Chapter 4
Administrative and Organizational Vulnerability

Background

Of all the elements that interact in the day-to-day operations of a hospital, the administrative and organizational aspects are among the most important in ensuring that disaster prevention and mitigation measures are adopted before a disaster strikes, so that the hospital can continue to function after an earthquake or other catastrophic event.

Administrative and organizational vulnerability to emergencies and disasters can be analyzed at two different levels. The macro level involves studying the resolution capacity of health facilities, which is based on currently popular concepts of health services modernization and decentralization. This type of analysis is ambitious: its final objective is the implementation of a total quality management policy for health services (see box 4.1). Continually improving the quality of a health facility's services automatically brings about improvements in the structural, nonstructural, and administrative and organizational conditions of day-to-day operations, leading to a hospital that performs more effectively, as a whole, in the event of an emergency or disaster. However, such an analysis lies beyond the scope of this book.

This chapter addresses the micro-level, which normally focuses only on those aspects relevant to a particular health establishment. However, it is possible to draw on the information available from several health facilities, to carry out a micro-level analysis of the administrative and organizational vulnerability of a fairly typical hospital. This includes those operational aspects that might have a negative impact on its ability to provide its services both in normal and in external or internal emergency conditions, as we will see in greater detail below. In order to do this, it is necessary to examine the activities carried out in the different departments of a hospital, their interactions, the availability of basic public services, and the modifications required in the event of an emergency.

Similarly, we will perform a critical review of a typical hospital emergency plan, seen as another administrative and organizational tool, in order to identify its possible weaknesses and underscore the useful components related to guaranteeing the functionality of existing services. It is important to stress that a hospital emergency plan, no matter how well crafted, will be useless if the building suffers serious damage to its physical infrastructure. Accordingly, this analysis is based on the assumption that structural and nonstructural deficiencies have been corrected or, if this has not yet been accomplished, that they have at least been identified and the emergency plan has taken them into account.

Box 4.1. Towards total quality in health care: the continual quality improvement process

The Continual Quality Improvement Process (CQIP) is a new managerial approach that is being introduced in health care programs worldwide.* A CQIP is based on the assumption that many organizational problems result from inadequate systems and processes, rather than individual mistakes. A CQIP encourages the staff at all levels to work as a team, take advantage of collective experience and skills, analyze processes and systems, use available information to identify the nature and magnitude of each problem, and design and execute actions that improve services. Quality is continuously reviewed and incorporated into the working process. Improvements in all functions are carried out gradually and continuously (proactively), and staff members are encouraged to take the initiative, quashing the myth that quality is expensive.

The state of California, in the United States, has very precise terms of reference for contracting preliminary studies and the implementation of CQIP in health services. These include reviewing processes in clinical and non-clinical services, including emergency care, family planning and health education. A CQIP must be steered by a committee that includes the medical director of each health facility, doctors and health personnel, administrators and technicians. CQIP studies must reflect the needs of the population based on age and disease categories.

* Department of Health Services of the State of California. Quality improvement system, 1992.

Note: For a more detailed definition and description of a CQIP program, see *Actualidad gerencial en planificación familiar: estrategias para el mejoramiento de los programas y servicios*, Vol. II, N° 1, 1993.

In the event of a disaster, a hospital must be able to continue caring for its inpatients while treating victims of the event, safeguarding all the while the lives and health of its personnel. For this to happen, the staff must be deployed effectively and know exactly how to respond to such a situation. The building and its equipment, supplies and lifelines must remain operational. Most hospital authorities recognize this fact, which is why they have established formal disaster mitigation plans.

However, most of these plans fail to provide administrative and organizational alternatives in the event of severe damage to the facilities. The issue has received little attention. This is worrisome, particularly in the many locations throughout the Americas where the population only has ready access to one hospital that, if rendered inoperative, could lead to a severe health crisis.

