

Chapter 1

Disasters and Hospitals

Background

A disaster may be defined as an event or occurrence—usually sudden and unexpected—that intensely alters the beings, objects and localities under its influence. It results in loss of life and health in the local population, causes severe environmental damage and the destruction or loss of material goods resulting in a dramatic disruption of normal patterns of life. Such disruption—which may be local, national or even regional in scope—gives rise to the need for immediate intervention and humanitarian aid.

Disasters may be caused by natural phenomena, human actions, or industrial accidents. Some natural disasters are caused by hazards that cannot be neutralized, because there is no way to control their causes. Earthquakes, volcanic eruptions, tsunamis, and hurricanes are examples of hazards that cannot yet be prevented or diverted. On the other hand, appropriate measures can be taken to control or reduce the impact of other natural events, such as floods, droughts and landslides.

The effects of a disaster vary according to the nature of the event itself and the characteristics of the communities and objects affected: the population, their natural environment, their housing, the public services on which they depend, and the physical structures and assets of industry, commerce, and other economic activities that provide goods and livelihoods.

A disaster causes both direct and indirect losses. The physical destruction caused by a disaster is considered a direct loss, and includes the human victims, environmental degradation (i.e., the alteration of the habitat), and damage to buildings, infrastructure, and urban spaces.

Indirect losses are generally divided into social and economic effects. Social effects include the interruption of transportation, communications (including the mass media), and other public services. They can include the negative image that a country or region might acquire in the wake of a disaster. Economic effects include the cost of reconstruction and rehabilitation, the impact of reduced production or consumption on trade and industry, the potential discouragement or flight of foreign investment, and the lack of access to basic services such as health care.

In many developing countries, such as those of Latin America and the Caribbean, disasters lasting 20 to 30 seconds have caused thousands of deaths and hundreds of millions of dollars in damage. The often incalculable economic costs of the direct and indirect losses from these events can represent an enormous percentage of the country's gross domestic product. Such losses increase poverty among the population and stall or set back economic development at the national or regional level.

In order to reduce existing risk levels, disaster prevention measures must be considered a fundamental part of sustainable regional and urban development. Given the negative impact of disasters on the development of the communities they strike, risk assessment must be incorporated into the key social and economic processes of each country or region, comparing the cost of taking preventive measures with that of disaster recovery. In most cases, prevention is more cost-effective than recovery.

In recent years, many publications in numerous fields have addressed the impact of disasters on human activities. Despite occasional differences, most of these publications agree on the components of

disaster impact. The Office of the United Nations Disaster Relief Coordinator (OCHA, formerly known as UNDRO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) held the Natural Disasters and Vulnerability Assessment meeting to propose uniform definitions that have been widely accepted in recent years. The report from this meeting provided the following definitions:

Hazard (H) is defined as the probability that a potentially disastrous event will occur during a given time period in a given place.

Vulnerability (V) is the level of loss that an element or group of elements—people, structures, goods, services, economic or social capital—that are exposed to risk would experience as a result of the probable occurrence of a disastrous event. Vulnerability is expressed on a scale from 0 (no damage) to 1 (total loss).

Specific Risk (R_s) is the level of expected loss as a result of the occurrence of a particular event. It is a function of hazard and vulnerability.

Elements Exposed to Risk (E) includes the local population as well as the buildings, civil works, economic activities, public services, utilities and infrastructure that are exposed in a given geographic area.

Total risk (R_t) is a quantification of the human losses, injuries, property damage and impact on economic activity that would result from the occurrence of a disastrous event. It is the product of the specific risk R_s and the elements at risk E

Risk may therefore be evaluated using the following general formula:

$$R_t = E \times R_s = E(H \times V)$$

where exposure E is considered implicit in vulnerability V .

Given hazard H_i (the probability that an event of intensity greater than or equal to i will occur during a period of exposure t) and vulnerability V_e (the intrinsic predisposition of an exposed element e to suffer impact or loss from the occurrence of an event of intensity i), the risk R_{ie} is understood as the probability of a loss to element e due to the occurrence of an event of intensity greater than or equal to i .

$$R_{ie} = (H_i \times V_e)$$

This expresses the probability that the social and economic consequences or effects will exceed a specific predetermined value during a given time period t .¹

It is therefore possible to craft a more precise definition of two concepts that are sometimes taken for synonyms, but which are in fact qualitatively and quantitatively different:

- **Hazard** is a risk factor external to a subject or system. It involves a latent or potential danger associated with a physical phenomenon of natural or technological origin that could arise in a specific location over a given span of time, producing adverse effects on people, property, or the environment. Hazard is expressed mathematically as the probability of an event of a given intensity taking place in a given place over a given period of time.

