), is pleased to edit the book ***Hospital Plans in Case of Disaster*** which has resulted from the CAMS's accurate work and the participation of many national and international outstanding specialists related to social security.

The ICSS General Secretariat, in an unprecedented effort, undertook the task of translating into English the original text of this book, in order to meet the demands of many English-speaking countries in whose territories natural or man-made disasters frequently occur, and to offer an useful tool to face them. Thus, the purpose of this book is to present the most efficient way of organizing hospital services and training the staff involved, in order to relief the always critical problems caused by disasters and to obtain the best care of patients.

On the other hand, the authors of this book -Dr. Norberto Treviño Garcia Manzo, president of the CAMS and Subdirector of the Mexican Social Security Institute, Dr. Felipe Cruz Vega and Dr. Armando Valle Gonzalez, distinguished officials of the same area in the Institute-, as well as the team of collaborators in the writing of this important work, for the first time have reached the joint and multidisciplinary result of experiences accumulated in the study of disasters, as well as the medical, scientific and technical skill developed when giving care in such cases. Nobody doubts that the instructions contained in this work are a sound and suitable guide for the preservation of the human life.

Roberto Rios Ferrer
Secretary General of the ISSC

INTRODUCTION

Mexico recently suffered the effects of natural and man-made disasters, the most dramatic being: the gas explosion in San Juan Ixhuatepec in the metropolitan area of Mexico City on November 19, 1984; the earthquake occurred in Mexico City on September 19, 1985; and the explosion in Guadalajara City on April 22, 1992. As usual in crises, in these disasters heroism, solidarity and efficiency of the institutions were present to help compatriots in disgrace; but carelessness and negligence, which meant lives and sufferings, must be also acknowledged.

The "International Decade for Natural Disaster Reduction" (IDNDR), declared by the United Nations Organization for the 90's, is placed historically in a moment when the impact of natural disasters on lost lives and goods quickly increase in the world. Only in 1991 more than 162,000 people died, economic losses were 44,000 million dollars in the same year, caused by 434 disasters. In spite that today we find techniques, methods and knowledge to prevent or alleviate the impact of disasters, paradoxically they are still changing the planet's life.

Technological disasters, derived from the industrial development of nations, are added to those natural.

The growing population concentrated in big cities and the irregular human settlements in highly vulnerable areas increase the risk factor and darken the panorama.

The role of hospitals in emergency medical care during disasters is very important. Response for the suitable care of the injured and the actions which avoid lost lives will depend on the organization envisaged to face the events and on the working integration in a certain region, as well as on the coordination inside an outside sectors.

In Latin America, more than 12,000 hospitals are located in vulnerable zones, thus being exposed to the direct effects of natural or man-made disasters. Examples are many hospitals damaged during the earthquakes of Mexico, Chile

and El Salvador, and the impact of the hurricanes "Gilberto" and "Andrew" which disabled roughly 75 hospitals having more than 7,800 beds.

Hence, training of hospital staff to successfully face these emergency situations has been a priority in all the countries. Such training includes knowledge, skills and expertise "intra muros", as well as projection into the community to act as agents of the change and to encourage less vulnerability.

The Mexican Social Security Institute, deeply committed to social security, and devoted to the recommendations issued by international organizations and the guidelines of the National Civil Protection System, not to mention the "Institutional Plan in Case of Accident", wishes to share experiences on the matter.

The general purpose of this book is to improve the whole health care of victims, by unifying medical-technical criteria and strengthening hospital plans, as well as promoting prevention, training and medical research on a scheme of sectoral and intersectoral functional integration.

Following are the specific objectives to reach the above mentioned purpose:

1. To improve the hospital plans in coordination with institutions and the society in general, and to favor the risk prevention in case of disaster.

2. By means of hospital plans, to relief the effects of disasters and to offer the injured the best possibilities of survival and recovery.

3. To encourage decreased morbidity, mortality and sequels for the victims.

4. To avoid mistakes due to lack of planning, organization or training, which later can damage the exposed population.

The most relevant recommendations issued from the experience of international bodies and national institutions, as well as from the "International

Meeting on Hospital Preparations in Case of Disaster", hosted by the Mexican Social Security Institute and held in Mexico City on September 1993, were taken into account and were added to this proposal as medium-term strategies, in order to strengthen the hospital plans in case of disaster and were worded as follows:

1. To make or update, carry out and evaluate the hospital programs, as well as to incorporate community, social and institutional participation, both at inside and outside levels.

2. To encourage in hospitals the evaluation of structural and non-structural elements, the preventive maintenance programs and the diagnosis of structural vulnerability with remedial arrangements.

3. To promote continuous education and the incorporation of relief subjects into the college and postgrade curricula in the medicine, engineering and architecture faculties, among others, considering not only aspects related to hospitals but also vital lines as aqueducts and sewage systems.

It is a satisfaction to say that this book was made thanks to the collaboration of authorities from national and international organizations, whose experience was collected and shared aimed at the organization of prevention and training schemes in the hospitals of such countries, in order to alleviate the impact of natural and man-made disasters, in the benefit of the people's health and as essential factor of the economic development with justice, equity and liberty.

CHAPTER I

ENVIRONMENT OF THE DISASTER AND MAIN ACTORS

In order to determine more accurately the purpose of this book, the **hospital** is identified as the most relevant player in the field of health. In order to make a "Plan of Hospital Preparations in Case of Disaster", however, the environment covered and effectively supported by a system must be taken into account. In this dynamic process, the system is thought as a **chain** where the **community** is the first link; the next one is formed by the natural leaders in the community, volunteers, **police**, and **firemen**, among others, who are linked operatively, to **pre-hospital services**; and at the end of the chain, the **medical units** identified by levels of operation are located (*1*).

In the following chapters, the role to be played by each actor will be mentioned more in detail. It is very important, however, to emphasize the relevance of a well organized and trained community in order to make that such links work as planned and have the hospital featuring the most important role: to care early for the patients which deserve to be attended, according to its own capacity (*2*).

The experience is that the best working of the system depends on a well trained, informed and organized community, consequently having decreased mortality rates and sequels for the victims, in addition to use appropriately the resources available at the moment of the disaster (*3*). It is proved that when the above mentioned sequence does not happen, usually the so-called "second disaster" occurs, since the immediate response of the community will be present anyway with the spirit of solidarity, guided only by the common sense prevailing in that time of acute crisis, but mortality and sequels will increase outstandingly.

In this system, it is taken as granted that the **hospital**, its management and 100% of the staff must participate in the making of the inside and outside plan for taking care in case of disaster, being involved from the beginning and as "hospital without walls" the rest of the actors in this chain, mainly the members of the community and, among them, the volunteers, natural and formal leaders, the police and the pre-hospital services, which identify the different risks threatening the area. Thus, they must be trained in "**basic support**" measures and must identify the real capacity of all the hospitals located in the area by level

and must identify the real capacity of all the hospitals located in the area by level of operation during disasters. With these measures, a true life chain can be guaranteed and the principle of the right patient transferred to the right hospital at the right moment can be fulfilled, thus the mortality and sequels being decreased and the resources available at the time of the disaster is best used (*4*).

The most important roles of the above mentioned players are presented as follows:

ROLE OF THE COMMUNITY

In order to have the best picture of the role played by the community in these plans, it will be split into two parts: the first one is aimed at the general participation of the society, and the second one at the role to be played by some characters like volunteers, lay providers, police and firemen, among others.

Experience has shown that in spite of the size or type of disaster, the **community's** response in disastered area is solidary, joint and immediate regarding the victims or the damaged. The community gives first aid, rates the injured and counts the dead, as well as alerts, evaluates the damages, and sometimes members of the affected community rate the extension of the damaged area. Hence, such members of the community start the rescue, the possible stabilization and the sending of the injured to the hospitals using the means available (*5*).

When making decisions on its own, the community, in critical moments and not being familiar with plans of response to disaster, will send patients not so injured to highly qualified hospitals and, on the contrary, very severe patients to first contact hospital, resulting an increased rate of mortality. The forecast of rehabilitation -be it physical, psychic, economic or social- will depend on the initial care received. Organizing the **community**, in coordination with health **institutions**, is the first sound step to face suitably the situations of disaster.

The common effort to be carried out by institutions must be directed to make a **multidisciplinary** work team, in order to write manuals on standards and

procedures for each type of calamity, and manuals to train and educate the **community**, mainly the voluntary, technical and professional staff on the watching, handling and control of disasters.

Every organization, agency or institution serving the population must make inventories of likely important material inputs, instruments, medicines, solutions, etc. Such inventories must be ranked according to the level of care, and are offered to the population in enough quantity and quality.

The **multidisciplinary** teams will help to make basic lists of the required equipment, instruments, solutions, medicines and medical surgical materials of urgency. The relationship of inputs must be established for the voluntary, technical and specialized professional levels, in order to regulate the criteria and to train the above mentioned staff in the suitable use of them, in the benefit of the population at risk (*6*).

Plans have been issued to attend situations of disaster by hospitals, some very efficient (7 to 11), others very heterogeneous, some well distributed and coordinated, others only as drafts, not diffused in the health team staff responsible for its implementation. The best plan is the one established at regional level with efficient **interinstitutional** and **intersectoral coordination** and submitted periodically, furthermore, to evaluation by means of **simulations** (12 to 15).

It is not an easy task to teach most of the health care staff these basic concepts. Usually, most of the institutions register in urgency services roughly 40% of patients not having urgent problems, due to the lack of a suitable service which meets this unsatisfied demand, many reasons included: geographic location, timetables and rigid shifts, among others.

PAHO-WHO disaster consultants in last years (*5*), when assisting many contingencies in hospitals, have found up to 60% of patients not eligible in emergency services. If a suitable social participation had been where the accident or disaster occurred, or other less complex health services had participated, the flow had been contained.

It is basic to incorporate the health services into the social network of disaster control. To be a reality, of course, it is indispensable the whole social organization, having information, training and implementation of preventive and action working plans in case of urgency or disaster.

For years the community or the civil society have made the **basic rating** of primary care and **transportation** of the victims in case of disaster. If the society is informed, trained and guided suitably, its role will be paramount avoiding the overload in hospital services, mainly in urgency units.

To be reliable for this civil society, it is important the participation of all, in order that medical units, their limitations, fields of action, and inter-relations with other health services are acknowledged. Link of the community's committees to the hospital committees will allow to assess the vulnerability, availability of means, staff transportation, truthful communication with the community by the written press, TV and radio.

The so-called **"life chain"** (figure 1) is based on the community and , in case of accident or disaster, it requires an efficient system of **immediate notification**, in order to trigger the early arrival of the organized help from public and private agencies. In the United States of America, this system is launched by the phone line 911 in most of the cities, in Russia by 03, in Japan by 119. In Mexico City, such line seems to be the 08, which now is applicable in some Political Delegations of the Federal District. It is essential that systems like the above mentioned are more developed. Today, however, efficiency of response before disasters is given by the coordination among the institutions integrated into the Civil Protection System in each location (16).

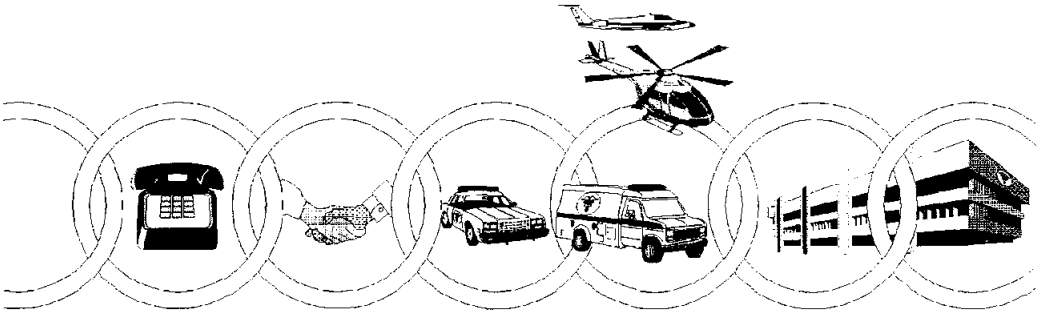
LAY PROVIDER AND PRIMARY EFFECTOR

The next level in this chain is the **lay provider**, that is the ordinary citizen in the site of the accident or disaster which, in addition, knows about first aid and basic cardiopulmonary reanimation. In some developed countries, the citizens **certified**

in such courses are the **sixth** of the population. In developing countries like ours, they make only **0.02%** of the population (*1*). It is obvious the importance of certifying more persons of the community in these internationally standardized theoretical-practical courses. The next link between the community and hospital is the public servants like the police and the firemen, among others, which have been named "**primary effectors**". Usually these persons have devices to radiocommunicate with one central which, on its turn, coordinates the response to the emergency with other agencies. It is essential that this "primary effector" is integrated operatively into the hospital program of care in case of disaster. These people must be accredited in the courses of "initial care for the poly-traumatized" and "basic life support", in addition to be qualified to identify the capacity of each hospital in the area during disasters, as well as their rating by colors (red, yellow, and green).

The team in the previous link must the direct responsible for making the coordination, in the place of the disaster, with the pre-hospital transfer services credited in the regional plan for care in case of disaster.

Figure 1
LIFE CHAIN



Early access Early support Quick Transportation Hospital ready

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CHAPTER II

PROGRAM OF HOSPITAL PREPARATIONS IN CASE OF DISASTER

It is very relevant the role played by hospitals in the emergency health care during situations of disaster. A suitable care for the injured and the polytraumatized, as well as the actions which will avoid lost lives, will depend on their organization and ability to respond.

Development of hospital programs in case of internal disaster (fires, floods, blackouts, collapses, pollution) and external (care for massive victims due to catastrophe or major accident) should be a juridically established standard in all the institutions related to the health sector in countries of the region, and mechanisms should be assured allowing to check their existence and efficiency (*1*).

POLICY OF THE PANAMERICAN HEALTH ORGANIZATION REGARDING HOSPITAL PREPARATIONS

Most of the hospitals in countries highly vulnerable to natural disasters, excepted those located in urban zones, are poorly prepared and equipped to attend the sudden demand of mass victims. There are no established committees nor programs of continuing education on the handling of huge emergencies.

Hospital preparations for disaster situations are an important part of the PAHO program on preparations for emergency and response in case of disaster. Following are the items which deserve to be carefully considered in the process of making hospital plans in case of disaster:

- Rating of hospitals and study of risk factors to determine vulnerability to disasters.
- Hospital organization to be prepared for internal and external disasters.
- Training of the staff at all levels.

- Making of contingency plans.
- Establishment of safety measures for structures, services and persons.
- Organization and development of simulation exercises and drills which measure the ability to respond of the hospital facilities during emergencies.
- Incorporation of disaster management into the continuing education activities in hospitals.
- Planning of construction and remodeling of hospital structures taking into account the vulnerability of the area and the risk factors.
- Introduction of measures which guarantee the provision of emergency equipment to hospitals, mainly those called "critical", allowing their working even in emergencies.

The Panamerican Health Organization, through its mechanisms of technical cooperation, gives expert support, promotes technical scientific meetings, encourages the development of staff training, and favors the cooperation among countries (*2*).