A systematic approach, which takes into account the fluid movement of staff, equipment and supplies in a safe environment during normal operations, is vital if an effective response to disasters is to be in place. This underscores the critical nature and interdependence of the various processes, buildings, and equipment. Deficiencies in any of these areas can plunge a hospital into a crisis.

i) *Processes*: They mostly have to do with the movements of people, equipment and supplies. They also include routine administrative processes such as hiring, acquisitions, human resource management, and the flow of patients through the various clinical and support service areas of the hospital.

ii) *Buildings*: Experience has shown that the design and construction of hospital buildings, as well as their future expansion and remodeling, their everyday operations and maintenance, must be safety-oriented to protect certain critical hospital operations such as emergency care, diagnosis and treatment, surgery, pharmaceutical supplies and food storage, sterilization, patient registration, reservations, or any other areas the institution considers a high priority.

In hospital design, emphasis must be placed on the optimal use of space and the configuration of the services provided, so that the different departments and activities can mesh together with the greatest possible efficiency and the lowest vulnerability. Many facilities have suffered a functional collapse as a result of simple omissions during their design, which could have been easily corrected or addressed at a marginal cost during construction or retrofitting.

iii) *Equipment*: Regular inspections and the proper maintenance can ensure that key and often costly hospital equipment can remain in good working order.

As discussed earlier, it is the duty of the authorities to assess the hospital's vulnerability to natural phenomena and obtain precise estimates of existing risk levels. Once the analysis is complete, the information gathered should be used to determine what level of risk is acceptable. In the case of administrative and organizational vulnerability, the analysis can start with a visual inspection of the facilities and the drafting of a preliminary assessment report identifying key areas that demand attention, alongside a study of administrative procedures, their critical points, and their flexibility in emergency situations.

Administrative aspects

The first aspects that must be evaluated are the administrative procedures related to infrastructure, including the resources that are supplied by public utility networks and on which its function depends, such as communications and information systems, water-supply and sewerage systems, and power supply.

The water-supply system generally includes pumping stations, water treatment plants, and underground mains and other pipes. It may suffer interruptions due to pump failure or, more frequently, pipe ruptures. Hospitals must therefore incorporate water storage tanks into the daily water supply system to ensure that clean water will be available in the event of an emergency.

The power supply system includes generators, high-tension lines, and above-ground substations and equipment. Transformers and porcelain insulators are the weakest points. Health facilities therefore have good reasons to procure emergency generators that can start supplying power at any moment.

During an earthquake, the vulnerability of water, sewerage, gas and fuel pipes depends on their resistance and flexibility. A high degree of flexibility can prevent the rupture of pipes during a moderate earthquake. Differential settlements can be compensated so that ground displacement does not necessarily lead to a rupture. Special attention must be paid to connections entering the building.

For the analysis of administrative procedures, the starting point must be the spatial-administrative relationships within the hospital and with its environment, including special agreements with public utility companies and suppliers in general. The following supplies and lifelines must be taken into account:

- **Water, power and natural gas (if there is a public network)**: Utility company involved; description of the service; location and general state of the main and secondary pipes; normal working conditions; description, general state and location of the main or incoming pipe; and alternative source of supply in the event of the main system failing.

- **Communications**: Service provider; description, general state and location of the link-up; number of lines extensions and expansion capacity; and alternative communications systems through VHF/FM or other frequencies.
- **Roadway system**: Capacity and general state of the main access routes, traffic patterns under normal and critical conditions, and pedestrian routes.

If it is discovered that external public utility networks are intrinsically vulnerable, hospital authorities must demand that utilities assess the vulnerability of external lifelines as part of an integrated local or national vulnerability reduction program. For instance, they must ensure that transformer poles or water mains be reinforced.

