THE IMPORTANCE OF DISASTER MANAGEMENT AND IMPACT OF NATURAL DISASTERS ON HOSPITALS

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ABSTRACT

The purpose of this research is to study and explore the importance of hospitals in natural disaster events and to identify the impacts on the hospitals in natural disaster events. A disaster is an unforeseen event, which can overwhelm the capacity of the affected people to manage its impact. Many people are periodically exposed to natural disasters in their life, and most disasters, or more correctly hazards that lead to disasters, cannot be prevented. However, their effects can be mitigated. Disaster management efforts aim to reduce or avoid the potential losses from hazards, assure prompt and appropriate assistance to the victims of a disaster, and achieve a rapid and effective recovery. It is crucial that hospitals remain safe and functional during and after disasters. Health facilities at all levels deserve special attention in the case of natural disasters as they must continue the work of current patient treatment within their facilities and provide additional care for persons injured by the disaster event. Disaster management becomes even more important for hospitals as the health sector has been particularly vulnerable to the damage caused. For this study, secondary information was retrieved from the Internet on sudden-onset natural disasters in different parts of the world was collected. This study found some barriers and deliverables for disaster managers that could mitigate the risk of a natural disaster's impact on a hospital. Accordingly, this paper evaluates the importance of disaster management for hospitals and the challenges that need to be considered during the disaster response.

Keywords: *Hospitals; Impact; Natural disasters; Mitigation; Strategy.*

1. INTRODUCTION

Huder (2012) defines disaster events as a "pebble drop in a pond where the pebble impacts the surface of the pond and ripples outwards". In the case of a natural disaster, the impact is often felt throughout a community. A disaster can be an unforeseen event; it can overwhelm the capacities of those affected, and disrupt many normal human activities (Tomasini and Van Wassenhove, 2004). Many people are periodically exposed to at least one natural disaster in their life, and most disasters, or more correctly hazards that lead to disasters, cannot be prevented; however, their effects can be minimized (Lin Moe *et al*, 2006). As communities worldwide face an increasing frequency and variety of disasters, there is an urgent need to reduce the risk from disasters (Lin Moe *et al*, 2006). Within this context, disaster management is significant as it can mitigate some effects such efforts aim to reduce or avoid the potential losses from hazards, assure prompt and appropriate assistance to the victims of disaster, and achieve a rapid and effective recovery. Disaster management becomes even more important for hospitals as the health sector has been particularly vulnerable to disaster. Health facilities, at all levels, deserve special attention in the case of natural disasters, as they must continue patient treatment and as well as care for those injured by the event (Eybpoosh, Dikmen, and Talat Birgonul, 2011). At any given time, hospitals have a population of patients, staff, visitors, and transient patients, but in a disaster event, the number may rapidly and substantially increase. The security and safety of all patients and occupants must be secured whilst continuing ongoing treatments and support services (Salamati *et al*, 2016). It is also important that promotion and prevention programs are not suspended, such as prenatal care and hemodialysis. As such, to ensure the continuity of service in the case of a natural disaster, a hospital must develop and implement formal plans to deal with such difficult events.

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The construction plan of the hospital building and its equipment must ensure it remains in a serviceable condition however in the poor hospital authorities recognize these facts, which is why they usually draw up plans to deal with disasters and develop design strategies that understand and mitigate risk by using a specially designed construction plan (Kenny, 2012) but between 1990 and 2010, more than 100 hospitals and more than 650 health centers were affected across the world as a result of natural disasters; in these situations, many hospitals either collapsed or were left in a vulnerable condition requiring evacuation (Bosher and Dainty, 2011). This suggests that, without proper planning in a disaster event, hospitals may face a difficult situation when trying to continue to deliver their services to patients, particularly as the hospital may be experiencing some chaos. Accordingly, this paper explores the importance of hospitals in disaster events and the impact of natural disasters on hospitals. The researcher in this study attempt to understand the importance of hospitals in natural disaster events, and also mitigate the risk of natural disasters on hospitals, and focusing on continuity of health services during natural disaster events. This paper is structured as follows: firstly, the concept of disaster and the importance of disaster management in hospitals are reviewed from the latest literature. Secondly, some challenges for hospital disaster management will be discussed, and finally, the paper provides a discussion that focuses on a better vision and appropriate framework in order to better manage hospitals in natural disaster events.