¹ Cardona, O.D. Estudios de vulnerabilidad y evaluación del riesgo sísmico: planificación física y urbana en áreas propensas. Asociación Colombiana de Ingeniería Sísmica, *Boletín Técnico* No. 33, Bogotá, December 1986.

- *Risk* is the expected level of destruction or loss that will take place given the probability of hazardous events taking place and the level of vulnerability of the elements exposed to these hazards. It is expressed mathematically as the probability that the economic and social consequences of a given event in a certain place over a certain period of time will exceed a given level.

In general terms, *vulnerability* may then be understood as the intrinsic predisposition of a subject or element to suffer damage from potential external events. A vulnerability assessment therefore constitutes a fundamental contribution to the understanding of risk, by analyzing the interactions between susceptible elements and a hazardous environment.

The fundamental difference between hazard and risk is that a hazard is related to the probability that a natural event or one caused by human activity will occur, while a risk is related to the probability that certain circumstances will occur. These circumstances are closely related not only to the elements' level of exposure to an event, but also to their vulnerability to the effects of the event.

Damage to hospitals

The need for health care establishments to be prepared and able to take action in emergency situations is especially critical in Latin America and the Caribbean. In the past, earthquakes, hurricanes and floods (such as those related to the El Niño phenomenon), and other natural hazards have shown hospitals and health establishments to be vulnerable to these disasters, often without the capacity to respond adequately.

Because hospitals play such a vital role in the recovery of a community after an earthquake, many factors must be taken into account when selecting the location of a health facility, as well as when designing, building, maintaining and operating it. These considerations range from structural resistance requirements to disaster response planning to the installation of a range of nonstructural elements and equipment.

Nevertheless, in the wake of intense natural events, many hospitals have ceased to function, suffered serious structural damage or even collapsed, depriving their respective communities of the medical care needed by disaster victims.

Many of the hospitals so affected were designed in accordance with seismic-resistant building codes. The structural design of a hospital requires much greater care than the design of a less crucial building or complex of buildings. Seismic-resistance standards in most Latin American countries are not adequate, because they are frequently based on a philosophy of protecting the lives of the building's occupants, not of guaranteeing the structure's continued functionality (see below).

Philosophy of Existing Seismic Standards

- Structures should withstand events of moderate intensity without damage.
- Damage should be limited to nonstructural elements during events of medium intensity.
- Structures might sustain damage but should not collapse during events of exceptionally severe intensity.

Table 1.1 lists some hospitals that have suffered serious structural damage or collapse, or had their operations curtailed due to nonstructural damage and functional problems during earthquakes; Table 1.2 provides examples of effects of earthquakes on selected facilities.

Table 1.1.
Selected hospitals affected by earthquakes

HOSPITAL	COUNTRY	EARTHQUAKE
Kern Hospital	USA	Kern County, 1952
Hospital Traumatológico	Chile	Chile, 1960
Valdivia Hospital	Chile	Chile, 1960
Elmendorf Hospital	USA	Alaska, 1964
Santa Cruz Hospital	USA	San Fernando, 1971
Olive View Hospital	USA	San Fernando, 1971
Veterans Admin. Hospital	USA	San Fernando, 1971
Social Security Hospital	Nicaragua	Managua, 1972
Escalante Padilla Hospital	Costa Rica	San Isidro, 1983
Benito Juárez Hospital	Mexico	Mexico, 1985
Medical Center	Mexico	Mexico, 1985
Benjamín Bloom Hospital	El Salvador	San Salvador, 1986
San Rafael Hospital	Costa Rica	Piedras Negras, 1990
Tony Facio Hospital	Costa Rica	Limón, 1991
Olive View Hospital	USA	Northridge, 1994
Municipal Hospital	Japan	Kobe, 1995
Antofagasta Hospital	Chile	Antofagasta, 1995
Tena Hospital	Ecuador	Ecuador, 1995
Coquimbo Hospital	Chile	Chile, 1997
Antonio P. de Alcalá Hospital	Venezuela	Cumaná, 1997
Miguel H. Alcívar Hospital	Ecuador	Bahía Caráquez, 1998



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Photograph 1. Total collapse of the Benito Juárez Hospital, Mexico City, 1985.



J. Graess

Photograph 2. Partial collapse of the Benjamin Bloom Hospital, San Salvador, 1987.