The community's Local Emergency Committee must also make sure that the various actors play the role expected of them in the emergency plan in order to guarantee the supply of basic public services to the hospital. This would include cordoning off nearby roads to ease the access of emergency vehicles and establishing security procedures to control access to the facilities. One of the functions of a Local Emergency Committee must be to ensure that lifelines remain operational or are quickly up and running again if disrupted. The institutional members of the Operational Committee must collaborate in key activities such as the provision of first aid, the prompt transport of the injured by ambulances and other vehicles, and public order in general.

Spatial distribution

To carry out an analysis of the internal and external spatial distribution of a hospital vis-à-vis its operation, both in normal and emergency situations, the following steps must be taken:

1. Develop an assessment model, based on current guidelines and existing models, and on desirable performance patterns. Assign priorities to the spaces that need to be assessed on the basis of the clinical or support services considered indispensable for emergency response.
2. Have the medical staff and participating architects and engineers review the building plans, the building inspection process, and the location of each relevant area, and establish the functional relations between them that must be reflected in the spatial arrangements of the various medical and support areas.
3. Analyze and evaluate the internal and external spatial organization of the hospital and compare with current standards and best practices.
4. Make recommendations on how to improve the functionality of deficient aspects.

Spatial distribution must be assessed on the basis of normal operations and their ability to respond to the massive need for emergency services, as well as the ability of other spaces to be adapted quickly to support the above services. An example of the physical and operational interdependency between services is included in figure 4.1.[1]

To reduce administrative and organizational vulnerability, recommendations must be made concerning efficient spatial distribution and interaction, once again both in normal conditions and when the number of victims exceeds the everyday capacity of the hospital. These recommendations must include solutions to help improve the internal and external functionality of the services provided by the hospital and their interactions in the event of an emergency.

[1] A similar chart may be found in Isaza, Pablo and Carlos Santana, *Guías de diseño hospitalario para América Latina.* PAHO Health Services Development Program, Series N° 61, 1991.

The issues to be considered include the following:

- *Access to the hospital complex*: Vehicle and pedestrian access; access by the staff and the public; auxiliary pedestrian access (exclusively for hospital and services staff); and air access, if available, in the form of a heliport or nearby runway.
- *Internal spatial relations (general hospital ground plan)*: Division between critical and complementary functional areas; internal and external spatial organization; spatial capacity to provide emergency response services without ignoring regular functions.

Figure 4.1.
Hospital services interrelationship matrix

	Administration	Training	Outpatient Care	Radiology	Clinical Laboratory	Pathological Anatomy	Physiotherapy	Emergency Care	Surgery	Obstetrics	Sterilization	Intensive Care	Hospital Admissions	Staff Dressing Rooms	Kitchen	Maintenance	Machine Room	Laundry Room
Training	●																	
Outpatient Care	●	●																
Radiology	●	●	■															
Clinical Laboratory	●	●	■	▲														
Pathological Anatomy	●	●	▲	✚	●													
Physiotherapy	●	●	●	■	✚	✚												
Emergency Services	●	●	●	■	■	■	✚											
Surgery	●	●	●	■	■	■	✚	■										
Obstetrics	●	●	●	■	■	■	✚	■	■									
Sterilization	●	●	●	▲	▲	▲	✚	■	■	■								
Intensive Care	●	●	●	■	■	■	✚	■	■	■	●							
Admissions	●	●	✚	●	●	■	●	■	■	■	■	■						
Staff Dressing Rooms	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					
Kitchen	▲	✚	✚	▲	▲	▲	▲	▲	▲	▲	▲	▲	■	●				
Maintenance	▲	✚	✚	▲	▲	▲	▲	▲	▲	▲	●	▲	▲	●	●			
Machine Room	▲	✚	✚	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	●	■	■		
Laundry Rooms	▲	✚	✚	▲	▲	▲	▲	▲	▲	▲	●	▲	■	●	■	■	■	
General Storage	▲	✚	●	▲	●	▲	▲	▲	▲	▲	▲	▲	●	■	▲	●	●	■

■ Key relationship
● Direct relationship
▲ Indirect relationship
✚ No relationship

The hospital's functionality, depending on the kinds of parameters used to measure it, can be rated as follows:

Good: The parameter under review satisfactorily meets current local standards in disaster reduction; there is no need to modify it.