OUTLINE OF A HOSPITAL PLAN IN CASE OF DISASTER

According to the PAHO, and not considering the physical characteristics, complexity levels and resources of the hospital, the new hospital plans must include the following features:

- To be backed by **operation capacity**, with resources available in the institution and in the community.

- To be working and **highly flexible** for an easy adaptation to the changing situations and circumstances.
- To establish clear **authority and command lines**, as well as the responsibilities and duties assigned, all they easily understandable.
- To be part of a **regional plan** in case of catastrophe, and to contribute to strengthen the plans of civilian protection.
- To be continuously **updated** and familiar with the use of the plan.
- To have measures for **internal and external** disasters.
- To establish clearly the specific activities for the phases of **preparations, alert, emergency, and re-establishment**.
- To be easily accessible to all the staff.

SITUATION OF HOSPITAL PREPARATIONS IN LATIN AMERICA AND THE CARIBBEAN COUNTRIES

According to the preliminary inventory made by the PAHO in Latin America and the Caribbean, there are 13,211 hospitals having a total 1,066,420 beds (*3*). These hospitals are ranked from highly complex hospitals to health centers and hospitals in the suburbia. Following the same source, Mexico has 805 hospitals having a total 60,099 beds. Notwithstanding the constant promotion and the experiences in countries vulnerable to disasters, nobody knows exactly the amount of such hospitals having preparation programs.

At the level of institutionalization of hospital preparations programs in case of disaster, the success is variable. The most developed countries in Latin America are: Colombia, Chile, Costa Rica, Mexico and Peru; while in the Caribbean, Barbados and Jamaica no important developments are recorded.

There is an urgent need for the incorporation of hospital preparations into the existing laws and regulations for the best working of hospital establishments. Such aspect must be included as a part of the **hospital creditation** programs. This purpose (*4*) will be strengthened by the interest in spreading the teaching of how to handle the disaster in universities.

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CHAPTER III

MEXICAN LEGISLATION REGARDING HEALTH CARE IN CASE OF DISASTER

Earthquakes in September 1985 allowed to assess the vulnerability of Mexico City and other areas of the country, with regard to the physical and social environment. It was also realized the lack of permanent instruments and mechanisms for the coordination of actions, as well as the organization and management which would articulate the public and private efforts (*1*).

Before such events, and considering that this matter was included in the Article 4 of the Constitution and in the General Health Act, some agencies had already plans and concrete actions to prevent and attend emergency situations, mainly: The Plan DN-III of the National Defense Secretariat, and the Help to Civilian Population Plan SM-AM of the Navy Secretariat; the Water Resources Secretariat developed actions of prevention and mitigation of accidents provoked by hydrometeorological phenomena; the Health Secretariat rendered services of prevention and care for contagious diseases, as well as attention to the damaged; the Social Development Secretariat (SEDESOL) implemented municipal plans of urban emergencies prevention and set standards for the solution of psychological problems; and the Federal District Department established in 1983 the "Protection and Recovery System of Mexico City in face of Disasters" (SIPROR).

The Federal Executive Power issued on October 9, 1985 a decree by which the National Reconstruction Commission was created aimed at the immediate care for the emergency situations and the settlement of foundations to prevent disaster in the future.

As an essential part of the above mentioned Commission six committees were created, assuming one of them, that of Civilian Safety Prevention, the responsibility for organizing the National Civilian Protection System (SINAPROC). Such committee, formed by nine work sub-commissions, issued on May 6, 1986 the document where the foundations for the establishment of the National Civilian Protection System were set, approved by presidential decree on the same date. The SINAPROC is conceived as an organized and jointed set of structures, working relations, methods and procedures established by the agencies of the federal public sector among them, and with organizations of

different social and private groups, in order to take commonly agreed actions aimed at the protection and preparation of citizens, against the dangers and risks arising in disasters.

Within the organization of the SINAPROC, the National Disaster Prevention Center (CENAPRED) is located. Attributes of such agency are to make scientific research on the matter, to train and prepare documents and messages aimed at the civilian population about protection.

By presidential decree, the creation of the **National Civilian Protection Council** (*2*) was published on May 11, 1990 in the *Official Journal*, as a consulting body for the coordination of actions and social participation in the planning of civilian protection, having also the responsibility for developing planning, consultation and decision actions, as well as convoking the public, social and private sectors -and the population in general- to guarantee the objectives of the National Civilian Protection System.

The National Health Program 1990-1994 (*3*) when diagnosing the health situation in Mexico poses the following: "It must be emphasized the increased injuries and deaths caused by disasters, both natural and linked to the human activity. This fact forces to adopt measures tending to avoid or control their occurrence. To that end, awareness and the corresponding training are a priority, in order to allow the immediate and organized action of all the population in case of disaster". Based on this set of problems, the **National Health Program** sets as a priority to reduce the morbidity and mortality rates caused by disasters. Thus, one of the eight **Action Programs** is assigned to **Health Care in Case of Disaster**, being this one a program mainly preventive according to the guidelines defined.

Therefore, the **National Civilian Protection System in Mexico** (O.J. May 6, 1986) (*4*) has two basic action guidelines:

First. To build in the Public, Social and Private Sector the **Internal Civilian Protection Units** whose duty is to safeguard the life of workers and to secure

the physical infrastructure of such institutions. In each of them, the administrative areas form, install and coordinate the units. With regard to the Health Secretariat, the Chief Clerkship, through the Material Resources Directorship, has a department which coordinates the Secretariat's Internal Civilian Protection Unit and promotes the creation of Internal Civilian Protection Units in the states.

Second. It is the line marked within the SINAPROC, where the Health Secretariat as part of the National Civilian Protection Council is aimed at giving health care in case of disaster, in coordination with the National Health System, as follows:

> **Pre-Hospital Health Care**: Directly given in the affected community, in shelters and in first aid posts;
>
> and **Hospital Health Care**: Given in the suitable hospital nearest to the sites where the damages caused by any disaster were suffered. The last one must have hospital care plans and preparations in case of disaster.

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CHAPTER IV

PRE-HOSPITAL CARE

Pre-hospital care is the one located between the community and the hospitals. Its efficiency in disasters depends on the organization and working in normal times, and on its functional integration into programs of hospital preparations in case of local and regional disasters. In our country, like anywhere in the rest of the world, pre-hospital care steadily increases its professional level. Not all the public sector institutions can render such services, mainly the social security institutions, since the internal regulations order to direct the resources to the care in the units once the entitled person arrives, and to place him(her) at the most suitable level of operation in order to solve the health problem. Today the principal organizations authorized to the important pre-hospital labor are: the Mexican Red Cross, the Rescue and Medical Urgencies Squad in Mexico City, and the Green Cross in Monterrey and Guadalajara. There are also groups of volunteers which must be subject to a process of official creditation in each location: they are theoretically and practically well trained, and have the suitable vehicles, equipments and inputs according to the regulations on the matter. The idea of functional integration which must be in the so-called life chain must be reinforced in order to obtain the best results when caring for victims of disasters. It is necessary, hence, in order to guarantee an organized, coordinated, efficient and early response in face of the disaster, to observe the following guidelines:

1.- To establish a mechanism which evaluates the **size of the disaster** and gives a congruous response.

2.- To level up in the Health Sector the criteria about: **Triage, international color code, techniques for the assessment of the victim and scoring scales and priority selection of the injured.**

3.- **To rate the hospitals** according to their capacity when caring for the victims of disasters, and to make a reference and counter reference system for patients.

4.- To make models of care in case of disaster, which must be proven to be useful in **simulations.**

RATING OF THE DISASTER SIZE

In face of a disaster situation, a logical and reasonable response should be given directly proportional to its scope. In the past, limited responses had been given which did not meet the needs of the affected community, or exaggerated ones entailing expensive resources(*1*). Every plan of hospital response in face of the disaster must be based on the evaluation of the disaster size, in order to generate a local, regional, national or international response being the case. The epidemiological monitoring of the disasters has allowed to identify different factors acting in the size of the damage, among which the most important are the type of disturbing agent, its degree of forecasting, its frequency and the degree of control. The explosions as disturbing agent, for instance, cause more deaths than a hurricane or a flood, probably due to the fact the latter are more foreseeable and controllable (*2*). Other factors which have proven to directly related to the size of the damage are the quick start, the duration of the impact and its intensity. Traditionally, the disaster size has been estimated by its effects on different aspects like:

a) Amount of the deceased or the injured

b) Disorganization of public utilities

c) Damage to public and private properties

d) Spreading of transmissible diseases

e) Estimated time of return to normality

f) Characteristics of the subsoil

Different investigations have concluded that the factors determining the patterns of dead people, the type of the injured and disappeared, and the amount of displaced population are:

a) The time in which the incident occurs.

b) The population density in the affected zone.

c) The type of human settlement and construction in the zone.

Earthquakes, for instance, are the disturbing agent which makes more casualties and troubles more the public and private structures, their impact start is brief, not controllable or foreseeable, and their duration is related directly to the amount of buildings and deaths. As demonstrated in the 1976 earthquake of Guatemala, 80% of the deceased population lived in adobe dwellings, while deaths were not recorded among those living in wooden houses. Other studies have revealed that deceases are higher when earthquakes occur in the night, and that the mortality rate rises when the population density increases in the affected zone (*3*):

Attempts to establish the are good and, in fact, have allowed to guide the answers, even if only have approached isolated aspects. In order to understand the disaster size, they must be wholly analyzed having in mind the type of agent, amount of the injured, density of the affected population, among others. That is why the disaster size has been rated based on a numerical scale: the size is determined according to a scoring obtained from the evaluation of different parameters, and the following levels are established:

1.- Big size (rated between 15 and 21 points)

2.- Intermediate size(rated between 11 and 14 points)

3.- Limited size(rated between 0 and 10 points)

According to the color code accepted worldwide, the response will be maximum (**red**) when national or international resources are used to meet the demands, intermediate response (**yellow**) when regional resources are used to

meet the demands, and limited response (**green**) when local resources are sufficient to meet the demands.

The parameters considered to establish the size of the damage and the points corresponding to each parameter are shown in table 1. The total amount will make the scoring and the disaster size (*4*).

TRIAGE, TRIAGE PLACES

Triage is a French word meaning classification and selection. In the health field. it is understood as a "dynamic process by which the priority ranking is determined". The classification is based on the supposed benefit to be obtained from the medical care, not only on the severity of the injured. In order to get the best results for the greatest amount of victims, the collective interest is preferred.

Although triage was first used in the in the XVIII century by the French surgeon Dominique Jean Larrey in 1799, during the war campaigns of Napoleon Bonaparte, it was in the First World War when the process was diffused and accepted worldwide (*5,6*).

In front of a triage situation, the doctor must pose two alternatives in the first place:

1) The hospital **does** have the capacity to meet the needs for medical care considering the amount of victims and the severity of the injuries. In this case, patients having injuries that threat their lives are attended first.

2) The hospital **does not** have the capacity to meet the needs for medical care considering the amount of victims and the severity of the injuries. In this case, patients having more possibilities of survival are attended using the least time and resources, in order to decrease mortality and consume the least time and resources (*7*).

Though triage can pose ethical problems, when such system is applied to a mass number of injured, has proven to decrease the mortality rate of recoverable victims. Today there are different triage systems whose tiny differences are the number of levels from four to six. They remain, however, compatible as of the foundations, the philosophy, the objectives, and the results (*8, 9*).

The triage process should not be understood as a rigid and inflexible scheme: the priority of treatment is based on the availability of resources, the abilities and limitations of the medical staff, the equipment and, above all, the likely result in the treatment of the patient.

All selection system must have the following characteristics:

a) To be simple

b) To be planned and diffused previously

c) The principles are totally accepted

d) To use all the available staff

e) To be applied continuously to all the patients

f) To be managed by a triage officer

Triage is dynamic, and it implies the continuous assessment of the patients and their response to the treatments. Patients, according to their evolution, could pass to other care priority (*10*). It is recommended that the triage officer is an experienced doctor able to command and control, since he will face often situations not yet predictable. In a disaster, at least three triage sites are required, each one giving different level of care (*11*).

In order to make the process easier, the priority patients must not been derived to secondary treatment in the initial triage site. This type of treatment is best

made in the next level, giving special attention to correct problems such as: maintenance of the airway, placing of the thoracic tube, and quick handling of the shock, among others. The three triage sites are:

Pre-hospital. It is implemented in a site near the disaster. It must be made by a doctor or specialized paramedic staff. It is recommended to establish the triage post 150 meters or more away from the disaster zone, if it is a safe place The triage officer must be at the access to rate all the injured as arrived. The selected patients will be arranged by rows depending on the priority level, and the starting end of the row must be adjacent to the transport zone in order to facilitate the evacuation of patients (figure 2). The main objectives in this stage of the process are:

to identify the injured; to determine the priority level by rating according to the color code; to treat as far as possible the injuries endangering immediately the life, and to transport the patients safely to the most suitable hospital

Urgency Room. Upon notification of a mass casualty number sent, the triage officer -which must be a doctor- will establish the rating site at the entrance of the hospital or at the urgency room. No patient will admitted to the hospital if not passed this second level of selection. If the number of the injured exceeds the officer's capacity, he(she) is empowered to appoint one or two assistants in order to make easier the process, being the officer responsible for supervising the work of the assistants. The main objectives of the second level are to re-assess the injured patients in order to determine if the priority level has changed and, mainly, to send the injured to the specific treatment area.

Hospital. In the treatment areas, the patient will be continuously re-assessed. It is recommended to lay out in this room the diagrams for handling and response to problems such as state of shock, burns, traumatisms in the children, among others, not familiar to the staff. This third rating level can be supported by laboratory studies like computerized axial tomography (*12*). The main objective

of this rating level is to send the injured to final treatment as general surgery, neurosurgery, haemodialysis or intensive therapy units (table 2).

INTERNATIONAL COLOR CODES

Different methods have been developed to distinguish the priority level of each patient, in order that the medical staff quickly knows the general condition of the victim. To this end, the use of color cards or armbands has been proposed. The main problem faced by these methods was confusion, since a sign or signal meant often the opposite in two different systems.

Trying to unify and to homogenize the criteria, a color code for the classification of patients has been internationally accepted. Such color cards have also the advantage that the general data, clinical signs of interest and treatments received by the patient can be written on them. When color cards are not available, the victims should be identified by an adhesive tape placed on the chest. Today such colors by priority are:

- red,
- yellow,
- green and
- black

Recently the gray color has been proposed to indicate radioactive injuries, but has not been accepted worldwide.

Red color: Critical condition patients. They require immediate and intensive medical care due to imminent risk to their lives, like in cases of airway injuries by obstruction, pneumothorax, unstable thorax, hypovolhaemic shock by intra-abdominal hemorrhage and vascularly injured wounds. They are patients whose prognosis, if appropriately and early attended, is favorable: their overlife rate is very high. First priority is assigned to these patients.

Yellow color: Severe condition patients. This group is formed by grave patients whose prognosis is better due to injuries which can wait a reasonable time to be attended without changing the overlife possibilities, like patients with multiple or open fractures, uncomplicated cranioencephalic traumatism. Second priority is assigned to these patients

Green color: This color identifies very critical patients and slightly injured patients. It includes, therefore, two types of patients: those whose prognosis is bad due to the type of injuries, even in the best circumstances, like skull traumatisms with exposed encephalic mass and extensive thorax injuries, where the most important thing is maybe to mitigate the pain, and slightly injured patients which can be attended as out-patients. Third priority is assigned to these patients.