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Photograph 3. Collapse of the fifth floor of the Municipal Hospital, Kobe, 1995.

Table 1.2.
General effects of earthquakes on selected hospitals

Earthquake	Magnitude (Richter Scale)	General Effects
San Fernando, California, U.S.A., 1971	6.4	Three hospitals suffered severe damage and were unable to operate normally when they were needed most. Furthermore, most of the earthquake victims went to two of the collapsed hospitals. Olive View Hospital, one of the most severely affected hospitals, was retrofitted.
Managua, Nicaragua, 1972	5.6	The General Hospital suffered severe damage. It was evacuated and later demolished.
Guatemala City, Guatemala, 1976	7.5	Several hospitals were evacuated.
Popayán, Colombia, 1983	5.5	San Jose University Hospital suffered damage and service was interrupted.

Earthquake	Magnitude (Richter Scale)	General Effects
Mendoza, Argentina, 1985	6.2	More than 10% of all hospital beds were lost (state + private = 3,350). Of the 10 facilities affected, 2 were demolished and 1 evacuated.
Mexico City, Mexico, 1985	8.1	Five hospitals collapsed and 22 more suffered serious damage. At least 11 facilities were evacuated. Direct losses were estimated at US\$ 640 million. The most seriously damaged hospitals were the National Medical Center of the Mexican Social Security Institute (IMSS), the General Hospital and the Benito Juárez Hospital. Between destroyed and evacuated hospitals, the earthquake produced a sudden deficit of 5,829 beds. A total of 295 lives were lost at the General Hospital and 561 at Juárez Hospital, including patients, doctors, nurses, administrative personnel, visitors and newborns.
San Salvador, El Salvador, 1986	5.4	More than 2,000 beds were lost, with more than 11 hospitals affected. Ten hospitals were evacuated and one completely destroyed. Damage was estimated at US\$ 97 million.
Tena, Ecuador, 1995	6.2	Velasco Ibarra Hospital (120 beds) suffered moderate nonstructural damage: cracked walls, broken windows, fallen ceilings, damage to the elevator system and some oxygen and water conduits. Service was suspended and the facilities evacuated.

Natural disasters seriously damaged 93 hospitals and 538 health centers in Latin America and the Caribbean between 1981 and 1996, causing structural collapse or extensive damage that left the health facilities in vulnerable conditions requiring evacuation. Considering an average capacity of 200 beds per hospital and 10 beds per health unit, losses during this period totaled an estimated 24,000 beds. With an average regional cost of US\$ 130,000 per hospital bed (the cost is approximately US\$ 220,000 in the English-speaking Caribbean and US\$100,000 in Latin America), direct accumulated losses in the region are estimated to be US\$3.12 billion dollars.²

² Economic Commission for Latin America and the Caribbean (ECLAC). Impactos económicos de los desastres naturales en la infraestructura de salud. Report no. LC/MEX/L.291. Mexico City, January 1996.

Hospitals and disaster situations

For the most part, health services are provided by a variety of health care establishments such as hospitals, health centers, health posts, and clinics. They may be managed by the government or the private sector. Hospitals normally offer emergency services and secondary or tertiary medical care, while health posts offer primary care and some first aid or basic care.

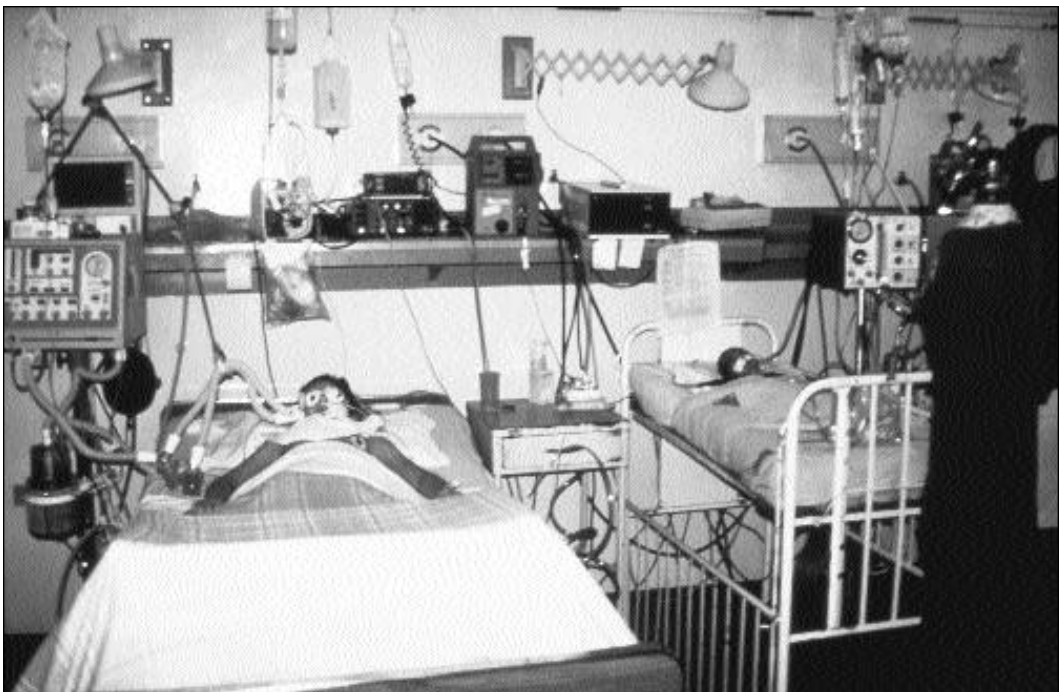
With their specific focus on treating sickness and injury, health care establishments clearly play a critical role in disaster response. As a result, special considerations for risk prevention and mitigation must be made from the moment of a hospital's conception. Two factors make this special approach fundamental to health care establishments:

- a) Their complexity and occupancy characteristics;
- b) Their role in the preservation of life and health in disaster situations, especially in diagnosing and treating sickness and injury.

Complexity and occupancy: causes of vulnerability

Hospitals are essential to disaster response, but they also tend to be highly vulnerable because of the following characteristics:

Complexity. A hospital is a highly complex facility which, by providing health care, must also function in certain ways as a hotel, an office building, a laboratory and a warehouse. The hotel aspect alone is complex, involving food and beverages as well as lodging. Health facilities generally include many small



Photograph 4. The lives of some occupants depends on equipment and uninterrupted supply of electricity and gases.

R. Boroschek

rooms and long corridors. Patients and visitors will be very confused in the wake of a disaster, when there may not be electrical power and fallen furniture or rubble may block corridors and room exits. Elevators will be out of service and stairways may be difficult to use.

Occupancy. Hospitals have a high level of occupancy, with patients, medical and support staff, and visitors present 24 hours a day. Many patients require assistance and continual specialized care. They may be surrounded by medical equipment, use potentially dangerous gases, or be connected to life-support equipment that requires an uninterrupted power supply.

Critical supplies. Most of the supplies required by hospitals (medicine, splints, bandages, etc.) are essential to patients' survival and crucial to the treatment of disaster victims.

Basic facilities. No facility depends on public services or lifelines more than a hospital, which cannot function without power, water, clinical gases, oxygen, fuel, garbage collection or communications.

Hazardous materials. Many products found in hospitals are dangerous if they spill or leak. The collapse of shelves holding medicines or chemicals can release poisonous liquid or gas. Spilled chemicals, damaged gas cylinders and ruptured oxygen lines can cause fires. The absence of normal security measures can also lead to the abuse of drugs normally kept under lock and key.

Heavy objects. Medical equipment and other appliances are often located above or near patients' beds or on high shelves. During a disaster, such equipment may fall, causing serious injury or obstructing evacuation routes. Other pieces of specialized equipment, such as X-ray machines, backup generators or autoclaves, are extremely heavy and may be tossed about or overturned during an earthquake.