Average: The parameter under review satisfies local standards only moderately; a minor modification could improve performance significantly.

Poor: The parameter under review does not meet local standards; it must be modified substantially to resolve this deficiency.

An example of functional-spatial assessment: the Ramón González Valencia Hospital in Bucaramanga,Colombia		
Relationship between the hospital and its environment	Good	The hospital is surrounded by a major roadway, Quebrada Seca Ave.;a main road,Carrera 33; and two secondary roads (Carrera 32 and Calle 32) that are wide and permit easy access both for pedestrians and drivers from the neighborhoods served by this hospital.It is close to a military camp (the Caldas Batallion), with a heliport that can be used during a major emergency.
		Access
Vehicle access 1 (V-1) to the main parking lot of the hospital complex,from Carrera 33, for employees only	Good	Cars can come in and out at the same time without hindrance, due to the width of V-1.V-1 can also be used to deliver patients or emergency supplies to the main building entrance without having to go through the parking lot.It is a controlled access,since only employee vehicles are allowed in.
Vehicle access 2 (V-2),from Carrera 32,to provide maintenance to power plant and storage tanks	Good	Fluid access by maintenance vehicles. Only maintenance vehicles allowed.
Vehicle access 3 (V-3),from Carrera 32,to the Emergency Care Unit, the Health Faculty and the Morgue	Average	While it provides access to the Emergency Care Unit,the Morgue and the Triage Area (formerly the Emergency Unit parking area), vehicle movements are obstructed when ambulances and private cars are delivering patients to the Emergency Unit. Moreover, it is not easy to turn around and get out.

Access		
Pedestrian access 1 (P-1) to the Main Hall	Good	Provides access to the public, ambulatory patients, visitors and staff from the square in front of the Main Hall.The Main Hall provides access to the Administration Dept., internal access to other hospital areas, and vertical access to the upper floors of the building.
Pedestrian Access 2 (P-2) to Outpatient Services	Good	It is an independent,direct access from the public square to the main lobby or entrance hall of the hospital.Due to its location,it facilitates the arrival of ambulatory patients,visitors and the general public.
Pedestrian Access 3 (P-3) to the Blood Bank, ground floor	Good	It is an independent,direct access from the public square to the main lobby. People who use this service are not necessarily hospital patients, so having an entrance that is completely independent from the other hospital areas is convenient.
Adjacent Structures		
Adjacent Buildings (1)	Good	The main building is made up of volumes of different heights and geometric configurations. However, no structurally independent modules were identified that might act as adjacent structures and produce a knock-on effect.
Adjacent Buildings (2)	Average	In the case of the other buildings in the hospital complex,no adjacencies were identified. However, due to the proximity of the Health Faculty building to the Emergency Care Area and the Morgue, any falling debris due to structural or nonstructural damage might block access to these units.

Source:Cardona, O.D.,et al. *Informe final del proyecto vuln erabilidad funcional y no-estructural del Hospital Ramón González Valencia,* Colombia,1997.

Organizational aspects

Among organizational aspects, many of the problems faced by a hospital in its day-to-day operations are caused by deficiencies in its preventive maintenance programs, or even by the lack of such programs. Ordinarily, this is not due to a lack of administrative will to implement maintenance standards, but to a lack of human and financial resources to carry out this task. In addition, lack of planning when expanding or modifying the physical facilities can lead to disorganized growth, which in turn can affect operations negatively, interrupting or slowing down some services and causing frustration among users.

It is important to stress that the disaster response elements outlined in this chapter must be seen as part of a broader, systematic disaster mitigation and prevention plan for the hospital.

A hospital can face two kinds of emergencies: external or internal.