Black color: Corpses. They must be treated respectfully. A priority is not assigned, but they must be transferred to morgues, without using the ambulances to this end. In Figure 3 a model of triage card is shown: on the face it has the identification date of the person, and on the back the health problems identified in the victim, according to the method of initial assessment proposed by the Course of Advanced Trauma Life Support (ATLS).

ASSESSMENT OF THE VICTIM

In a disaster situation patients must be evaluated simply, quickly and safely. That is why several systems have been developed to help the doctor in assessing and treating the injured. Taking into account the procedures established, it is convenient to adopt the Course of Advanced Trauma Life Support (ATLS) diffused by the America Surgeons College Committee on Trauma due to the following reasons:

a) The first cause of demand for care during disasters is traumatisms.

b) The system has proven to be efficient by decreasing the mortality rate and sequels.

c) Its wide diffusion and acceptation will allow to standardize evaluation and handling criteria.

In order to get the best results from the procedure, some considerations must be made when evaluating patients affected by some kind of disaster.

1. They have injuries which, due to their gravity, are a life risk.

2. They haven't had time to be prepared to the now faced situation.

3. They often experience multiple injuries.

4. Injuries are so slight that can't be detected in the beginning.

5. During the treatment and rehabilitation stages, they require continuous revaluation.

6. Background of diseases and ingestion of medicines that could change their clinic condition or their response to the treatment.

The method proposes four sequential phases, as follows:

1) **Primary Survey**

2) **Resuscitation Phase**

3) **Secondary Survey**

4) **Definitive Care Phase**

Primary Survey

It is mainly aimed at identifying injuries likely to cause the victim's death, and at initiating the treatment. Vital functions like breathing and circulation must be emphasized. As mnemonics, the acronym ABC* is recommended. It includes:

- (A) Airway maintenance with the cervical spine control
- (B) Breathing and ventilation
- (C) Circulation with hemorrhage control
- (D) Disability (Neurological Status)
- (E) Exposition (to undress completely the patient)

Resuscitation Phase

It must be carried out simultaneously and jointly with the initial evaluation. It includes permeabilization of the airway with posture operations or the use of devices, oxygen supply at the highest concentration, and handling of the shock replacing the lost intravascular volume with blood or solutions in order to maintain the circulatory function and the aerobic metabolism.

Secondary Survey

It can start only when the first phase is concluded, and the resuscitation is initiated. It is a thorough examination, from top to toe, including vital signs. The revision must be careful, detailed and complete, but quick at the same time. The

* In English, acronym meaning: airway, breathing and circulation.

four scanning techniques (inspection, touching, auscultation, and percussion) must be applied systematically to the body regions. The patient must be continuously re-evaluated, and in this stage diagnosis can be carried out.

Definitive-Care Phase

All the patient's injuries are treated, fracture stabilization and the necessary surgery and dialysis are applied. Failure to any of these stages during the victim's evaluation and treatment can result in invalidity and unnecessary deaths.

SCORING SCALES AND PRIORITY SELECTION OF THE INJURED

Development of systems directed to estimate and rate the gravity of the injured has evolved for more than two decades, and different systems have been proposed -like TS* and TRS**- to be applied in the pre-hospital environment, while others -like ISS***, TRISS**** and APACHE I and II*****- are used in the hospital environment (*13-17*). In general they were created to guide the primary selection, to support the clinic treatment, and to favor a judicious prognosis (*18,19*).

They all have proven to be useful when suitable applied in the evaluation of traumatized patients.

The doctor rating and selecting must have in mind such parameters which have proved to be related to gravity, among others, the anatomic (table 3) and

* In English, acronym for: Trauma scale.
** In English, acronym for: Revised trauma scale.
*** In English, acronym for: Injuries severity scale
**** In English, acronym for: Trauma rating and injury severity scale
***** In English, acronym for: Acute physiology and chronic health evaluation.

functional (table 4) criteria, the mechanism of injury production (table 5), the co-factors of morbidity (*20-22*), and mainly the clinic judgement.

Main objectives of the rating scales are: to identify those patients who, due to their gravity, require to be attended in highly specialized centers, to send less injured patients to less complex units. These actions allow, in addition, to maximize all kind of resources, since they are devoted to patients really requiring them, a very relevant circumstance during disasters, when all the resources can be insufficient.

When anatomic criteria are used, frequently a certified diagnosis is required, thus being subject to time and unusable in the pre-hospital environment. Physiological criteria are based on the normality of vital signs, which can be initially unchanged by compensation mechanisms or be affected by the previous ingestion of medicines. To be based only on the mechanism of the injury can result in deviations, since the mechanism is often provided by second and third parties, whose appreciation can be inaccurate. Ratings, on the other hand, have forgotten to include some risk factors like previous diseases, taking of medicines, age and sex.

The following characteristics must be included in the ratings for evaluating the gravity of the injured:

a) To be based on accessible parameters in the pre-hospital environment.

b) To be easily understandable.

c) To be easily applicable.

d) To be practical and quick.

e) To prove to be forecasting worthy.

f) To encourage a judicious prognosis.

g) To be loyal in face of different observers.

It is necessary to develop prospective, controlled and compared studies which assess the usefulness and efficacy of the gravity score ratings, which must include all the above mentioned criteria and which must impact positively on the morbidity and mortality rates of the disaster-stricken injured.

RATING OF HOSPITALS FOR DISASTER CARE

Pre-hospital care medicine has progressed outstandingly in last years. In the middle 60's, during pre-hospital care, triage or priority selection were not carried out, and ratings for assessing the gravity of the injured didn't existed, then the patients were transferred to the nearest hospital.

Data published by the National Research Council of the United States of America (*23*) on that time, demonstrated the need for improved pre-hospital care and the creation of centers specialized in trauma. Later studies proved that mortality rate decreased dramatically when patients were admitted to such centers (*24,25*), a fact that fostered the development of such units across the United States of America (*26*).

During a disaster, the work of rescue and the selection of victims would be fruitless if the patient, accurately classified, is not transported to the suitable hospital, which not always is the nearest, but the one having the physical, material and staff infrastructure necessary to provide the care level required by the patient. The rule of **triple R** says that the right patient should be transported to the right hospital at the right time.

In Mexico, one of the most crowded cities spread on an area of 1,500 square kilometers and having serious traffic problems, care must be regionalized, the decision level in the zone hospitals must be determined to attend different types of the injured, and a reference and counter-reference system must be established in order to provide an organized, early and efficient response when taking care for groups of victims.

To this end, the application of hospital ratings is recommended (table 6), based on the medical units regionalization by the Mexican Social Security Institute and mainly on the availability of physical, material and staff resources. In such regionalization, three specialization levels are considered according to the score obtained by the hospital in the hospital evaluation sheet:

a) Highest specialization hospitals (80 to 100 points): **RED**

b) Intermediate specialization hospitals (60 to 79 points): **YELLOW**

c) Secondary support hospitals (50 to 59 points): **GREEN**

The triage color codes have been used in order that patients of a given color are easily canalized to the hospital of the corresponding color.

The classification comes from a hospital having 24-hour services in main specialties all the year, functioning of two surgery rooms at least, support of X-ray diagnosis, laboratory, pharmacy and 50 beds at least. A hospital like this is assigned 50 points.

A MODEL OF URGENCY AND DISASTER CARE SYSTEM IN MEXICO CITY, APPLICABLE TO ALL BIG CITIES

The health situation in big cities shows a very changed epidemiological panorama where the frequency of infecto-contagious diseases is maintained, while chronic-degenerative diseases, accidents, violence and disasters increase. This model is presented including the essential elements pretending to be integrated functionally to form a care system for urgencies and disaster in megalopolis.

In Mexico City, the problem is more complex due to the characteristics of the transportation systems, increasing growth of industry, size of social problems,

marginal and conurbated areas, and the fact of being highly seismic zone. Such situation as a whole generates a huge demand for urgency health care in the existing public and private services to respond in case of accident care, both domestic like traffic, injured by violence and disaster, as well as acute diseases which endanger the patient's life.

To attend such problems, activities have been carried out aimed at forming a system in which pre-hospital and in-hospital care is considered suitably in face of any situation or contingency (*27*).

The creation of the system for urgency and disaster care is aimed at guaranteeing the immediate and efficient medical care to all the inhabitants of the city through the organized participation of all the National Health System institutions in the Federal District.

To this end, a magnetic media directory has been made of all the hospital units in the city, where the installed capacity, location, communication systems, number and type of services, amount of beds and doctors specialized in urgency care are recorded, as well as the hospitals having trauma-shock services and intensive therapy.

The areas forming the system in which all the urgency services must participate are those of communications, transportation, pre- and in-hospital care, and information.

This system is aimed at creating an organization which coordinates and regulates the immediate care response in disaster situations and allows the best use of resources, opportune care, limited physical and social damage through early rehabilitation and reintegration of the injured into the productive life. It permits also to know critical levels, and analyze particular and general situations, making the decisions suitable in the case.

Another important aim is to strengthen intrasectorally and interinstitutionally the programs and actions directed to solve the operational problems in urgency and disaster care.

For its organization, the following are identified as necessary administrative bodies: In the first level, a general coordination; in the second level, a managing center; and in the third level, the acting bodies.

Having in mind the integration, the general coordination adopts flexible criteria in the use of resources, by entering agreements and developing policies, programs and evaluation of standards.

The managing center will work 24 hours a day, 365 days a year, and must have the control instruments organized and updated to facilitate the immediate response, as well as publish updated catalogues of services, technical reports and press bulletins.

The acting bodies are the hospitals, which must give immediate and priority care to the accidented. Depending on the amount of demand and supply in the hospital, options of expanded services must be established in each hospital, available resources must be foreseen, and the staff must be constantly trained.

Strategies to be taken into account for the "Metropolitan System of Urgency and Disaster Medical Care" are as follows:

1.- To establish an unified managing system to respond in case of urgency/ disaster.

2.- To make an unified infrastructure of interinstitutional communication and with other operational areas, in urgency and disaster situations.

3.- To review, update and keep in magnetic media the inventory of medical care resources.

4.- To review and, being the case, to propose new modes of regionalizing the health services in the metropolitan area.

5.- To determine the general and specific responsibilities of institutions and hospital units according to the needs of the affected population and available resources.

6.- To standardize the ways of pre-hospital care for the injured, in the different institutions forming the system.

7.- To review, update and keep the education and career contents of the staff, in order to determine the needs and the training program for all the health team caring for the injured. Thus, a specific profile will be made.

8.- To meet the care and rehabilitation needs by the reference and counter-reference system.

9.- To provide the intermediate and intensive therapy ambulances with all the equipment and staff suitably trained in urgency and disaster care.

10.- To organize the voluntary social participation by means of the managing center.

11.- To reinforce health planning, prevention and education actions, through research and knowledge of causes and effects of urgencies and disasters.

12.- To propose the participation of private institutions with regard to standardized urgency and disaster care, under the coordination of the managing center.

13.- To propose the Political Delegations accident prevention campaigns and limitation of the damage within the community.

14.- To spread the information through the channels of the managing center.

According to the commented model, the operation scheme in front of a contingency is presented as follows succinctly.

The "primary agent" must be a person duly prepared and trained to determine and delimit the size of the damage, and will take into account the parameters and will rate them pursuant to the above mentioned rating.

The international color code will serve to identify the hospitals according to the available resources and the operation capacity. The code is also used to qualify the organo-functional risk degree of the victims, and it establishes easily the place of the definitive care (the red patient was transferred to the red hospital).

The "primary agent" will transmit information to the radio central and to the Urgencies Department, which is empowered to activate the sending of medical brigades with special equipment, depending on the contingency and type of calamity, and to start the hospital plan.

The triage officer must: select the appropriate place for the classification, selection, care and transfer of victims to the hospital centers, establish a command post with radio and cellular communication, mark the transfer and evacuation routes, and install a single information and guidance module to the public. In special situations, a temporary care and first aid area can be established, and if necessary, supported by medical ambulances, patients will be transferred to the hospital most suitable to each one.

The hospital care sub-system must be a model of regionalized care, at the time of the alarm. In this type of hospital all the surgery is suspended, patients whose clinic condition allows it will be discharged, and those stable patients which can't be handled at home will be sent to green and yellow hospitals. Expansion areas must be opened, and care binomials must be integrated.

Systematically, hospitals must carry out the following actions:

1.- An operative command will be established in the medical unit, which coordinates the internal actions with the central levels.

This command is under the responsibility of the medical unit director or the head of urgency service.

2.- Utilities of the hospital are revised to guarantee that water supply, light and physical areas are duly conditioned to receive patients.

3.- To designate the "Triage" area with the integration of multidisciplinary teams which have as relevant duty to categorize the patients by medical care priorities, and to prepare the reanimation areas for caring critical patients needing vital and intensive support to preserve their lives.

4.- To define routes of access to the hospital.

5.- To assign sufficient material resources in the "Triage" and medical care areas.

6.- To give the necessary inputs in the areas of laboratory and clinic tests, imagenology and blood banks.

7.- To establish coordination with the central store for the supply of complimentary inputs.

8.- To prepare immediately the surgical area and to guarantee the availability of surgical equipment.

9.- To log continuously admissions, care given, surgical operations, transfers, discharges, and deceases.

10.- To be in permanent communication with the central informing periodically on the additional needs, number of beds and stretchers.

11.- To install a public orientation and information module.

12.- To prepare special guards for the staff to be active, mainly in the substantial areas of the hospital.

13.- To make a final permanent evaluation of the operative program, and to keep the central command informed.

In short, the general program established will be developed in progressive actions according to different performance scenarios. In order of complexity they imply:

1) First aid, and rescue.

2) "Triage" and stabilization.

3) Surgical stabilization, selection and transportation.

4) Definitive care.

Some are made in the scene of the disaster, others in the support medical unit.

The shown model has been strengthened and consolidated through the experience in the Health Services General Directorship of the Federal District Department.