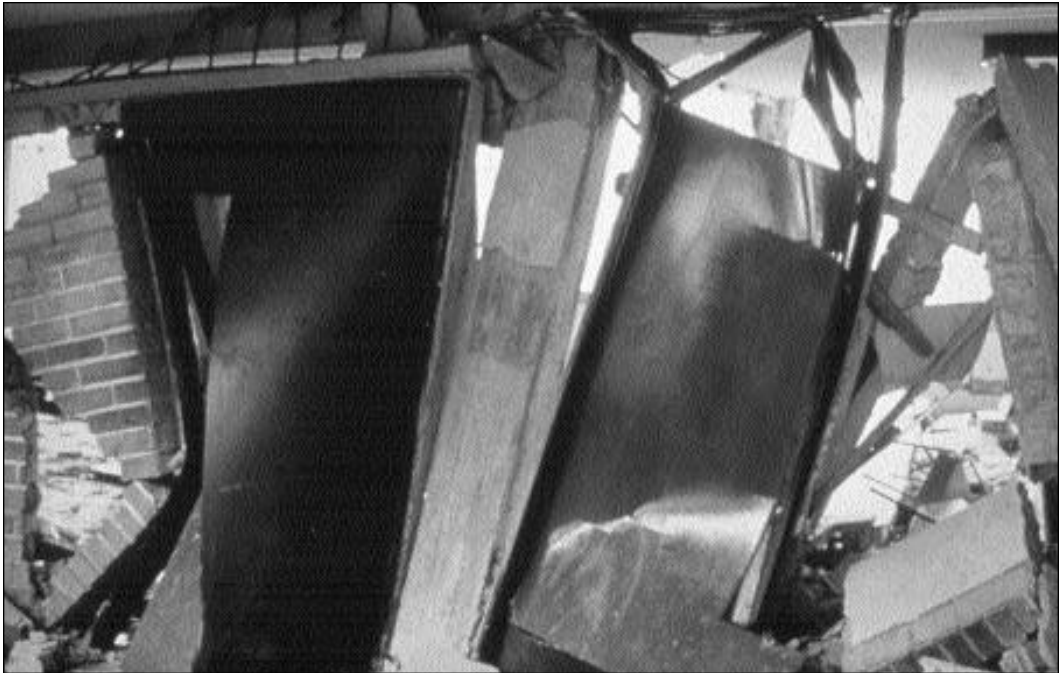
To summarize, a hospital is a complex system that demands uninterrupted power and potable water, continual communications services, solid and liquid waste disposal, and a steady supply of pharmaceutical products, medical and surgical supplies, specialized gases, chemicals and fuels. At the same time, each of these necessities also represents a hazard if improperly stored, handled, or maintained, and can become a hazard during an earthquake, fire, explosion or other disaster.

The hospital in disaster situations

As outlined above, at any given moment, a hospital may have a high population of resident patients, outpatients, medical and paramedical staff, administrative employees, and visitors. As a result, there are three main elements to disaster preparedness planning:

1. Treatment of patients must continue during and after a disaster or emergency.
2. The safety of all occupants must be assured. A vulnerability assessment of the facilities should be conducted. If necessary, the building should be retrofitted according to current design and construction standards. If this is not immediately possible, emergency plans should be adapted in the meantime to take the existing vulnerability factors into account.

3. At some point during an emergency or disaster, it may be necessary to evacuate ambulatory and non-ambulatory patients. This will be more complex if the disaster occurs suddenly and at a time when there are many visitors who are generally unfamiliar with evacuation procedures. Throughout Latin America, the number of visitors at peak hours, such as weekends, can be as high as double the number of patients.



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Photograph 5. Column failure during earthquake.

A hospital's capacity for effective disaster response depends on systematic organization and easy mobilization of personnel, equipment and supplies in a safe environment. Procedures, buildings and equipment are all critical and interdependent. A weakness in any element of a hospital's functional system could cause a crisis throughout the institution. The following issues must be taken into consideration:

Emergency procedures. Emergency procedures are especially important in the mobilization of people, equipment and supplies. The design of the necessary procedures includes the formation of a committee to formulate and implement disaster mitigation measures and carry out emergency response planning.

Buildings. Disaster mitigation plans must address the need for repairs in case of damage to the hospital facilities, both before and after a disaster occurs. Past events have demonstrated that existing plans are deficient in this area. The design and construction of hospital buildings must take into account occupants' safety and the preservation of critical areas including the emergency room, diagnostic services, surgery units, pharmacy, and food and medicine storage areas.

In the past, hospital design emphasized optimum use of space and configuration of services so as to provide the most effective interrelation of functions and activities among different departments. Many new hospitals built with modern design and construction techniques have been found lacking when called upon to attend to massive numbers of injured patients. This is often due to defects in the distribution of elements and the location and arrangement of nonstructural components. Many establishments fail due to simple design omissions that could have been corrected at a marginal cost during construction or through later intervention.



O.D.Cardona

Photograph 6. Collapse of stairway during earthquake prevents evacuation.

Equipment. The items found within a hospital building are more likely to become a hazard during an earthquake than during a hurricane. A great deal of damage can be averted through simple, inexpensive mitigation measures, such as securing shelves to the walls and placing equipment strategically in safe locations. Regular inspections and appropriate maintenance can assure that equipment is kept in good working order.

Estimating damage to hospitals after a disaster

The assessment of damage sustained by a hospital should be conducted by a multidisciplinary team including doctors, engineers and architects. The team should develop a strategy that will allow hospital activities to continue effectively despite the upheaval caused by the disaster. The assessment strategy will depend on the kind of disaster. In the case of an earthquake that has caused the partial or total collapse of the physical structure, files on the building's infrastructure, service capacity and the number of people occupying it when the disaster occurred may be destroyed so it may be necessary to gather this information from outside sources.