- An external emergency, for our purposes, can be the result of a natural disaster that has struck the community, requiring the hospital to remain minimally operational (i.e., with little or easily manageable structural or nonstructural damage), or it can be related to an enormous increase in the demand of some service, frequently emergency care, due to a specific external factor such as an epidemic or a massive traffic accident in the vicinity.
- An internal emergency takes place when a given set of circumstances leads to the functional collapse of one or more of the services provided by the hospital. These circumstances can include a fire (an operational failure) or the sudden unavailability of lifelines or indispensable equipment due to, for instance, an explosion, or even something as simple as lack of preventive maintenance.

In some cases, both types of emergency may coincide.

Regardless of the type of emergency, the institution must be capable of resolving the technical deficiencies that may arise, in the shortest possible time, and reorienting the necessary human and logistical resources towards the services that most urgently require them. It is also necessary to plan in advance, with the support of public service providers such as firefighters, paramedics, civil defense officials, and transit authorities, in order to establish cooperation and coordination agreements. This might require setting up a formal emergency response network at the local level, including a system of referral facilities that can accommodate an overflow of emergency patients or that might transfer patients presenting injuries of a certain level of complexity.

All these inter-institutional mechanisms must be taken into account in the hospital's disaster mitigation and prevention plan, on the basis of the vulnerability of the structure, its equipment, and its administration and organization. A clear distinction must be made of the kinds of activities appropriate for each type of emergency. The plan must be a flexible tool, but must cover all functional relationships identified, so that services can continue to operate.

Internally, each of the services provided by the hospital will be of greater or lesser importance in the management of an emergency. Indispensable services, by definition, require immediate logistical support, both in terms of human resources and in basic supplies (water, power, food, pharmaceuticals). Non-critical services should be prepared to cede part or all of their personnel and even their facilities, so that they can be temporarily converted into additional emergency treatment areas in disaster situations. Table 4.1 lists typical hospital activities and their relative importance in the event of an emergency.

Table 4.1.
Typical hospital activities and relative importance in an emergency

Clinical and support services	Importance in the event of an emergency
Trauma and Orthopedics	5
Intensive Care Unit / Intensive Treatment Unit	5
Urology	5
Emergency Care	5
Sterilization	5
Diagnostic Imaging	5
Pharmacy	5
Nutrition	5
Transport	5
Recovery	5
Blood Bank	5
Outpatient Consultation/Admissions	4
Pediatric Surgery	4
Pediatrics	4
Laboratory	4
Laundry Services	4
Hemodialysis	4
Internal Medicine	3
Gynecology and Obstetrics	3
Administration	3
Neonatology	3
Respiratory Medicine	2
Neurology	2
Ophthalmology	2
Filing and Case Management	2
Dermatology	1
Psychiatry	1
Oncology	1
Otorhinolaryngology	1
Dental Services	1
Therapy and Rehabilitation	1

Scale of importance:
5:Indispensable 4:Very necessary 3:Necessary 2:Preferable 1:Dispensable

Source: This is a modification of a table prepared by R.Boroschek,et al.in *Capacidad de respuesta de hospitales ante desastres sísmicos:aspectos no estructurales*. International Conference on Disaster Mitigation in Health Facilities,Mexico City, 1996.

External emergencies

As mentioned earlier, a hospital should be able to face a significant natural disaster in its vicinity in such a way that, regardless of the structural and nonstructural damage suffered, its vital operations can continue to function without interruption or with the briefest possible disruption.

The U.S. Veterans' Administration[2] requires that the essential activities of health facilities be able to continue unimpeded for at least three days after a disaster takes place, in order to deal with existing inpatients and handle the injured as a result of the event. In defining essential activities, it is assumed that the hospital structure remains nearly intact and most electrical and mechanical systems still function, albeit with some limitations. Energy, communications and water supply must be guaranteed.

The emergency plan must also contemplate the fact that a natural disaster, particularly a seismic event, is likely to produce certain kinds of injuries, such as fractures, cuts, traumas, lacerations and burns, as well as others related to extreme anxiety such as insulin comas and heart attacks.