Table 1
PARAMETERS FOR RATING THE DISASTER SIZE

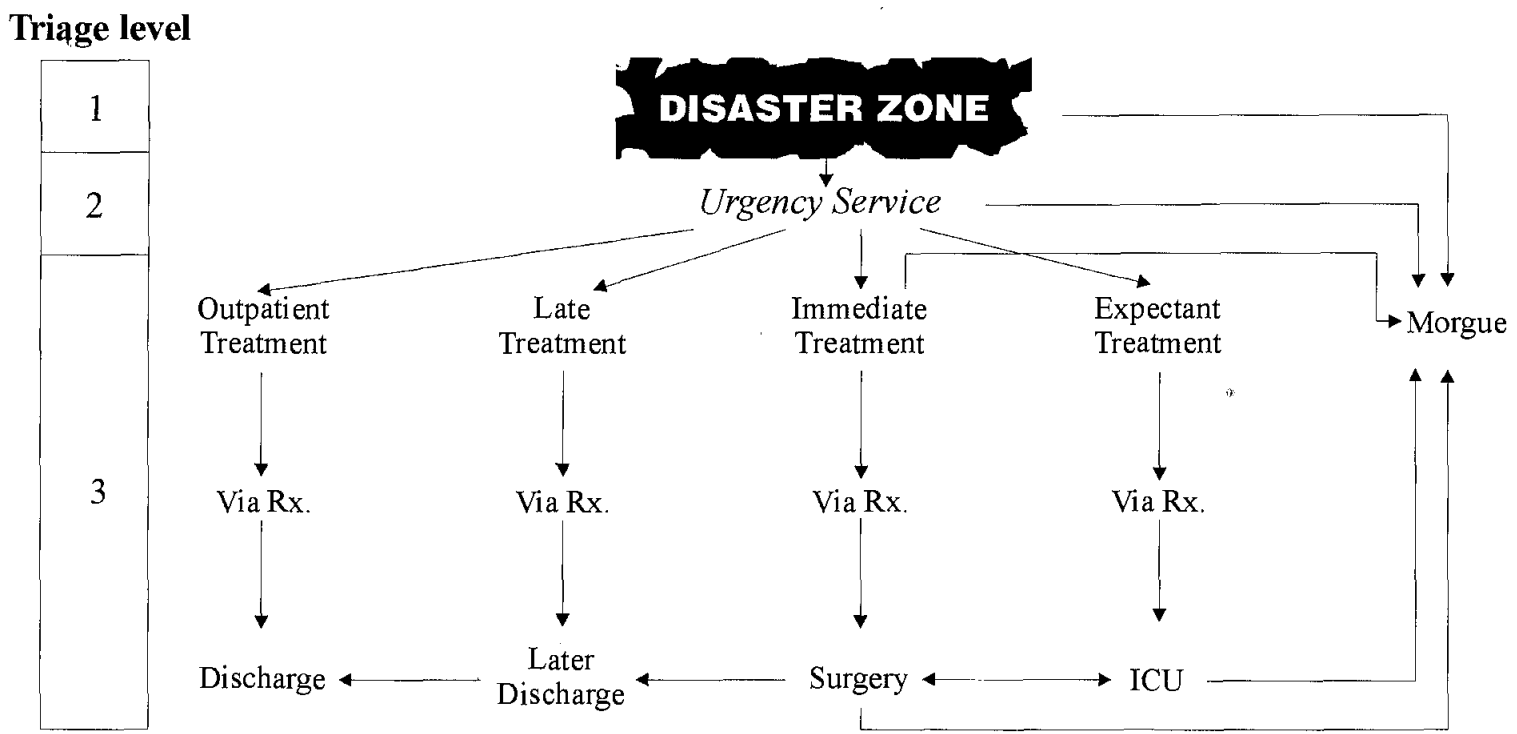
TYPE OF DISASTER	PT.	POP. DENSITY*	PT.	Nº VICTIMS: DEAD, INJURED, INTOXICAT.	PT.	RE-ESTABLISHMENT RETURN NORMAL.	PT.
GEOLOGIGAL:		HIGH	3				
EARTHQ. BIGGER THAN 7° R MORE THAN 30 SEC.	7			MORE THAN 100 DEAD OR MORE THAN 400 INJURED	8	MORE THAN ONE WEEK	2
EARTHQ. FROM 5 TO 7° R MORE THAN 30 SEC.	2						
CHEMICAL:		MEDIUM	2	FROM 50 TO 100 DEAD OR FROM 200 TO 400 INJURED	6	UP TO 72 HOURS	2
EXPLOSION	6						
FIRE	5						
INTOXICATION	4						
HYDROMETEOROLOGICAL:		SCARCE	1	LESS THAN 50 DEAD OR FROM 50 TO 200 INJURED	4	FIRST 24 HOURS	1
HURRICANES	3						
FLOODS							
SOCIO-ORGANIZATIVES:		NULL	0	NO DEAD REGISTERED OR LESS THAN 50 INJURED	2		
CONCENTRATIONS	2						
ACCIDENTS (AIR, GROUND)							
SANITARY:							
EPIDEMICS	1						

CruzV.F., Cymet R.J., Mendez S.L.M. PRESENTED AT THE INTERNATIONAL MEETING ON HOSPITAL PREPARATIONS IN CASE OF DISASTER, CIESS, SEPT. 1-3, 93

* According to the rating of the INEGI

Table 2

TRIAGE PLACES



Modified from Hughes J.H. *Community Medicine* en Postgrad. Med. 60: 223.

Table 3

ANATOMICAL CRITERIA

* Head, throat, thorax, and proximal extremity penetrating injuries
* Amputation of extremities
* Two or more long bone fractures (proximal)
* Pelvis fracture
* Paralysis of any extremity
* Burnts on more than 10% of the body surface (BS)
* Inhalation burnts combined with other traumatisms
* Fractures by squashing

Maslanka A. Avances en Traumatología, sistema de puntuación y selección prioritaria. En Clin Urg Med. 1993; 1:19-33

Table 4

PHYSIOLOGICAL CRITERIA

CARDIOVASCULAR SYSTEM	CENT. NERVOUS SYSTEM
* *Systolic blood presure*	* *Eyes open*
* *Pulse*	* *Verbal response*
* *Capilar filling*	* *Motion response*
	* *Level of awareness*
RESPIRATORY SYSTEM	**OTHERS**
* *Frequency*	* *Injured part*
* *Breathing effort*	* *Type of injury*
	* *Abdominal exploration*

Maslanka A. Avances en Traumatología, sistema de puntuación y selección prioritaria. En Clin Urg Med. 1993; 1:19-33

Table 5

CRITERIA BY INJURY MECHANISM

CAR ACCIDENT	MOTORCYCLE ACCIDENT
* *Death of the companion*	* *Speed >32 km/h*
* *To be expulsed*	* *To be expulsed*
* *Rescue >20 min.*	
* *Speed > 45 km/h*	
* *Vehicle deformed >50 cm*	
* *Sunken vehicle >30 cm*	
FALL	**COLLISION**
* *Higher than 6 m*	* *To be thrown or knocked down*
	* *Impact >8 km/h*

Maslanka A. Avances en Traumatología, sistema de puntuación y selección prioritaria. En Clin Urg Med. 1993; 1:19-33

Table 6

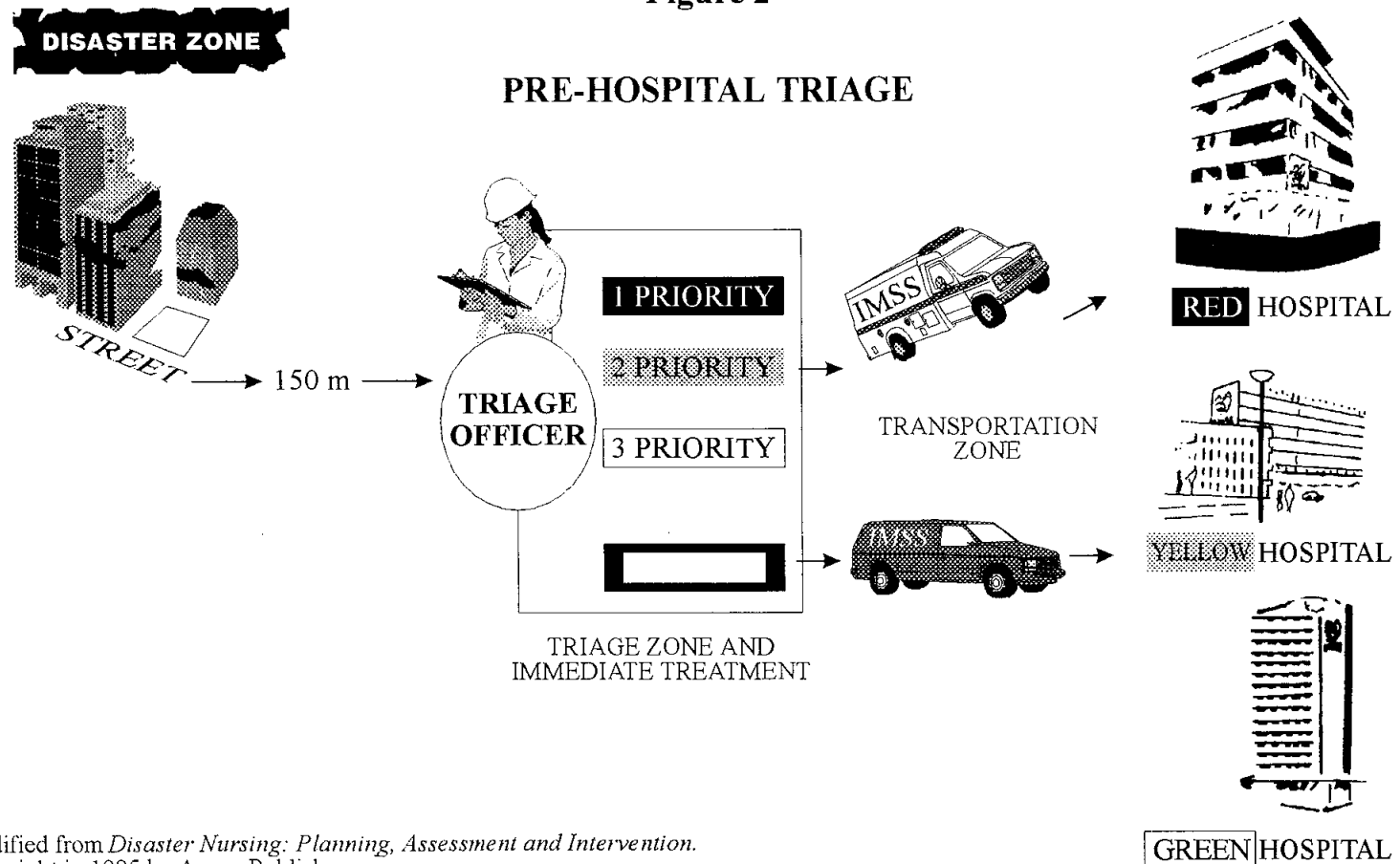
RATING OH HOSPITALS ATTENDING DISASTER SITUATIONS

EVALUATED PARAMETER	POINTS ASSIGNED
PHYSICAL RESOURCES:	
NUMBER OF BEDS	*1 POINTX EACH 50 BEDS, 4 POINTS MAX.*
SURGERY ROOMS	*4 POINTS X 10 OR MORE* *2 POINTS OF 5 TO 9 ROOMS**
COMPUTERIZED AXIAL TOMOGRAPHY OR MAGNETIC RESONANCE	*3 POINTS*
ULTRASOUND	*2 POINTS*
SERVICES AVAILABLE:	
MUSCLE-SKELETON TRAUMA	*5 POINTS*
BURNTS	*5 POINTS*
NEUROSURGERY	*3 POINTS*
THORAX SURGERY	*3 POINTS*
INTENSIVE THERAPY UNIT	*3 POINTS*
RACHIMEDULAR TRAUMA	*2 POINTS*
STAFF RESOURCES:	
ATLS DOCTORS	*4 POINTS + 10 DOCTORS*** *2 POINTS OF 5 TO 9 DOCTORS*
EDC (24 HOUR) EMERGENCY SERVICE	*6 POINTS*
COMMUNICATION AND TRANSPORT FACILITIES:	
HELIPORT	*2 POINTS*
AMBULANCE	*2 POINTS*
RADIOTELEPHONY	*1 POINT*
RADIOCOMMUNICATION	*1 POINT*

** LESS THAN 5 ROOMS 1 POINT*
*** 4 POINTS MAX.*
Cruz V.F., CymetR.J., Mendez S.L.M.

PRESENTED AT THE INTERNATIONAL MEETING ON HOSPITAL PREPARATIONS IN CASE OF DISASTER: CIESS, SEPT. 1-3, 1993.

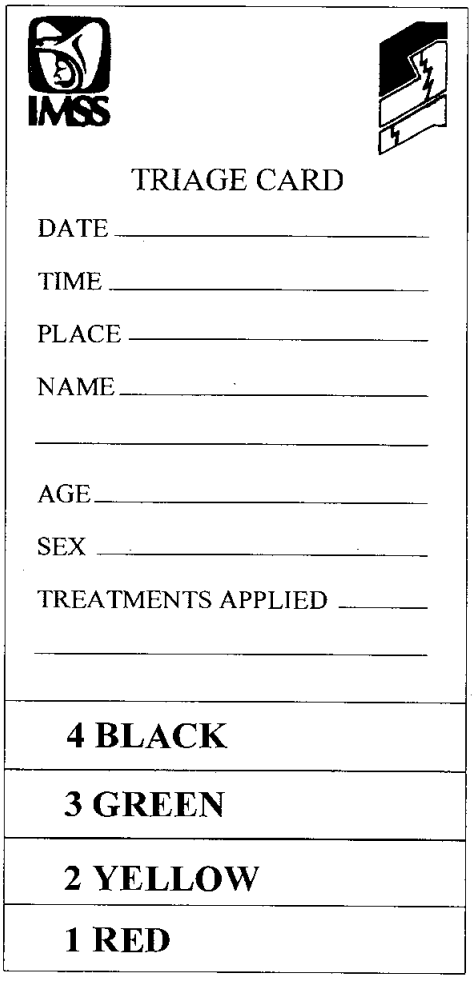
Figure 2



Modified from *Disaster Nursing: Planning, Assessment and Intervention.*

Figure 3

AN INSTITUTIONAL MODEL OF TRIAGE CARD



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CHAPTER V

VULNERABILITY OF HOSPITALS

The need for the hospitals to be prepared and fully able to act in emergency and disaster situations is a specially important aspect. The impact of earthquakes and hurricanes in the near past and the damages caused to medical units has proved that such facilities are vulnerable (*1*).

In the last two decades, as a consequence of earthquakes, more than one hundred hospitals have been reported severely damaged, and even totally collapsed. Namely, two examples are recorded in the American Continent (*2*): On February 9, 1971, during the earthquake in San Fernando, California, four hospitals were severely damaged, hence being unable to operate when most required. In 1985, health sector hospitals in Mexico City were substantially damaged: 13 hospitals with 4,300 beds were out of service (*3*).

Many hospitals in the region of the Americas characteristically are buildings from the early times of the Colony, whose structures need to be reinforced and maintained, or modern facilities where the construction materials not always meet the safety standards.

In this book the most important aspects related to hospital vulnerability are recorded. It is a subject in which doctors must act as a team with works and maintenance engineering professionals, among others, in order to keep safe their working environment.

For the best understanding of the subject, we adopt a series of definitions published by PAHO/WHO (*4*).

VULNERABILITY

It measures the susceptibility or intrinsic predisposition of the elements exposed to a threat to suffer damage or loss. Such elements can be the structures, non-structural elements, persons and their collective activities.

In general, vulnerability is meant in terms of potential damage or loss, according to the severity or intensity degree of the phenomenon to which the element is exposed (figure 4)

STRUCTURAL ELEMENTS

They are the parts of the building that resist and transmit to the foundations the forces of the building weight and its content, the burdens caused by earthquakes, hurricanes and other environmental agents. Structural elements of a building are, therefore, the columns, beams, joints, floors, plates, covers, walls and foundations which finally transfer the forces to the ground.

