

Hospital Preparedness in Earthquake Zones: A Must

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Introduction

It is important that medical and paramedical teams responding to earthquakes and treating victims understand the following: (1) the definition of an earthquake; (2) the consequences of an earthquake; and (3) the common international terms used.

Earthquake

An earthquake is the shaking or trembling of the earth, which may be natural or man-made (e.g., due to atomic explosion) in origin. An earthquake is a sudden, strong movement or slipping of the earth's crust that result in a sudden release of energy. Earthquakes occur at certain locations where the tectonic plates which form the earth's crust, coincide. Populations that live near these zones or on these plates always must be prepared for earthquakes and their consequences. The direct impacts of earthquakes may be seen in several forms, such as shaking, ground ruptures, landslides, avalanches, fires, soil liquefaction, tsunamis, and/or flooding.

Earthquake Clusters

Several related sequences can follow an earthquake. The most common sequence can be described as follows:

Aftershock—An earthquake of similar or of lesser intensity following the main earthquake. Responding hospital teams must be aware of its risks and take all necessary precautions.^{1,2}

Earthquake Swarms—A sequence of earthquakes that occur at a certain location within a short period of time. These earthquakes all have the same magnitude, which is the main difference from an aftershock.^{1,2}

Earthquake Storm—In cases when the main earthquake strikes a fault in a cluster, it may cause shaking and stress in the redistribution of the previous earthquake. These storms may occur for a longer period of time and can take years. The mitigation, medical, and paramedical team should be aware and alert to respond accordingly on its serious risks.

Patterns of Injury

The responding hospital team should understand the pathophysiology of injuries caused by an earthquake in order to: (1) prevent or reduce the fatalities and impacts of the injuries; (2) prepare and provide the responders with necessary equipment and medication required to manage the injuries; and (3) employ and train qualified medical and paramedical staff to manage such injuries.

Researchers have agreed to divide earthquake injuries into three different types.²⁻⁸

Fatal Injuries—These injuries usually occur within the first minutes of the earthquake. But, Corinne Peek-Asa considers fatal injuries as those that occur within the first day of the earthquake.⁵ The most common cause of death usually is head injury, followed by chest injury.^{5,6,8} Other causes of death include

asphyxia, body compression shock, bleeding, and complications due to hip injury. It is remarkable that there is no single, complete autopsy of any victim of earthquake in the literature. This shortcoming can be explained by the large number of victims and limited time and resources of the responders at the location of the earthquake.

Hospitalized Victims—Injured survivors usually are admitted to referral hospitals. Lower limb injuries account for nearly half of these injuries. Femoral fractures are the most common type of fracture reported.

Post-Traumatic Stress Disorder (PTSD)—Many, if not all, victims either showed early or late signs and symptoms of PTSD. Earthquakes remain one of the most frightening events due to natural hazards, and the sense of losing a loved one, home, and belongings causes strong, disturbed feelings for the victims.

Field Hospitals

Working in a field hospital near the epicenter after an earthquake is a risky and dangerous task because of aftershocks and other earthquake-related consequences. The site for a field hospital should be chosen with great care. It should be in a relatively safe area, away from any collapsed buildings. The hospital staff should take every possible precaution to protect themselves and the victims.

The role of the hospital should be: (1) stabilizing the patient, triage, clearing and maintaining the airway, and evacuating them as soon as possible; (2) simple hemostasis; and (3) simple external fixation of fractures.

Transportation and Evacuation

Helicopter ambulance and aircraft proved to be the most efficient methods of transportation after the Bam earthquake. After an earthquake, every second is precious and could mean saving or losing lives. Delays in the transport of victims to the nearest referral hospital by land ambulance due to blocked roads directly impacts the chances of survival and recovery of the injured victims. Air transportation provided an excellent chance for reducing the fatalities.

Communication

The disruption of communication has been noted following earthquakes due to damage to communication networks. Therefore, satellite, cellular telephones, and/or cable communication should be the methods of choice.

Hospital Preparedness

Hospitals located within or near the epicenter, or in a region close to the affected area, may serve as referral treating centers. In case of an earthquake, the referral hospital should be well-prepared to respond quickly and healthcare planners should consider following elements:

1. *Geography*—The location of the referral hospital should be chosen with great care. It should be away

from the seaside, volcanic regions, and mountains, and should be near to and accessible by main roads.

2. *Building Structure*—During the last few years, infrastructural developments have improved remarkably. Establishments use highly developed materials able to absorb the seismic waves of earthquakes, which decreases the risk of sudden collapse and gives people ample time to evacuate from a building. This technology should be used in hospitals. In addition, the referral hospital should have its own well-maintained power and water resources. The hospital also should have a space for helicopter and aircraft landing.
3. *Medical and Paramedical Staff*—The medical and paramedical staff should be qualified and well-trained in responding to different types of injuries, including burns. There should be enough staff members available all day and night.
4. *Communication*—An effective and tried network of satellite or cable communication should be available to provide communication within the referral hospital, other hospitals, ambulance services, and other healthcare providers within the area, both nationally and internationally.
5. *Transportation*—Air transportation is the method of choice. Therefore, special arrangements should be made to plan for helicopter and aircraft transportation.
6. *Education, Training, and Drills*—Education and training are key. All staff members should understand the nature and consequences of an earthquake. They should be familiar with all scientific terms used internationally. Drills should be conducted frequently, and a regional drill should occur annually. Continuous training enables hospital staff to be prepared to respond quickly. A ready, well-informed, and well-trained hospital staff reduces fatalities drastically.
6. *Research*—The conduct of research is vital, especially in ruling out the causes of injuries and to determine how to prevent or reduce the risks of injuries. Research may continue through the long-term impacts of an earthquake.
7. *Establishing a Network for National, Regional, and International Coordination and Cooperation*—In most cases, local hospitals can not admit all of the earthquake victims. Therefore, it is essential to establish a network of coordination between different healthcare providers or organizations, either nationwide or internationally. It is recommended that this coordinating network meet regularly. Coordinating and meeting for the first time during the disaster may cause confusion and delay in the needed services for the victims.
8. *Aftermath*—Regular follow-up of the cases is important. Many of the victims and medical and paramedical staff suffer from PTSD. Therefore, counseling should be available.

Documentation of all the events should be made and be published for extraction of facts, lessons, and to highlight the vital importance of hospital and staff preparedness in cases of disasters such as earthquakes.

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