The assessment process should begin with a precise definition of the type of installation that has been damaged. The level of complexity of the services the facility provided will influence the strategy for compiling data on the type and magnitude of damages.

An estimate of economic loss reflects the value of the assets destroyed at the time of the disaster. Their replacement will be influenced by factors such as the characteristics of the hospitals to be rebuilt, the resources available to the community or country, the level of institutional development in the health sector, the government's priorities for disaster response, and the allotment of budgetary resources. Replacement value is estimated based on the cost of new equipment, which often implies a technological improvement in the facilities. In the case of repairs, assessment is based on the market price of the inventoried assets.

In addition to direct losses from structural destruction, the estimate should include indirect losses, such as the reduced volume of services provided and the cost of attending to disaster victims in provisional facilities or transferring them to other institutions during the reconstruction process.

Although there is a wide range of indirect damages, some especially common types include:

1. Increased risk of transmission of infectious or contagious diseases and other health risks;
2. Increased cost of public and private health care, outpatient care and hospitalization;
3. Reduced standard of living for communities affected by environmental degradation such as the lack or reduced availability of potable water.

A common characteristic of natural disasters is their extreme impact on social resources, especially general services for economically disadvantaged populations. Damage to hospital establishments can accentuate the weaknesses of a national health care system, affecting or delaying the delivery of basic health care to the population.

Risk reduction in hospitals

Health authorities in Latin America and the Caribbean have worked to promote a process of institutional change, seeking to improve the allocation and use of resources and positively influence public health. Their work in hospital management has made inroads toward infrastructure development that reflects the needs of communities. Aspects of this development that relate to reducing the level of risk posed by natural disasters include:

- a) Analysis of the demand for hospitals; and
- b) Assessment and reduction of vulnerability.

Analysis of the demand for hospitals

Increased demand for health care and the limited supply of services have led to a resource rationalization process that has resulted in the development of planning, organizational and structural concepts such as the following:

1. The hospital network, defined as a system of health facilities that provide different levels of care, where interactions among the facilities are based on the provision of complementary services;
2. The need to prevent the disorganized growth that occurs when a hospital seeks to increase its capacity by expanding and equipping its physical plant without considering limitations such as the supply of basic materials, traffic routes, and hospital vulnerability;
3. Hospital certification or accreditation by level of care which constitutes an essential tool in the creation of a hospital network, and addresses criteria such as the characteristics of the popula-

tion served by the hospital, coverage areas, morbidity, type of services offered, available human resources, hospital safety, and hospital maintenance;

4. Referral and counter-referral systems comprising the standards, protocols and procedures that regulate the treatment and referral of patients from one level of health services to another. Referral systems should maximize the use of resources on the basis of efficiency, effectiveness and opportune health care.

The potential for an increase in the demand for health services after a natural or anthropic disaster requires that changes be made in the way the system functions. To be effective, these changes must take into account the type of event, as well as its magnitude, intensity and duration, and the place, population and infrastructure affected by it. It is also important to take into account epidemiological data, morbidity and mortality rates, and the general state of public health in the region. This information must be applied to aspects of the health system's ability to provide services in order to develop an optimal supply/demand ratio in the event of a disaster. An assessment of the potential demand for health services is important in order to identify variables that can have a negative influence and address them before disaster strikes.

Assessing and reducing vulnerability

Given the importance of an efficient response to emergencies and the need for a functional health care infrastructure in the aftermath of a disaster, hospital administrators must conduct structural, non-structural and administrative/organizational vulnerability studies. Hospital vulnerability can only be determined through an integrated vulnerability assessment covering all three of these factors.

Some of the results of a structural vulnerability assessment will serve as raw data for the assessment of nonstructural vulnerability. Nonstructural assessment, in turn, plays a key role in determining administrative/organizational vulnerability. An integrated hospital vulnerability assessment should address all three elements in the following order: (a) structural vulnerability, (b) nonstructural vulnerability, and (c) administrative/organizational vulnerability.

A vulnerability assessment may begin with a visual inspection of the facilities and a preliminary report by a team of experts that identifies areas in need of attention. The report may be discussed with other consultants and the hospital administration in order to set priorities and time frames for making the necessary changes.