The projected or existing facilities devoted to health services, if located in zones exposed to seismic movements, must meet earthquake-resistance standards aimed at giving safety and besides at protecting the vital equipments in the hospital (5). The earthquake-resistance is a construction standard whose purpose is to avoid the building collapse: in low intensity events the structure and content would not be damaged, and in very intensive earthquakes its structure would be strained and deteriorated permanently, but not collapsed. Thus, the construction weight and content are supported without casualties, even if the building must be finally demolished, or repaired and reconstructed (figures 5 and 6).

NON-STRUCTURAL ELEMENTS

In a building, all other elements different from the structure, such as facades, windows, ceilings, panels, equipments, electric, mechanic and hydraulic utilities, and in general the inventory furnitures and other appliances are known as non-structural elements.

In the case of hospitals, the non-structural elements are more valuable than the cost of the very building. The structural item is not more than an average 15% of the total cost of the hospital.

The non-structural elements can influence the occurrence of structural failures. Heavy equipment like: Central air-conditioning system, X-ray devices, tomography equipments, electric generators, boilers, hydrotherapy tanks, and others can change significantly the dynamic response estimated in the building design and construction, by being displaced or turned over when not anchored, thus provoking at last partial or total collapses of the building. Elements fallen on a sector of the structure can generate a severe impact. Remodelations and arrangements in hospitals must always take into account their likely effect on the structural elements in case of seismic movement.

FACILITIES AND EQUIPMENTS

The incidents most frequently observed in earthquakes are (*6*):

- Fallen oxygen and flammable gases cylinders, whose content is lost, thus creating a high risk situation.
- Fallen emergency generator due to poor anchorage and corrosion, as well as collapsed high voltage transformers and spilled oil, thus provoking power interruption in critical moments, in addition to the fire risk.
- Displaced telephone exchanges, thus provoking interrupted communications in the hospital.
- Collapsed shelves in stock rooms, laboratories, and pharmacy, among others, thus provoking loss and disorganization.

DESIGN

It is very important to consider the way in which the hospital is going to absorb the energy generated by earthquakes. The first seismic waves loaded with

energy are resisted by the building, which doesn't move. It is not impacted, however, only by the earthquake size, but also the time of duration. In Mexico City, earthquakes lasting more than one minute are dangerous; if the seismic waves keep on arriving to the hospital, the latter must oscillate to dissipate the received energy. If energy keeps arriving the time the earthquake remains, the hospital must be designed in such a way that coatings, plastered surfaces and finishings –generally speaking everything but the structure, which at last resists and keeps the building standing (*7*)– are cracked.

In case that the earthquake lasts near two minutes, in Mexico City the hospital will start failing in structural horizontal elements like beams and slabs, but the hospital will stand even if structural elements fail.

The above description is part of design philosophy considered in the construction regulations of the European countries, the United States of America, Asia and Mexico. The hospital must stand and bear all the likely damages, since, faced to an earthquake, must keep working partially or totally, fulfilling its social function.

For a structural project to be reliable, it must satisfy the following items:

- The hospital must be resistant all along, both horizontally and vertically. In case of intensive earthquakes, in the stories beams and slabs must fail first, but columns never. Failures must be ductile, but no fragile. An example of ductile failure is a plastic bar, supported in the ends and forced in the middle. Under these conditions, it becomes deformed each time the force is increased and, before the breaking point, it "warns" its weakness and fails on the due time. A fragile failure is, on the other hand, a "piece of chalk" (gypsum bar to write on the blackboard) which "doesn't warn" its weakness and breaks suddenly provoking the secondary damage (figure 7).

- The hospital must have a good absorption rate like the shock absorbers of a car: they minimize the impact of tires on the road. In the hospital the shock absorption is made with non-structural elements like the number of division

walls, not using light walls, but walls made of overcooked red bricks. The more division brick walls, the more shock absorption.

- The hospital must be ductile. The plastic bar is ductile, it is like a clay mass which allows to make different forms without losing the physical properties: it can be deformed without being broken. The structure engineer takes into account all the above mentioned in the design phase.

Coordination between the architect and the structure engineer in the design phase is essential, mainly to have suitable spaces when needing to evacuate the hospital. In this situation, two basic phases must be considered: The horizontal evacuation and the vertical evacuation facilitate the safe arrival of patients and staff to the ground level.

It is fundamental to always have in mind the hospital preparations plans in case of disaster, as well as the analysis of vulnerability of the medical unit in its most important aspects -the structural elements and the non-structural elements. It depends on the above mentioned that patients and staff behave properly in the critical moments of a disaster, for the sake of improved safety and efficiency.

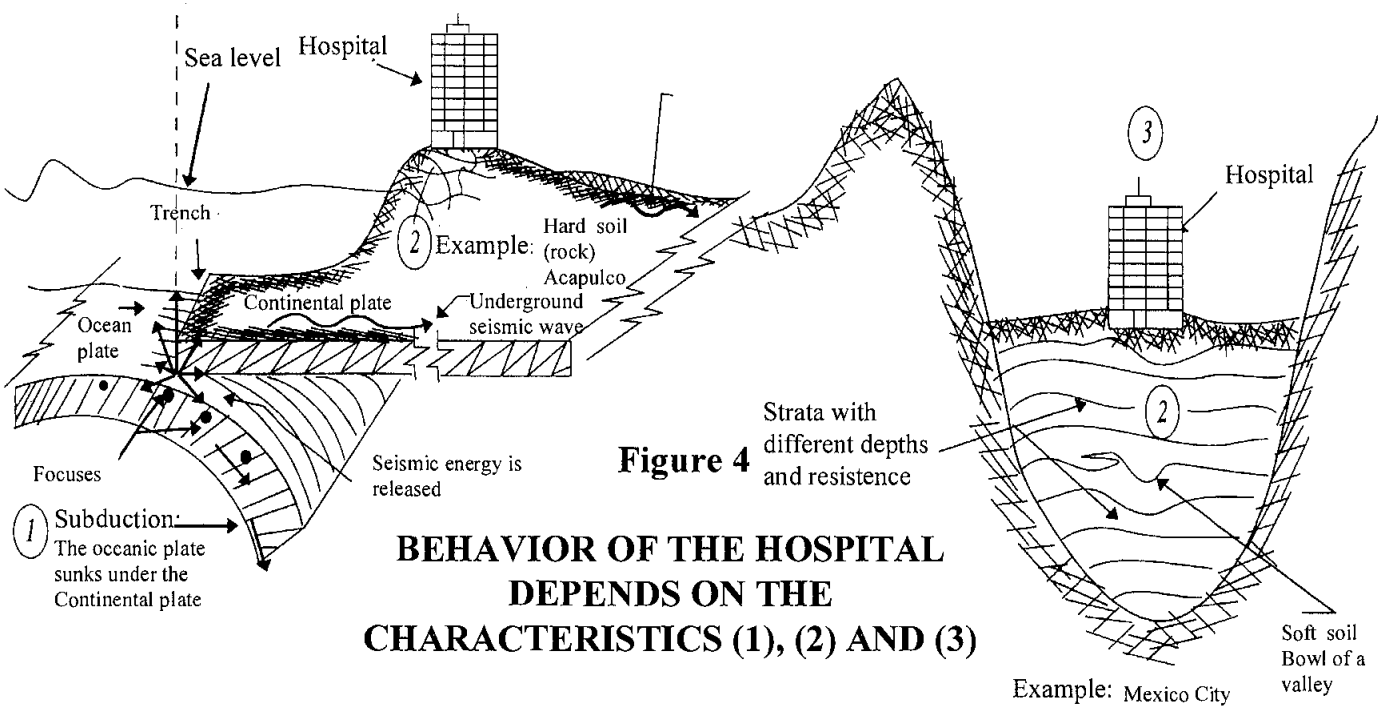

Figure 4

BEHAVIOR OF THE HOSPITAL DEPENDS ON THE CHARACTERISTICS (1), (2) AND (3)

(1) SEISMIC TRIGGER

* LENGHT OF RUPTURE OF PLATES
* DEPTH OF RUPTURE
* INCLINATION ANGLE OF THE OCEAN PLATE
* HARDNESS OF PLATES
* ELASTIC CHARACTERISTICS OF PLATES, AMONG OTHERS

(2) PLACE OF LOCATION

* EPICENTER DISTANCE
* HARD OR SOFT SOIL
* CHARACTERISTICS OF THE BASIN: DEPTH, FORM OF BOTTOM, DIMENSIONS
* WATER CONTENT IN SOIL, ETC.

(3) TYPE OF STRUCTURE

* RIGID OR FLEXIBLE
* IN CORNER, OR NOT
* SYMETRIC, OR NOT
* HIGH OR LOW
*. SLIM, OR NOT
* MASS VOLUME
* FORM IN PLANT, AND OTHER

Le Royal L.P. Ensayo. *Sismología y Comportamiento estructural.*

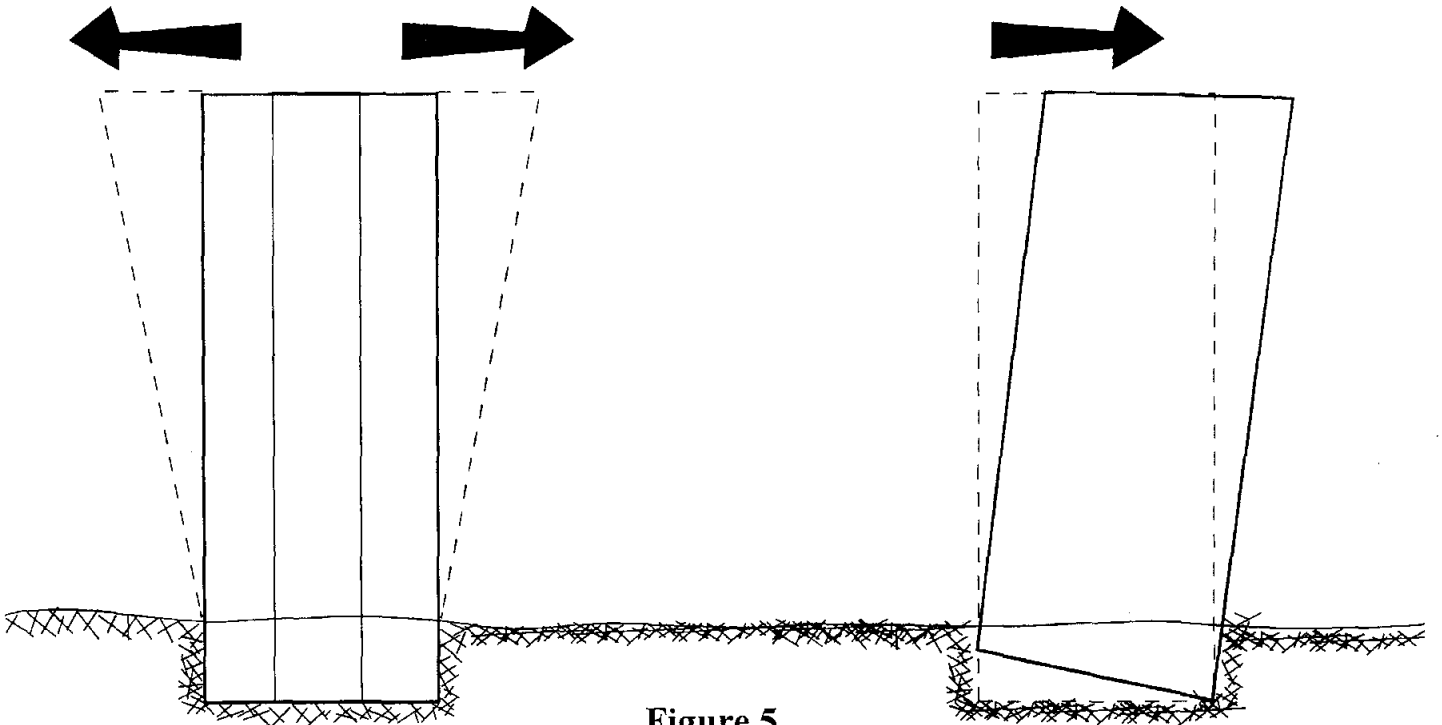

Figure 5

ELASTIC BEHAVIOR OF A HOSPITAL

After oscillation of its elements, the system recovers from deformations

INELASTIC BEHAVIOR OF A HOSPITAL

After oscillation, the structure is deformed; it doesn't recover the original position, neither falls.

Le Royal L.P. Ensayo. *Sismología y Comportamiento estructural.*

FORMS IN WHICH A WELL DESIGNED HOSPITAL DISSIPATES THE RECEIVED SEISMIC ENERGY
(Design Philosophy)

NOTE: "A hospital can be affected structurally by earthquakes, but never fall"

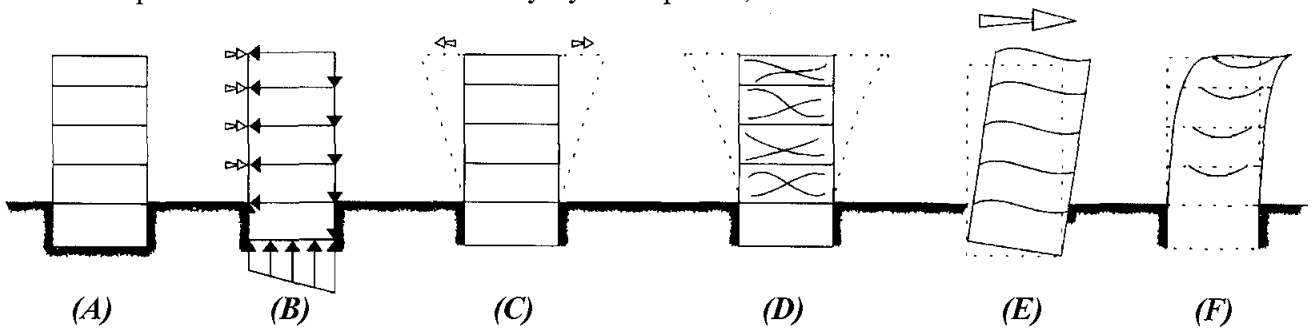

Figure 6

MECHANISM OF SEISMIC ENERGY DISSIPATION

(A) HOSPITAL WITHOUT SEISMIC EXCITATION

(B) THE HOSPITAL RESISTS THE FIRST VIBRATORY SEISMIC WAVES

(C) AFTER, THE STRUCTURE STARTS OSCILLATING SLOWLY, THUS THE SEISMIC ENERGY IS DISSIPATED, WITHOUT PERMANENT DEFORMATIONS

(D) WHEN THE EARTHQUAKE CONTINUES, OSCILLATIONS ARE SO WIDE THAT DAMAGE FINISHINGS AND CRACK THE DIVISORY WALLS. THE MOST AFFECTED ZONE IS THE ELEVATOR CUBE AND STAIRS. THUS, A BIG PART OF SEISMIC ENERGY IS DISSIPATED

(E) IF THE EARTHQUAKE CONTINUES, THE STRUCTURE IS SO DEFORMED BY DISSIPATING ENERGY THAT DEFORMATIONS ARE PERMANENT

Le Royal L.P. Ensayo. *Sismología y Comportamiento estructural.*

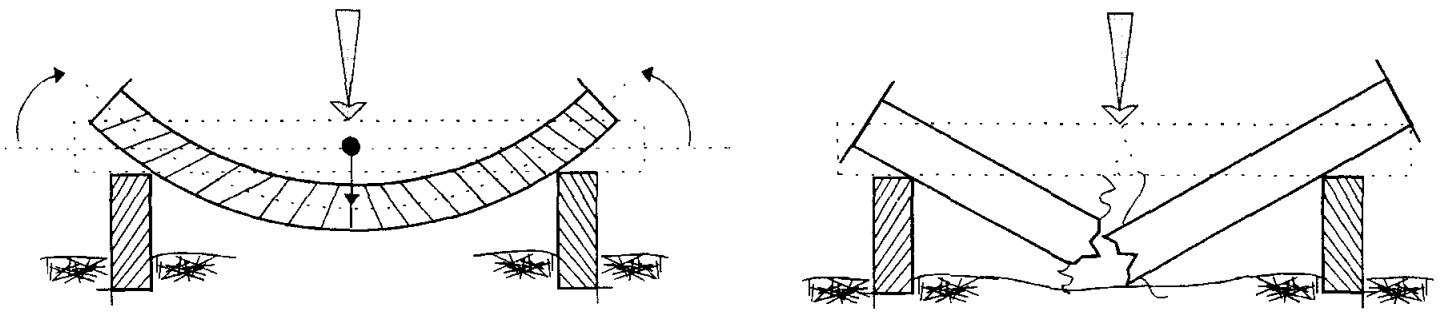

Figure 7

DUCTILE FAILURE

EXAMPLE: A plastic bar is very deformed before breaking; it warns that is in trouble

FRAGILE FAILURE

EXAMPLE: A piece of chalk is broken suddenly without perceiving deformations. It doesn't warn to be in trouble.