Some sources[3] estimate that in the event of a quake roughly 50% of inpatients will have to be transferred to less complex hospital facilities or even back to their own homes. Estimates also suggest that in severely critical situations the hospital might be called upon to expand its care capacity as much as tenfold, depending on the reliability of lifelines such as the water supply system or the medical supplies already stored in the hospital.

The emergency plan must contemplate the conversion of existing facilities for massive emergency care. This of course depends on the physical distribution of the various departments, the availability of equipment and personnel, and the severity of the quake, including the number of victims.

Essential activities in the event of an external emergency

The following is a list of the areas considered essential for caring for the victims of an earthquake (table 4.2). Emergency care, of course, plays the leading role, which may require physical expansion by converting Outpatient Consultation and other nearby areas. The table shows the activities that are directly related to victim management (patient care), support services, and institutional support.

Table 4.2.
Essential activities in the event of an external emergency

Patient care	Medical support	Institutional support
Emergency care	Pharmacy	Command post
Classification of patients	Clinical lab	Maintenance dept.
Immediate ambulatory care	Imaging (X-rays,etc.)	Information services
Non-urgent care / Admittance	Morgue	Nutrition
Surgery	Sterilization	Supplies
Recovery		Storerooms
Intensive care		Communications

2 Veterans Administration. *Study of establishing seismic protection provisions for furniture, equipment and supplies for VA Hospitals*. Office of Construction, Washington D.C., 1980.

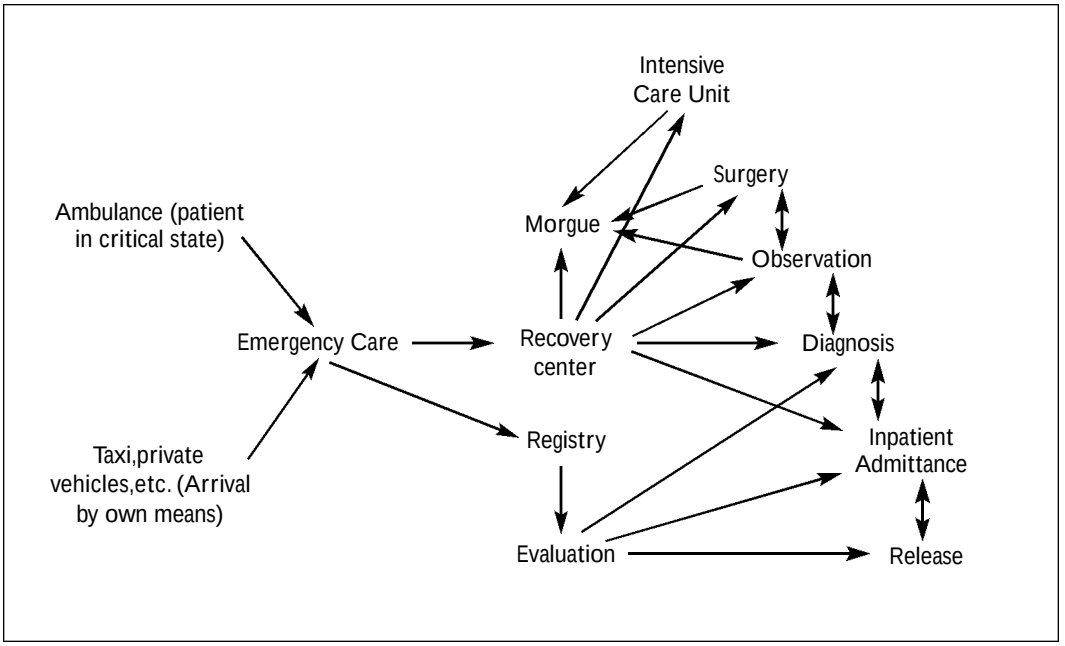
3 Ibid.