Structural vulnerability

The terms "structural" or "structural components" refer to those parts of a building that are required for physical support. They include foundations, columns, supporting walls, beams and diaphragms (i.e., floors and ceilings designed to transmit horizontal forces occurring in an earthquake through beams and columns into the foundation).

Both existing and planned health care establishments in areas exposed to seismic activity must comply with building codes for seismic resistance. These codes are intended to ensure the safety of the building's occupants and, secondarily, to allow the facility to continue functioning during and after the event. Although completely earthquake-proof structures are financially unrealistic, seismic-resistance standards provide design criteria to avert collapse and assure functionality after an earthquake.

Nonstructural vulnerability

The term "nonstructural" refers to components that are physically joined to a building's structure (including partitions, windows, roofs, doors, and ceilings), those that are essential to the building's functionality (such as plumbing, heating, air conditioning, and electrical connections), and items located within the building (such as medical or mechanical equipment, or furniture). The three categories of nonstructural elements are therefore architectural components, installations, and equipment. In the case of health care facilities, nonstructural components often represent a greater economic value than the structure itself. Analyses indicate that nonstructural components generally account for more than 80% of the total cost of a hospital.

In some situations, nonstructural components can affect the occurrence of a structural failure. Heavy equipment such as central air-conditioning systems, X-ray equipment, CT scanners, electrical generators, boilers and hydrotherapy pools may be found on the upper stories of a hospital or on a floor dedicated to these central systems. The placement of this equipment can significantly modify the original calculations of a structure's behavior. Unanchored equipment may also slide or roll, causing a partial or total structural collapse. Architectural elements such as unreinforced stucco and heavy facades can also alter the behavior of the building as it vibrates.

In terms of the hospital's functionality, the damage or loss of some nonstructural elements can seriously disrupt the provision of services. While they do not represent a direct danger to building occupants, such losses pose an indirect risk through the failure of equipment or systems. For example, damage to an electrical generator may interrupt the power supply to basic life-support systems, such as the respirators in an intensive care unit.

Administrative/organizational vulnerability

The term "administrative or organizational vulnerability" refers primarily to the distribution of space, and the relationships between these spaces and the medical or health care services provided in the hospital. It also refers to the physical and functional relationships between the different areas, and to administrative processes such as hiring, supply procurement, maintenance routines, and so on. Appropriate zoning and relationships between the areas of a facility can assure adequate functioning not only under normal conditions, but also in case of emergency or disaster. The arrangement and relationship between outpatient consultation areas, areas surrounding the structure, and emergency services, and the creation of a specially protected area for general support services, can ensure appropriate medical treatment and avoid the functional collapse that can occur even if the building has not suffered severe damage.

It is the health care administrator's responsibility to anticipate and address these issues in order to reduce the potential loss of service and the social impact that occurs when efficient health care cannot be provided when it is most needed, after a disaster.

Planning and financing

Health care administrators should seek opportunities to incorporate disaster prevention and mitigation concepts into processes such as maintenance, expansion projects, equipment upkeep and hospital accreditation. Coordination with government and private institutions that study geological, seismological and hydrometeorological conditions will assist in the identification of the different types of hazards facing existing or future health care facilities. This information allows appropriate prevention and mitigation measures to be taken, reducing the hospital infrastructure's overall vulnerability. Admin-

istrators should use vulnerability assessments to reach a realistic balance between the required investment and the expected benefit in terms of mitigation of economic and social losses. An acceptable level of risk will be defined and ultimately reached through the application of the appropriate measures.

Hospitals should carry out ongoing risk mitigation planning based on the information described above, within the framework of an institutional policy that formulates the necessary objectives, strategies and activities. Preparations for emergency response are interdependent and complementary to risk mitigation activities.

Promotion and financing strategies

One of the difficulties in implementing disaster mitigation strategies is demonstrating the need for such investment: that is, its cost effectiveness. Factors that can weigh against the investment include the difficulty of predicting certain types of natural events, and the near-permanent economic crises faced by health care facilities in most developing countries. However, a convincing argument can still be made that reducing the vulnerability of health services, in order to guarantee the safety of people, equipment and services when they are most needed, is a highly cost-effective decision in both social and economic terms.

Promotion and financing can take a variety of forms. The approaches listed below are easy to implement, although they obviously require the previous or simultaneous development of a disaster mitigation program for health care establishments. Such a program should include human resource development and training, technological development, the establishment of standards and regulations, and the provision of expert knowledge by consultants.