Le Royal L.P. Ensayo. *Sismología y Comportamiento estructural.*

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CHAPTER VI

A MODEL FOR MAKING A HOSPITAL PLAN IN CASE OF DISASTER

In a major emergency or catastrophe situation, be it of natural or technologic origin, or derived from social violence, the immediate priority is aimed at saving lives by aiding the victims. To this end, the core of the systematized help in the health sector is located first on the emergency health care, where hospitals play a vital role.

Caring for many victims poses important organization problems in countries where emergency services are poor and not well coordinated. On the other hand, well structured hospitals not necessarily mean to be prepared to respond satisfactorily in major emergency situations, if they have not been equipped to that end.

Due to the demographic, geologic, topographic, and hydrometeorologic characteristics, and the industrial and social development, each city, town or community is faced to the occurrence of different disasters. The health services infrastructure can also show significant variables. Therefore, the described model tries to offer general guidelines to make the hospital preparations program in case of disaster with the necessary flexibility and according to the operation reality. It is desirable that the management and staff in each medical unit, acting as a committee, succeed in making their program "tailor-made", having in mind the likely risks to face, with the present staff and resources integrated functionally in a regional context and approached interinstitutionally and intersectorally.

DESIGN

The program must be based on the institutional experience related to the area, and guidelines and general concepts of international organizations and national bodies are incorporated. The aim must be to give the disaster victims whole medical care through unified medico-technical criteria, and to promote education and research on the matter.

The design must have in mind accurately determined functions, attributes and actions, as well as assignment of responsibilities to the health care staff, which will systematize, order and encourage the whole health care.

Its action and command guidelines must include hospital units on a regional basis, integrated into the National Health and Civilian Protection System.

Its application will be based on four essential functions:

- The first is preventive, tending to decrease risks and to mitigate likely damages to the population, the staff and the properties of the institution,
- The second is directed to provide with whole health care those who require it in a reference and counter-reference system of patients.
- The following two are aimed, the first at improving training and staff development systems in case of disaster, and the second at promoting medical research on the matter.

The plan design will consider an organized sequence of actions, made by the staff coordinated by the management, previously trained and knowing accurately their functions, which must be contained and resumed in a consultation document named "**action card**". Such card is a simplified and useful guide which records the actions to be fully performed by the management and coordinating staff in order to avoid important omissions in the plan implementation. The **action cards** must be a valuable instrument at the time of the disaster since they show clearly and succinctly the actions to be performed by the staff to which they are directed, usually a service head located in the official organizational chart of the hospital, in order to launch efficient actions, thus avoiding double functions in the whole care for disaster victims. The cards must be visible in the places where the involved work (it is suggested to place them behind the door in each office).

Pre-hospital actions will be carried out by the public and private rescue services and, in general, by the solidary civilian population which gets involved in these situations. The voluntary groups in the neighborhood will be credited based on the staff training, resources and equipment available according to the regulations. It is very important to coordinate and harmonize suitably the hospital and such bodies, in order to get the best pre-hospital response and, hence, the best use of the resources available at the moment.

The plan must be split in two main sections: the **external plan** and the **internal plan**.

EXTERNAL PLAN

It is divided into the above mentioned functions, with their **attributes, activities and actions**.

Function 1

To perform actions before the disaster in order to decrease risks and to prevent health injuries.

Attributes: It is directed to diminish and mitigate the impact of disasters on the public health.

Activities: To know the geographic environment of the hospital to identify its population and risks to which it is exposed.

Actions:

- To identify on a plan of the area the main communication ways to the hospital, as well as the alternatives if destroyed.

- To locate geographically by colors the hospitals in the region, according to their decision capacity in order to determine the reference and counter-reference systems in case of external disaster.

- To decide on the location of public and private services in the region which can support the plan, if required.

- To locate on the same plan the chemical plants, oil reservoirs, nuclear plants, airports, highways, rivers and others, which are a potential risk of disaster in the region.

- To perform periodical coordination and harmonization actions with the public, social and private sectors, located in the geographic environment of the hospital.

Activity: To perform actions in which the health care staff makes plans and organizes training, selects physical areas and material resources likely to be used in case of external disaster.

Actions:

- To identify and mark the physical areas which must be adapted to be used in case of external disaster.

  - Triage area at the entrance of the urgency service.

    - Area assigned to place the patients rated as red and yellow.

  - Area close to the urgency service for green patients.

    - Outpatient area.

    - Consultation rooms, corridors and waiting rooms.

    - Plaster, cures and sutures

- Intensive care unit

  - Discharges based on the medical criterion

  - Increased amount of beds

- Operating room

  - To suspend programmed surgical operations

  - To enlarge the Pre-operation and Post-operation areas

- Hospitalization

  - Discharges based on the medical criterion

  - Increased amount of beds

- Control and Command Center (it is recommended to locate it at the office of the subdirector)

- Auxiliary services

  - To suspend programmed studies

- To perform actions which allow to have the resources essential to medical care for the mass victims, according to previously defined lists.

- To establish the measures leading to have the suitable communication systems, in order to have the hospital in permanent touch with: the Command Center, the authorities and members of the National Health and Civilian Protection System.

- To list the health staff with management and coordination duties which acts in case of external disaster, through action cards.

- To establish programs for the rational use of resources.

Activity: To apply strategies leading to introduce and inform about the preventive program.

- To design and make periodically production laboratories with the health care staff, in order to perform the teaching-learning process of this module.

- Supported by the authorities, to design and make periodically medical care simulations in external disasters.

Function 2

The hospital program is activated in face of an external disaster.

Activity: To establish opportunely and efficiently the activation mechanisms of the program.

Actions:

- **Alert:** As soon as an external disaster is informed, the Director or the person in charge of the hospital in that moment will collect the following data:

  - Type of disaster.
  - Place.
  - Time when occurred.
  - Type and number of victims.
  - Identification and telephones of the informer.
  - Time when the report was received.
  - The information must be checked by telephone

- **Alert to the staff:** It is expected that the response be organized and only from the required staff, according to the disaster size.

- **Meetings for the decision-making:** the Director or the person in charge at the moment of the disaster will join the governing body in the urgency area to standardize criteria and actions to be taken, according to external disaster care program of the hospital.

- **To activate the control center:** Immediately after, it will be located in the area having the most efficient communications. Usually it is established at the hospital director's office, and must be supported by the medical and administrative underdirector's offices, the medical education and maintenance department.

Activity: To determine the type of hospital response which makes an action proportional to the disaster size.

Action:

This response is divided into three phases:

1. Phase I
2. Phase II
3. Phase III

Phase I

It will be used when the disaster size and the number of victims doesn't exceed the urgency capacity. The staff must be informed, and the responsible for the service must be identified to perform their duties according to the corresponding action cards. Injury care **binomials** -one doctor and one nurse- must be formed to attend at a time only one patient, until stabilization or transfer to definitive care.

To triage previously admitted patients, whose quick and suitable mobilization is supervised.

To immediately prepare the areas of care for the victims by priorities (triage), in urgencies mainly for red and yellow patients.

To triage on this level, a **Triage officer** will be appointed who will be responsible for the triage before the victims are admitted to the urgency service. To this end, experienced and judicious doctors are required. Ideally, the staff credited in the ATLS (Advanced Trauma Life Support) course is considered. Each of such doctors must be in charge of only five binomials, in order to get a suitable coordination in the urgency area and its extension as service during the disaster care. The integration of the physical areas of disaster care must be divided into three sections: Area of cardiopulmonary reanimation or shock, area of immediate care, and area of expectant treatment.

Area of cardiopulmonary reanimation

It will attend the first priority patients. It must be the best equipped ward in the service, and will have among other things: Oxygen and suction intakes, monitors and defibrillators, fans, material and medico-surgical equipment. The equipment and materials will be furnished by a nurse exclusively devoted to this task.

Area of immediate care

It will attend the semi-critical second priority patients, which will require a minimal handling to maintain their physical stability before they are delivered to definitive treatment.

Area of expectant treatment

It will attend the third priority patients, namely those having minor injuries, or those being critically injured.

It is suggested to handle two separated areas and to place them as expansion zones of the urgency service (waiting rooms, corridors, and physical medicine, among others). They must be conditioned with stretchers, oxygen cylinder with gauge, portable vacuum cleaners, monitors, blood pressure kits, red car and a post of material and equipment reprovisioning.

Phase II

It will be used when the response capacity of the urgency service is exceeded, and the support of other hospital health care services is required.

All those actions of phase I are included. Responsibles for the medical care services supporting that of urgencies must be identified to perform their duties according to the corresponding action cards.

Services involved in this alert are: Operating rooms, intensive care unit, hospitalization, laboratory, blood bank, X-ray and equipment and sterilization central.

The different areas will be immediately activated as follows:

Operating room:

- To suspend all programmed operation, to return the patients to hospitalization, and to assess discharges to home, in order to have the most of beds. To request support from extra staff, both doctors and nurses.

- To call for support from domestic services personnel in order to keep the rooms best used and the least waiting between interventions.

- To increase the number of stretchers and personnel in pre- and post-operation handling areas.

- To keep communication with the urgency service to support in surgical needs, if required.

Intensive care unit

- To assess the admitted patients for transfer to ward, and to increase the available beds in this area.
- To call for support from the maintenance unit in order to keep perfectly the equipments during the emergencies.
- To be communicated with the emergency service to give opportune support.

Hospitalization

- To re-assess the admitted patients in order to discharge, under the strict medical criterion, the greatest number of them, and to increase the available beds for the victims coming from the urgency service.
- To assess the possibility of expanded number of beds within the physical area.
- To assess periodically the patients arrived from the disaster.

X-ray

- To suspend the attention to programmed patients.
- To support permanently the urgency service.
- To request the necessary extra inputs.
- To request extra personnel if necessary.

Laboratory and Blood Bank

- To suspend the normal activities.
- The staff will support directly the urgency service in taking the samples and processing the results.
- The necessary extra inputs will be requested.
- The communication with the urgency service will be kept.

Equipment and sterilization central

- It will provide the urgency service and the laboratories with the necessary instruments and equipment.
- It will request the support from extra personnel in order to maintain the response level required by the emergency.

Phase III

It will be used when the type of disaster and the number of victims require the total response from the unit. Even the support from other hospitals can be requested.

Those actions of phase I and phase II are included. Responsibles for all the services and departments of the unit will be present at the command center to receive instructions and to inform immediately their staff on the activities to perform. Substantive activities for the following services are:

Maintenance

- It will support the critical areas by assigning personnel which will solve immediately the problems.

- It will keep in working condition the power house, in order to guarantee enough fluids and power.

- It will request the necessary inputs.

Administrative Underdirection

- It will support the actions directed to quickly adapt the areas of urgency extension.

- It will demand the personnel department to locate the service providers likely to support the areas in need.

- It will coordinate a suitable supply flow to the critical areas with the general services.

- It will provide staff depending on the absenteeism and the extra needs informed by each area in the disaster care.

- It will provide stock goods, if necessary

- It will provide cash to cover the needs arisen.

Social Worker

- It will record the admission of victims, and will keep the medical report updated, as well as the location and destination of victims, in order to inform the relatives periodically.

- It will be coordinated with the medical staff and medical assistance, in order to expedite the procedures of hospitalization, transfer, discharges of the victims, and handling of the deceased.

- In the hospitalization areas, it will handle and expedite the discharges, according to medical order, and will inform the urgency service and the command center on the number of available beds.

Medical assistant

- He(she) will expedite the movement of patients previously admitted in the urgency and hospitalization areas by medical order.

- He(she) will record the admitted patients, and will keep the patient census updated.

- He(she) will keep the relatives informed on the victim's health condition and location.

Supply

- It will provide opportunely the inputs required by each area: Cure materials, medicines, oxygen, spare parts, among others).

Vigilance

- It will control the entrance and exit of persons and vehicles through the accesses permitted in this phase of disaster care.

- It will keep a strict exit control of all the institutional goods.

- It will reinforce the vigilance in medical care areas

- It will request, authorized by the Director or the responsible at that moment, support from the public security agencies, in case that internal security should be increased and the traffic in areas of emergency vehicles access should be eased.

Dietology Department

- It will assess the need for increased rations to cover the patient's diets and the extra meals required for the staff at work.

It must be emphasized to establish and maintain and efficient coordination system between the hospital areas involved in the care for disaster victims and the central command. It is also very important the hospital coordination with the authorities of the relevant institution, which will be informed opportunely on the initial situation and periodically on the evolution of the disaster care. The pertaining formats will be unified with the sector's hospitals in order to facilitate the task, in addition to fulfill the requirements issued by the National Health and Civilian Protection System.

On this score, the main actions are:

- To establish communication with the different hospitals being able to support the unit's actions, in face of the demand for disaster-related health care.

- Such hospitals must be previously rated according to their decision capacity and operation level in case of disaster (color codes), in order to facilitate the reference and counter-reference of patients.

Actions after the external disaster

The response to an emergency situation must include plans and programs for the quickest return to normality. Following are some actions to be emphasized:

To keep permanent communication between the command center and the reference and counter-reference hospitals, and between the unit's director and the staff.

To identify, organize and distribute the extra help requested and not used.

- With the participation of the unit's governing body, to make a detailed report to the institutional authorities.

- With the participation of the hospital governing body, to assess the application of the hospital plan for external disaster care: virtues are identified and the detected deviations are corrected.