The following section provides a description of how one of these services will function both in its day-to-day operations and in the event of an emergency.[4]

Emergency care

Statistics must be analyzed—or gathered, if currently unavailable—concerning the average number of patients handled by the Emergency Care Unit, including overflow provisions and the availability of a surgical unit exclusively for emergencies, with personnel availability around the clock. Figure 4.2 illustrates the normal flow of patients.

Figure 4.2.
Patient flow in an emergency



The key difference in the event of a disaster is that triage is performed prior to the arrival of patients to Emergency Care, and the successive inflow of patients is determined by their classification. No treatment of any kind is carried out in the triage area. Patients classified as "green" are sent to Outpatient Consultation (expansion area), while "yellow" and "red" patients remain under observation or are sent to Recovery, the Intensive Care Unit, surgery or any other urgent service required.

In the course of the emergency, it is essential for the following services and supplies to be available: lighting and power, water, medicinal gas and the vacuum network (if possible, although individual suction can be used). The communications system is especially important.

[4] See Cardona, O.D., et. al: *Informe final del proyecto vulnerabilidad funcional y no estructural del Hospital Ramón González Valencia*, Colombia, 1997.

Assessment of essential activities

An example of an assessment of the institutional and logistical support for essential activities required in the event of a massive earthquake can be found in table 4.3. The ratings system work as follows:

- **Optimal**: Efficient allocation of resources or personnel
- **Adequate:** Acceptable allocation of resources or personnel; operations can proceed normally
- **Minimal:** Barely acceptable allocation of resources or personnel; operations can proceed with certain restrictions
- **Inadequate:** Unacceptable assignation of resources or personnel; severe limits on the activity in question, or impossibility of carrying out the activity in question

Table 4.3.
Example of an assessment of institutional/logistical support for key activities

Activity	Support of vital services	Assigned personnel
Emergency Care	Adequate	Optimal
Patient Classification	Adequate	Adequate
Immediate Ambulatory Care	Adequate	Adequate
Non-urgent care	Minimal	Minimal
Surgery Units	Minimal	Adequate
Recovery	Minimal	Minimal
Intensive Care	Minimal	Adequate
Respiratory Therapy	Adequate	Minimal
Pharmacy	Minimal	Adequate
Lab	Minimal	Adequate
Diagnostic Imaging	Minimal	Adequate
Morgue	Minimal	Adequate
Command Post	Minimal	Optimal
Maintenance	Minimal	Adequate
Information Center	Inadequate	Adequate
Nutrition	Inadequate	Minimal
Supplies	Minimal	Adequate
Storeroom/Warehouse	Inadequate	Adequate

Internal emergencies

Internal emergencies can have a variety of causes, such as a minor natural disaster or one caused by human activity that only affects the hospital. Some operational aspects may lead to the functional collapse of the hospital. Consequently, the hospital's organization must have the necessary mechanisms in place to restore normal functioning within a reasonable time.

One tool that must be available in the event of total functional collapse must be an evacuation plan, whether total or partial. Evacuation routes must be properly identified throughout the facilities.

Evacuation is a combination of activities and procedures aimed at preserving the life and well-being of people by means of their orderly flow to lower-risk areas. The decision to evacuate partially or totally must be taken by the hospital director, the head of medical care, the administrator, the head of nursing or the physician in charge. It may also be taken by external personnel, such as firefighters, whose prior knowledge of the hospital's emergency plan, including the key facilities, enables them to play a leadership role when required.

A description of an internal emergency plan and all of its procedures (including warning, execution of plan, care of evacuees, safety and administration) can be found in the specialized literature.[5]

[5] See for instance: PAHO, *Organización de los servicios de salud para situaciones de desastre* (Publicación Científica No. 443), Washington DC, 1983; PAHO/WHO, *Establecimiento de un sistema de atención de víctimas en masa*, Washington DC, 1996; PAHO/WHO, *Simulacros hospitalarios de emergencia*, Washington DC, 1995.

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