- *Approval of operating licenses.* The approval or renewal of health care facilities' operating licenses provides an excellent opportunity to require all centers to adopt seismic-resistant construction techniques and take measures for disaster preparedness and mitigation.
- *Approval of investment budgets.* Budgetary line-items represent one of the most common means of promoting specifically focused investments and development processes. This tool can also be used to ensure that institutional development plans include disaster mitigation and preparedness measures. Financing for maintenance or construction projects, such as remodeling or expansion, can be made contingent on the execution of a vulnerability assessment and the inclusion of mitigation measures in the design. As mentioned earlier, it is considerably more cost-effective to build a seismically resistant health care center or retrofit an existing structure than to cope with the economic and social losses from the structural collapse of a hospital, with its consequent morbidity, mortality, loss of equipment and interruption of health care services.
- *Hospital accreditation processes.* The concept of accreditation, which became popular several years ago, involves a centralized entity that stipulates the conditions under which health care can be provided (see box 1.1). Individual institutions are required to fill in standardized forms for the assessment of criteria that can range from the condition of the physical plant to the equipment used and the quality of human resources. The accrediting body reviews the forms and issues a qualification to the institution. The accreditation must be renewed periodically, and can hinge on specific disaster mitigation and preparedness measures.
- *Approval of incentive-oriented budget items.* Economic support is another way to promote mitigation and preparedness measures in hospitals. Incentives can include co-financing for vulnerability studies, consulting or design work, or execution of some of the necessary modifications.

A hospital prepared for disaster situations: The "SAFE HOSPITAL"³

The Mexican Social Security Institute (IMSS) has presented an initiative designed to assure that hospitals are safe and prepared for disaster response. The plan has four stages:

1. A vulnerability assessment is conducted in hospitals that provide secondary and tertiary levels of care (i.e., the most complex hospitals). The personnel of each hospital carries out this analysis, on the basis of the environmental hazards present. The results of the analyses are used in developing or updating Disaster Health Care Plans (PAISD) appropriate to the vulnerabilities of each establishment. Simple, low-cost corrective measures are implemented to address the problems detected.
2. An Institutional Certification Committee made up of specialized professionals performs an exhaustive vulnerability assessment of any secondary or tertiary level institution that requires such an assessment. The relevant mitigation measures are implemented, and the PAISD revised, according to current standards.
3. A competent national body validates the results obtained in steps 1 and 2.
4. International recognition as a "Safe Hospital" is granted to those establishments that meet the parameters established by the national body mentioned in step 3.

International participation

Risk reduction in hospitals and health care establishments has been consistently promoted in Latin America and the Caribbean in recent years due to the need to raise safety levels in the health care infrastructure in the region. The Pan American Health Organization (PAHO/WHO) has worked to attain the political commitment by health care authorities, encouraged regional exchange of expertise and experience in this area, and has promoted dissemination of information and technical training for the professionals involved, encouraging a multidisciplinary approach. This book, for example, is the result of activities designed to promote risk mitigation in health care establishments.

³ The full description of this project can be found in the report *Hospital preparado para enfrentar situaciones de desastre: "Hospital Seguro,"* prepared by the Mexican Social Security Institute in September 1998.

International Conference on Disaster Mitigation in Health Facilities⁴

In 1996, the Pan American Health Organization, under the auspices of the Government of Mexico and with the support of the Secretariat of the International Decade for Natural Disaster Reduction (IDNDR), the Department of Humanitarian Affairs (DHA) of the United Nations, the Economic Commission for Latin America and the Caribbean (ECLAC), the Organization of American States (OAS), and the World Bank, convened an International Conference on Disaster Mitigation in Health Facilities.

For the first time, health care authorities from throughout the Region made commitments for the 1996-2001 period to reduce the impact of natural disasters in high-priority health care facilities. Priority status was based on vulnerability and each country's political, economic and logistical capacity. Some of the most important commitments for immediate fulfillment included:

- To formally determine which existing health care institutions have priority for vulnerability studies and disaster impact reduction measures;
- To introduce mitigation measures in the design and construction of new health care facilities and in remodeling and expansion of existing facilities;
- To include nonstructural disaster mitigation or intervention measures in all maintenance, inspection, restructuring and improvement of existing hospitals;
- To identify budgetary resources and have hospital disaster mitigation plans classified as a priority.

Several countries in the Region have developed projects to partially or fully comply with the Conference recommendations.

⁴ Pan American Health Organization. Subcommittee on Planning and Programming of the Executive Committee, 30th session, 30 and 31 March 1998. SPP30/6, Rev. 1, Washington D.C., 29 April 1998.

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