INTERNAL PLAN

Like the external plan, it is divided into the four functions described in the beginning of this chapter. There, attributes, activities and actions of the internal disaster response plan are integrated.

Function 1

To perform preventive actions in order to rise the health level, to decrease risks, and to prevent health injuries in case of internal disaster.

Attributes: They are directed to alleviate and mitigate the impact of internal disasters on health.

Activity: To know the geographic environment of the hospital in order to facilitate medical care services and evacuation of patients and disaster victims.

Actions:

- To identify on a chart of the region the main communication ways of the hospital, as well as the alternate ways in case of obstruction or destruction of the former.

- To locate geographically by colors the hospitals in the region, according to their decision capacity, as well as to determine the patient's reference and counter-reference systems, if required.

- To identify where the public and private services in the region likely to support the plan are located.

- To identify on the same chart the chemical plants, oil reservoirs, nuclear plants, airports, highways, rivers and others, which are a potential risk of disaster in the hospital.

- To define alternate sources of water, light, food, clothes, medicines and medicinal gases supplies

- To perform periodical coordination and harmonization actions with the public, social and private sectors, located in the geographic environment of the hospital.

Activity: To know the hospital vulnerability from the structural and non-structural viewpoint, in order to establish the suitable safety measures for the patients, visitors, staff and properties protection.

Actions:

- To describe the structural and architectural characteristics of the hospital, as well as those of alternate supply sources, like the cistern capacity, autonomy of the light and power plant, among others.

- To identify in each hospital area the risk and safety zones, inside and outside the hospital.

- To design and mark clearly by zones the evacuation routes and the emergency exits.

- To locate and mark the safety equipments in case of disaster.

Activity: To perform activities by which the health care staff plans, organizes and selects the physical areas and the material resources likely to be used in case of internal disaster.

Actions:

- To identify the safest areas in the hospital to be used in case of internal disaster and to locate temporarily the services (urgencies, control center, admission of regular patients).

- Parking yards, open areas, gardens, closed areas in the hospital.

- To perform actions which allow to have the resources essential to rescue, to give first aid and to evacuate internal disaster victims according to the check list.

- To establish measures leading to have the internal and external communication systems which allow the hospital to send out alert signals and to keep a permanent communication with the necessary agencies.

Internal	External
- Loudspeaker	- Radio
- Ring battery-powered	- Telephone
- Siren	- Matra (Radiotelephony)

- To link the health staff with the management and coordination functions acting in case of internal disaster, according to action cards.

- To establish programs for the best use of the resources.

- To establish public health programs.

Activity: To perform strategies aimed at introducing and informing on the preventive model of the hospital response plan in front of internal disasters.

Actions:

- To design and make periodically production workshops with the health care staff, in order to make concrete and consolidate the teaching-learning process of the Plan.

- To design and make once a year an evacuation drill in case of internal disaster.

Function 2

Activation of the Hospital Plan in face of an internal disaster.

Attribute: It is directed to obtain an efficient and opportune response from the health care staff, with regard to protect the integrity of patients, visitors, staff, institutional and workers goods

Activity: To establish the activation mechanisms of the internal disaster plan, in order to give the internal disaster victims the whole medical care with warm quality, and equity.

Actions:

Alert Signal. As soon as information on an internal disaster is received, the following data must be collected:

- Type of disaster, time at which started, and number of the persons involved.
- The obtained information must be checked immediately before any action is taken.
- To perform actions to alert the staff, so that the response is organized only with the required staff, depending on the disaster size.
- The Director or the person in charge of the unit in that moment will be the responsible for activating the plan. The type of response must be offered based on the actual extent of the damages.

- To locate the "control center" in an area having safety measures for the support staff there joined, which preferably must be the hospital director, the medical and administrative underdirectors, the nursing, medical education, and maintenance heads.
- If possible, this place will be efficiently communicated with the inside and the outside of the hospital, in addition to basic services.
- To join the governing body in the control center to standardize criteria and actions according to the internal plan.

Activity: To know the different alerts and codes likely to occur in the hospital unit, and the way to inform the health staff.

Red code	= fire
Yellow code	= evacuation
Blue code	= human violence
Green code	= acute disease

The general functions of each code will be described, and their most important actions will be detailed as follows.

Red code

This code will be used when fire is identified in any part of the hospital.

Yellow code

It shows the need for evacuating a service, an area or the whole hospital. The evacuation can be:

- Partial horizontal: when only part of one floor is cleared
- Total horizontal: when all the floor is cleared
- Vertical: when several floors are evacuated
- Total: when all the hospital must be evacuated

Blue code

It means human violence, which can occur as: threat of bomb, physical aggression inside the unit, or mass external aggressive demonstration.

Green code

It indicates the presence of an acute disease in some hospital visitor, admitted patients, or the very staff, which endangers imminently the life, as in the case of severe attack to the myocardium, among others.

Notification of code

Actions:

- After the authorization of the Director or the person in charge of the hospital at that moment, the corresponding code will be informed by the speaker system, twice repeated.

  Example:

  Red code.....second floor
  Red code.....second floor

  When the problem is solved, and after the authorization of the person in charge of the hospital at that moment, it will be informed by the speaker system:

  Red code.....second floor.....Solved
  Red code.....second floor.....Solved

Sound codes:

These can be a ring, buzzer or siren, which must be battery powered, and only will be used when the electric power is affected.

They must be used exclusively in case of total evacuation, and will be indicated ringing three times for three seconds.

Example:

....
3 sec. 3 sec. 3 sec.
....
3 sec. 3 sec. 3 sec.
....
3 sec. 3 sec. 3 sec.

In case that the alert signal is made by mechanic siren, the sound of the latter will continuous and will last 30 seconds, repeated three times.

The type of response given by the hospital depending on the disaster size must be identified, and will be divided into three phases:

Phase I	: Local internal alert, or in one service
Phase II	: Internal alert in two or more services
Phase III	: Internal alert in all the hospital

Phase I: Local internal alert, or in one service, will indicate that it is confined in only one service and doesn't interfere the usual functions of the hospital.

Phase II: Internal alert in two or more services will indicate that functions in such areas are affected and that staff there appointed will require the support from specific brigades, while the rest of the services is in alert state.

Phase III: Internal alert in all the hospital will indicate that the usual functions of the hospital are totally restrained, and the support from all the unit's staff and its brigades is necessary to perform specific actions in favor of the patients and visitors' integrity, as well as the staff in order to evacuate the building in an orderly way. The responsible for the hospital at the moment will assess the need for external support.

Activity: To integrate brigades

Brigades to be integrated by the hospital staff are:

Fire and fluid and energy control brigade
Evacuation brigade
Safety brigade
Basic life support brigade

Fire brigade

Must be commanded by the Maintenance Service Head, and will be formed at least by ten men, in the different shifts, including the special shifts and holidays. During the brigade training, any member of the staff can join the brigade, after the authorization of the immediately higher head of the worker.

Duties of the fire and fluid and energy control brigade responsible are, among others:

- To check the suitable location of the fire equipment, its periodical inspection, and maintenance.
- To participate and get the best trained brigade in all the shifts.
- To collaborate in the suitable location of the safety signals, and to reinforce all the fire prevention actions.
- To supervise periodically that flammable substances are not stored in unauthorized areas of the building.
- To corroborate that the electric supply is disconnected immediately in the emergency area.
- To check that the water pump, designed to be used in case of fire, in permanently in working conditions.

Evacuation brigade

It will be formed at least by two persons from each floor or service, which must know the safest evacuation routes according to the Internal Plan. Among other activities, they must corroborate that all the persons are out of the affected zone at the end of each evacuation.

- It will clear the affected area in the best orderly way. To this end, it will make that patients able to walk and visitors form a row and, joining hands, are guided by a staff member at the beginning of the row and other at the end.
- Patients unable to walk will be evacuated by the brigade or by the previously trained domestic services personnel, who will use manual transportation methods like only one assistant (to lift with arms, human support, dragging, etc.) or two assistants (to make a seat with two or three arms, human stretcher, etc.), and those using stretchers with two assistants (the minimum for short distances), thus giving safety, stability, speed and observation of the evacuation routes marked in the plan during the transfer.
- Evacuation will be carried out by priorities: In the first place the most grave patients in critical areas of the hospital. In case of fire, patients nearer to the doors will be evacuated, trying to keep them as closest as possible to the floor in order to avoid smoke intoxication.

- It will check that nobody is left in the affected area, before leaving the place.
- Patients must be carried to the safety zones previously assigned in the internal plan.
- It will keep informed the command center on the actions carried out.

Safety brigade

It will be formed by men, and will be supported by the vigilance personnel, as well as the domestic services personnel when required, having as duty to provide the patients, visitors and hospital workers with safety at the moment of disaster. It will be commanded by the Administrative Underdirector or the Administrator.

Basic life support brigade

It will be made of binomials formed by one doctor and one nurse, preferably located in all the floors and services of the hospital. Such staff must be credited in the corresponding courses. It must also act when support to the triage areas is required.

Actions after the internal disaster

- To know the hospital conditions after the disaster in order to keep on giving attention, or to advise that a temporary or definitive evacuation is needed.
- To identify the requirements for the patients' transfer when a total evacuation from the building is carried out to the hospital's open areas, and to make the later transfer according to reference and counter-reference system of patients in the internal plan.
- To write the necessary reports to be delivered to the authorities, according to provisions in the National Health and Civilian Protection System.
- To make the evaluation workshop with the hospital governing body to analyze and assess the application of the internal plan, and to make he necessary adjustments for its best working.

Function 3

- To train and develop the health care staff in case of disaster.
- To promote the health education programs for the hospital staff, in damage prevention and decreased risks programs.
- To credit the greatest number of courses taught by the Committee on Trauma of the American College of Surgeons (Advanced Trauma Life Support - ATLS- and Pre-Hospital Trauma Life Support - PHTLS).

Function 4

- To make medical research on disaster situations.
- To promote and encourage the development of medical research projects on disasters, aimed at the solution of problems related to injury prevention, decreased risks and increased health level of the community.
- Such promotion should be constant and on the three operation levels, and the contents will cover epidemiological, preventive and damage mitigation aspects, as well as the simplified victim care measures and other items which will be treated in chapter VII of this book.

SIMULATIONS

In spite that natural and man-made disasters have killed thousands in Mexico, the prevention attitude is not part of our daily life yet. Accident prevention and the opportune and efficient response in case of disaster, have been isolated behaviors promoted after the occurrence of the catastrophe, but soon forgotten.

This prevention and safety culture begins to make us aware of the need to invest time, money and trained staff on the above mentioned requirements, the

only way to decrease the negative effects of disasters on lives and goods of the community (*1*).

It is a basic duty of the medical area to promote such culture, not only to give our staff and properties more safety, but also to extend it to the community involved in the environment of medical units.

Simulations are a substantial part in the development of the disaster culture. They are the best way for the personnel, together with users in the medical unit, to practice the activities envisaged to perform a simulated action, thus the right response habits being generated and consolidated. Simulations are the best way to check plans, keep them updated, and detect mistakes or omissions which otherwise would be unnoticed.

The main objectives in the theoretical, practical and repetition training are:

1) To train the hospital staff to respond in face of a disaster.

2) To detect mistakes or failures existing on the plans of emergency response.

3) To get the least time required to put the hospital in working condition.

The new organization and coordination of a simulation must be aimed at this: every participant should know the role and activities to be performed, in order to consolidate the habits and the right response actions.

It is important not only the individual or collective response, but also the sound knowledge on the handling of prevention and assistance equipment for personal fire protection (fire extinguishers, hydrants, etc.), tools essential in the real or fake actions (*2*).

The word **Simulation** refers to the use and development of a model, which is the theoretical representation of a reality. In activities charged to the hospital, a simulation is the representation of an emergency caused by the impact of one

or more disturbing phenomena under pre-established conditions and times, and which, for the sake of the care and physical integrity of the users, constrain to take specific measures in each situation, even the unit evacuation (*2*).

Types of Simulation

Three types are identified: Programmed, unexpected, and on duty.

Programmed. Participants know their relationship, and the procedures. They must practice before the actual implementation.

Within this kind of simulation, the **Cabinet Simulation** is performed in the class room by the responsibles for its implementation in the medical unit. The whole team must participate in order to be informed on the actions to be taken by each one, while the likely alternatives are indicated in case of changes in the emergency situation.

There will be a questions and answers panel, in order that everybody is informed on the actions corresponding to the different internal response teams (3).

Unexpected. The medical unit staff doesn't know that it will be performed, and is informed at the moment of execution. It supposes that participants should know the actions established in the hospital plan for disasters. **It must not be performed if previously programmed simulations have not been carried out.**

On duty. This simulation must be performed only when the unit elements have made several programmed or unexpected simulations, and the staff is well trained.

The suitable trained hospital is selected as care center when mass accidents occur.

This is the moment to really evaluate the training received by the hospital staff (*2*).

In order to actually make a suitable and systematized knowledge of the actions to be performed during a simulation or in fact, simulations must be performed periodically. Therefore, it is suggested to perform:

- One each month, if the medical unit is located in high risk zone.

- One every three months, if it is located in medium risk zone.

- One every six months in low risk zones (*3*).

Structure of the simulation. Structuring a simulation will take into account the following:

- Planning
- Coordination
- Implementation
- Evaluation

The work must be done jointly with the management of the unit, the workers in the different shifts, the union representatives, and the authorities both institutional and civilian (police, firemen, civilian protection, rescue corps, etc.)

Planning. It is essential to design and plan a scenario, namely the set of hypothesis on the moment, phenomena, conditions, and place where the disaster would occur. It must be the most similar to reality, having into account the previous experiences.

Basic items are:

1.- To establish the objectives of the drill.

2.- To determine exactly the location, furniture condition, control panels of electric facilities, etc.

3.- To determine the safety zones where the staff, patients and visitors must head at the end of the drill.

4.- To establish spaces for the assignment of safety areas according to the location of emergency exits.

5.- To propose types and location of alarm systems, and the suitable signposting of evacuation routes and risk zones.

6.- To mark the evacuation priorities: (*5*)

a) Persons (minor, disabled, women, men)

b) Materials, which are divided into three groups:

- Dangerous
Which can provoke major destructive risk (oxygen tanks, fuel, anesthetic gas, etc.)

- Useful in emergencies
(instruments, portable fans, electrocardiographs, etc.)

- Documents, securities, and previously classified material which can't be replaced.

7.- To indicate the type of evacuation to be performed:
a) Horizontal partial evacuation
b) Horizontal total evacuation
c) Vertical evacuation

Coordination. It is the communication with the staff involved, so that it is informed on the actions to be performed during the simulation.

1.- To appoint the clinic department heads involved as coordinators or brigade heads.

2.- To emphasize -the coordinator to the department heads- the need to be organized and cooperate in the actions inherent in the simulation, in order to plan the staff, patients, and visitors participation.

3.- To propose that brigades are formed with the staff suitable to the brigade duty.

4.- To talk with the staff about the project, in order to be interested and to facilitate support.

5.- To appoint, among the organizers, those suitable to different tasks like:

- To make surveys on the knowledge degree and activity of the staff, patients, visitors and neighbors of the unit, about subjects like disaster type, in order to get real statistical data on their attitude.

- To prepare and lecture in the unit or selected areas on disasters and how to prevent them.

- To organize talks aimed at sensitizing the staff on evacuation drills.

- To show the staff audiovisual material related to disasters and place evacuation.

- To inform the staff on the existence of different information formats for the fixed and floating population in the unit, as well as on the need for a good handling before and after any contingency, be it fake or true.

- To make posters having preventive information on the drill, which will be placed on the areas to be evacuated.

- To design information leaflets and fliers to be distributed among the unit users.

- To place the necessary signals.

- To prepare information on the actions to be performed by brigades in case of evacuation.

- To check the free passage by emergency exits for their best use.

- To coordinate evacuation, by taking part in the drill and cooperating in all the aspects.

- To train simulators (unit users preferably) when the practice is meant to be as real as possible.

- To inform those living around the hospital, as well as the competent authorities and rescue corps in the influence area, on the date and time of the simulation.

- To evaluate the drill and make conclusions.

Implementation. To prepare a time chart for the development of activities.

Example:

——— Day. Surveys are carried out.

——— Day. Survey data are collected and results are obtained.

——— Day. Talk with coordinators of the areas to be evacuated.

——— Day. Talk with staff.

——— Day. The required signals are placed. Written information on the event and plan to be followed by brigade heads.

——— Day. (Before the simulation.) To distribute information fliers to the staff, patients and visitors.

——— (Time) Preparations for the filming.

——— (Time) The alarm system is activated and the event is timed.

——— (Time) Brigades are activated.

——— (Time) End of the evacuation drill and registered time.

Evaluation. The simulation evaluation allows to assess the development and results of the former. It must be aimed mainly at checking:

1.- If the organization measures considered in the plan were fulfilled regarding time and form.

2.- If care in the disaster zone was suitable and efficient.

3.- If transfer of staff, patients and visitors to safety zones was carried out having all the necessary supports.

In the actions of the hospital simulation in case of evacuation, the following must be taken into account:

1.- Working of the systems in general.

2.- Staff performance.

3.- Participation of external support.

4.- Participation of patients and visitors.

5.- Advertising of the event.

Considering these parameters, the following factors will be evaluated more specifically:

I.- Working of the systems

1) Hypothesis and scenario

Do the situations and scenario deserved the evacuation?

Was the scenario according to the type of disaster?

2) Alarm systems

Were there responsibles for its activation?

Were it activated opportunely?

Was it heard or seen by all the community present at the unit?

Was the alarm which in fact activated the simulation actions?

3) Evacuation routes

Were they suitable?

Were there obstacles on them?

4) Signposting

Was it suitable?

5) Equipment

Did it work and was enough for the emergency care?

6) Evacuation procedure

Was it according to the evacuation needs?
(Areas, floors, and number of evacuated persons are considered)

7) Traffic standards

Were they respected?

Was the traffic jammed?

Were the traffic areas free for the brigade members?

8) Clearance time

- Assessment of the estimated time and the real time of evacuation.

- Times are compared to those recorded in earlier simulations.

- Causes of delays are determined.

9) Safety zone

Was it easy the access to such area?

Was its location well signaled?

Was the zone enough signaled?

Did the zone really meet all the safety standards?

II.- Staff performance

1) Performance of the clinic department heads

Did they fulfilled their duties?

Did they make the more suitable decisions?

Did they have control over the brigade members and users in the safety zone?

2) Performance of the brigade members

Did they follow the instructions issued from the brigade heads?

III.- Participation of external support

Did it come opportunely?

Was it coordinated with the director or the unit responsible?

Was it suitable and necessary?

IV.- Participation of the unit users
(patients and visitors)

Did they fulfill the established standards?

Did they follow the instructions of the floor head or responsible?

Did follow the instructions of the brigade members?

How was their attitude?

V.- Advertising of the event

Was it enough the information to the staff, patients, visitors, observers and invited to the event?

Were the actions there indicated actually performed?

-Extraordinary observations.

We must have in mind that the best plan is not the one already written, but the one already submitted to the evaluation of simulation.

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CHAPTER VII

TRAINING AND MEDICAL RESEARCH IN DISASTERS

Handling disasters must be approached on a multidisciplinary and intersectoral way. In the field of health sciences, three main areas are developed for the curricula in pre-grade and post-grade: the organization and administration area, the medical-sanitary care area, and the research area. All they must face towards the preventive phase, the emergency phase in case of disaster, and the post-emergency or early rehabilitation phase, thus involving the geologic hydrometeorologic, physical-chemical, socio-organizative and technological disasters.

Teaching must be orientated towards the acquisition of knowledge and practices aimed at performing actions in the disaster site and in the field of hospital care. Most doctors are not trained to apply basic life support techniques. They are able to perform the most complex and highest technology operations. They live in the times of laser beams, magnetic resonance, laparoscopic surgery, but in the practice they are unable to apply immediate measures which allow the victims to be stabilized (1). Jointly with the formal training in sophisticated high technology techniques, it must be taught how an airway is permeabilized using basic and advanced operations, how to protect an injured cervical spine, how to initiate the treatment which counteracts the volume loss by hemorrhage, how to transfer patients in a safe way, and how to care for them when carried to the nearest **suitable** hospital.

Teaching must be orientated towards the environment sanitation and the sanitation engineering, with two priorities: to supply water and excreta control, since both become factors which facilitate potentially epidemic diseases, by pollution, or lack of water supply. Simple techniques of how to handle residual chlorine or measures against the water pollution by feces must be taught (*2*).

It is also important to have in mind the element of the epidemiology teaching; that is, the application of the epidemiological method and the instruments offered by this discipline, both in the descriptive phase and in the analytical one, in order that such instruments are applied not only to planning, but also to the operational response and research (*3,4*).

The nutrition and feeding area is not the health sector responsibility with regard to food supply, but it is responsible for watching the nutrition, mainly that of damaged groups and, of course, for designing practical diets which cover the minimal proteincaloric requirements, having in mind the sociocultural habits of the affected population (*5*).

In curricula, logistics and supplies must be taken into account. Doctors know well the use of pharmacology, as well as the nurses and some sanitation instructors. At the moment of an emergency, however, they are unable to estimate amounts of medicines essential to one thousand, five thousand or ten thousand victims, due to the fact that they are familiar with daily prescriptions to only one patient at a time. In case of disaster, persons which cooperate nationwide or worldwide require specifications, for instance on antibiotics permanently demanded: if it is basic or not, if wide spectrum is desirable, its presentation (capsules, powder, syringes), which population covers and for how long (*6, 7*).

Administration of shelters for temporary affected is another very important subject, since it must present another dynamic, another mentality, another strategy different from the emergency administration in the disaster site. Here, primary health care, administrative organization, public health measures and psychological support are blended (*8*).

With regard to the psychological and psychosocial support, doctors, nurses, social workers and communicators, among others, should be informed at least to give early support, and to detect syndromes which can complicate the mental health of the individual. On this score, some instruments have been developed which can be applied by the community workers: they detect early symptoms of anguish and anxiety which allow the professional an early intervention and the group support (*9*).

According to the different experiences in universities and medicine faculties and post-grades, an optional or curricular subject must be introduced; or to

incorporate such subject into social medicine or public health, and make it a course of continuous medical education (*10*).

At international level -Mexico included-, the doctors creditation in courses of the Trauma Committee of the American College of Surgeons like the Advanced Trauma Life Support (ATLS) course and the Pre-Hospital Trauma Life Support (PHTLS) course has been developed. Such courses are aimed mainly at the doctor not attending major trauma cases in the daily practice, and requiring occasionally to evaluate and treat a patient with severe traumatism immediately after the accident (*11*). This concept is basic in disaster situations. For long time these courses have been acknowledged and accepted at international level, since their essential content has been very useful for doctors and technicians in medical emergencies where polytraumatized patients are attended (*12*).

In our country, diffusion of the ATLS course has been a major contribution to standardize criteria among doctors from public and private institutions. Thus, strong links are established between the pre-hospital, hospital and inter-hospital actions: member of this chain speak in fact the same language, since it emphasizes the importance of evaluation and immediate treatment of the polytraumatized patient during the first hour, by starting actions at the very moment in which the accident occurred and immediately after going on with the initial evaluation, vital resuscitation procedures, re-evaluation and stabilization, if required, transfer to other more equipped hospital (*13*). The course includes written examinations before and after, conferences, case presentation, discussions, training in operations able to save lives, practical experience in surgery laboratory, and evaluation of the doctor's competence and updated knowledge. At the end of the course, each doctor must be able to implement and practice the knowledge and expertise acquired for the initial care of the polytraumatized patient. It is desirable that the doctors appointed to the urgency services of health sector institutions are credited in such courses, which will facilitate the best response of the system faced to disasters (*12*).

Disaster research must be focused to three basic points: Characterization of the disaster, short, medium and long term effects on health, and application of

technologies. Some potential research areas are big opportunities for the institutions, namely (*10*):

1.- Efficacy and efficiency of the medical emergency actions. It is important to compare time vs. overlife of the patient. It is known in the practice, but no extensive research exist which proves that the opportunity to act on time has increased the overlife in similar conditions of the injured patient.

2.- To measure the efficacy of search and rescue techniques. For instance: How efficient is the use of trained dogs, sonar, X-ray equipments, fibroscopies to locate victims in the wreckage? No scientific publications are on that matter.

3.- Research protocols on the syndromes of crushing, related to morbidity and mortality rates, must be widened.

4.- To increase research on the psychological effects and social aspects related to disasters.

5.- Survival in patients trapped in wreckage. Cases have been described from the clinical viewpoint, but not from the physiological response criterion. It exists both the group of newborn children and the group of adults, men and women. When trying to explain the survival of children, mass factors, liquid percentage and unawareness are mentioned; in adults, however, trapped several days without the necessary supply of oxygen, water and food, and under stress, it must be investigated which are the physiological factors that allow survival.

6.- Study of water purification and treatment, and early detection of leaks and pollution.

7.- Human behavior in face of an emergency. Behaviors are advised based on standards and previous experiences. When an earthquake occurs, for instance, it is advisable not to go out running, to place oneself under a table, to look for the beam of the door. It must be found out, however, if such norms are performed by the population.

Based on the development of multidisciplinary research, we'll improve our response to disasters.

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CHAPTER VIII

RECOMMENDATIONS

Phenomena causing disasters have always existed, and their potential to destroy the human society has augmented, probably due to the increased population and to the rising unbalance between man and environment.

Harmful effects of the disasters are added to the difficult times of economic and social crisis experienced mainly in Latin America and the Caribbean, a situation whose consequence is retarded development in such countries.

The analysis of the subjects dealt by experts in this book shows that, in the field of disasters, almost everything is to be done. Therefore, the following recommendations are derived:

Strategic planning is the best way to face disasters.

To perform mass campaigns of information directed to the population in general, in order to increase the disaster culture.

To identify the natural and formal leaders in the community, and to train them in the care for disaster situations.

To organize the community's committee for disaster prevention, and to make a plan for disaster care, taking into account the geographic environment and likely risks to which they are submitted.

To train the public servants in the disaster care, and to integrate their participation into the community and pre-hospital attention.

To make plans of regional response to disaster situations in which the community, and the intrasectoral and extra sectoral institutions participate.

To unify medical criteria in the initial treatment of the polytraumatized patient at pre-hospital and hospital level.

To encourage and to participate in programs of International Organizations related to hospital preparations in case of disaster in the Latin American and Caribbean region.

To favor the exchange of knowledge and experiences on hospital preparations for disaster situations in countries of the region.

To increase the preparation and equipment level of hospitals in order to attend a mass number of victims.

To include in the process of hospital creditation in the Latin American and Caribbean countries, to have a plan for internal and external disaster care, and to establish the mechanisms aimed at checking if it exists and is updated.

The plans of hospital preparations must:

- Be supported by the operative capacity of the hospital.
- Be functional and highly flexible.
- Establish clearly the command and authority lines.
- Be part of the regional plan.
- Be continuously updated.
- Forecast internal and external disasters.
- Establish specific activities for the different phases of the disaster.

In order to guarantee an organized, suitable and opportune pre-hospital response, it is required:

- To evaluate the disaster size.
- To standardize in the Health Sector the triage criteria, the international color code, the techniques for assessment of the victim, and the ratings of priority selection.
- To rate the disaster care hospitals according to their decision capacity to attend different types of victims.
- To make a reference and counter-reference system for patients.

- To make disaster care models, and to check if they are useful in simulations.

To design hospitals which meet the construction standards and regulations in force. In order that the unit is reliable, it must comply with the following:

- To be uniformly resistant.
- To have shock absorption properties.
- To have ductility properties.

In the hospital design, both architects, structural engineers and the medical must intervene in order to establish the space and equipment requirements regarding the possibility of total evacuation.

All the hospitals must be checked with regard to their structural and non-structural vulnerability, in order to make those adaptations and remodelations which give the required safety to the staff and the patients.

In the plan, each person in the hospital must be assigned specific duties and responsibilities, which can be easily performed and always available in printed form (the so-called action cards).

The plan must include actions tending to decrease risks and to alleviate damages, to give medical care when required, to promote staff training and development, and to encourage medical research on the matter.

The hospital plans in case of disaster must be made by the management and the operative staff of each unit, based on its reality, available resources and mainly considering the risks to which the unit is exposed and the community which will be attended.

Management of the unit must be part of the hospital committee, in order to have the necessary support and to guarantee a generalized diffusion.

The hospital units must perform periodical simulations (on a six month basis), since this is the best way to check plans and keep them updated.

Universities must include in their curricula of medicine, architecture, engineering, social work, and nursing, among others, the subject of preparations in case of disaster.

Health sector institutions must encourage research on preparations in case of disaster with a multidisciplinary approach.

La Secretaría General de la Conferencia Interamericana de Seguridad Social (CISS), por indicaciones de su Presidente, licenciado Genaro Borrego Estrada, se ha propuesto llevar a cabo un importante programa editorial para cumplir de mejor manera con sus finalidades fundamentales consistentes en recopilar y difundir los avances de la seguridad social.

La Conferencia concentra sus esfuerzos en la publicación de documentos cuyo propósito es lograr una seguridad social eficiente, ante las necesidades sociales, y procurar que su contenido sea de interés general y comprenda una extensa variedad de temas. Su programa editorial responde, por lo tanto, a las demandas constantes de las instituciones de seguridad social del continente, para contar con un mayor número de publicaciones en las que quede constancia y testimonio de los diferentes trabajos que realizan, y a la generación de documentos útiles a las instituciones por parte de los órganos de la CISS, las Subregiones y del Sistema de información de la Seguridad Social Americana. Se publican dos colecciones: monografías de seguridad social de los países representados en las CISS y libros especializados en temas de seguridad social. Queda a las instituciones el compromiso de acentuar su periodicidad mensual, su Revista Seguridad Social, bimestral, y el Atlas de la Seguridad Social Americana, dan respuesta a las mismas demandas institucionales.

La presente publicación forma parte de este programa integral de difusión editorial, que realiza la Secretaría General de la Conferencia Interamericana de Seguridad Social.

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