2. LITERATURE REVIEW

2.1. THE CONCEPT OF DISASTER

The World Health Organisation (2006) defines disaster as “any occurrence that causes damage, ecological disruption, the loss of human life, or the deterioration of health and health services, on a scale sufficient to warrant an extraordinary response from outside the affected community or area. The disaster has been defined by many researchers; for example, it is identified by Burnham (2013) as an unforeseen event that is suddenly overwhelming”. McEntire (2015) describes disaster as “a destructive, deadly and disruptive incident that happens when a hazard connects with humans”. Disasters can happen abruptly and can be classified as a dangerous and calamitous incident, which overwhelms and disrupts infrastructures (Ardalan, 2013). From a different perspective, it can be described on a household scale, where a disaster can cause major sickness and social calamity, or an essential economic catastrophe (Shaluf, 2007). It is clear from the above definitions that a disaster causes damage not only to human lives but also to constructed entities (Rathore and Gosney, 2015). However, there are two common points in all of the aforementioned descriptions, which are time and location. Indeed, Al-Dahash *et al.* (2016) confirm that disasters are defined based on time and space. Also, Alexander (2003, cited by Al-Dahash *et al.*, 2016) described the disaster as a combination of vulnerability, lack of measures, and hazards that require the implementation of appropriate measures for planning, and the use of appropriate resources in order to mitigate the adverse impacts. Scientists have pointed out that natural disaster occurrences have significantly increased and intensified in the last 30 years. In Figure 1, the statistics demonstrate the number of earthquakes across the world between 2000 and 2015.

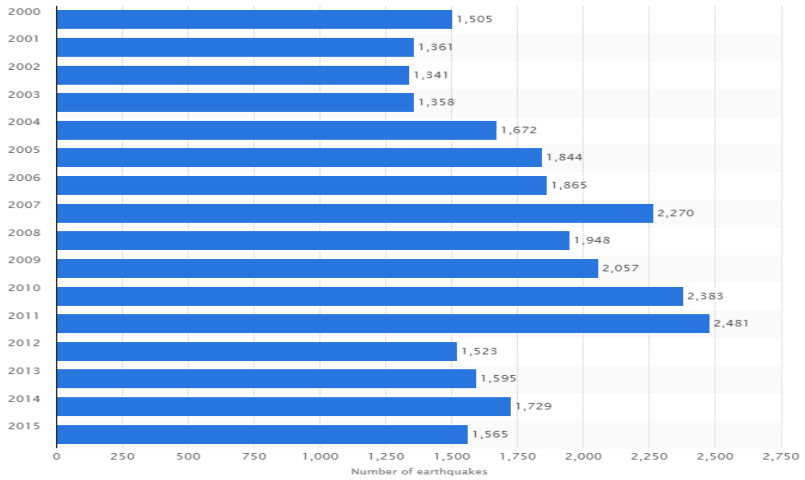

Figure 1: Development of the Number of Earthquakes (M5+) Worldwide between 2000 and 2015 (Source: Gulyaeva and Arikan, 2016)

Although there are some similarities between definitions, such as time, space, and their unforeseen nature, there is no universal definition of disaster events (Shaluf *et al*, 2003). Disaster events may happen in two different types such as; natural, and manmade. In 2015, the total number of earthquakes with a magnitude of more than five in the richter scale reached nearly 1600. While the technology used to record and find the source of earthquakes has improved since the 20th century, the ability of scientists to predict earthquakes or other natural disasters is still severely limited (Gulyaeva and Arikan, 2016). Hence, in this study researcher efforts to will go deeper into natural disasters such as an earthquake, flood, and assessing the impact of natural disasters especially earthquake and flood on hospitals.

2.2. SIGNIFICANCE OF DISASTER MANAGEMENT IN HOSPITALS

The hospital has been defined by PAHO (2000) as "a laboratory, hotel, office building and warehouse". The significance of hospitals and health centers is well recognized in terms of their importance in providing services to patients at any time. Indeed, hospitals are arguably powerful symbols of social progress. They are a prerequisite for stability and economic development and have symbolic social and political values that contribute to a community's sense of security and well-being (Musani, 2008). It is crucial that hospitals remain safe and functional during and after disaster events, and it is recognized that hospitals at any size need high attention in the case of natural disasters, as they must continue patient treatment and provide care for persons injured by the event (Eybpoosh *et al*., 2011).

Hospitals are expected to be ready to play an essential role in reducing death and injury, and hospital readiness has been defined as the ability to effectively maintain hospital operations, sustain a medically safe environment, and adequately address the increased and potentially unexpected medical needs of the affected population (Yeatts *et al*. 2009).

Over the past years a number of hospitals around the world have been affected by disaster events; for instance, between 2001 and 2011, 119 natural hazard events were recorded in 25 provinces of Iran (11.9 hazards per year) that affected the primary health care centers and threatened the lives and safety of health staff. This represents 3.1% of the 3,903 natural hazard events overall that occurred in the same time period in Iran. These 119 events led to the physical damage or functional failure of 1,401 health centers, the injury or illness of 644 people, and the death of 127 health workers. Kerman, Sistan and Balouchestan and Lorestan were the provinces that experienced the highest number of adverse impacts from natural hazards on their health centers. Figure 2 demonstrates the occurrence of natural hazards in Iran between 2001 and 2011, which had an impact on its primary health care facilities.

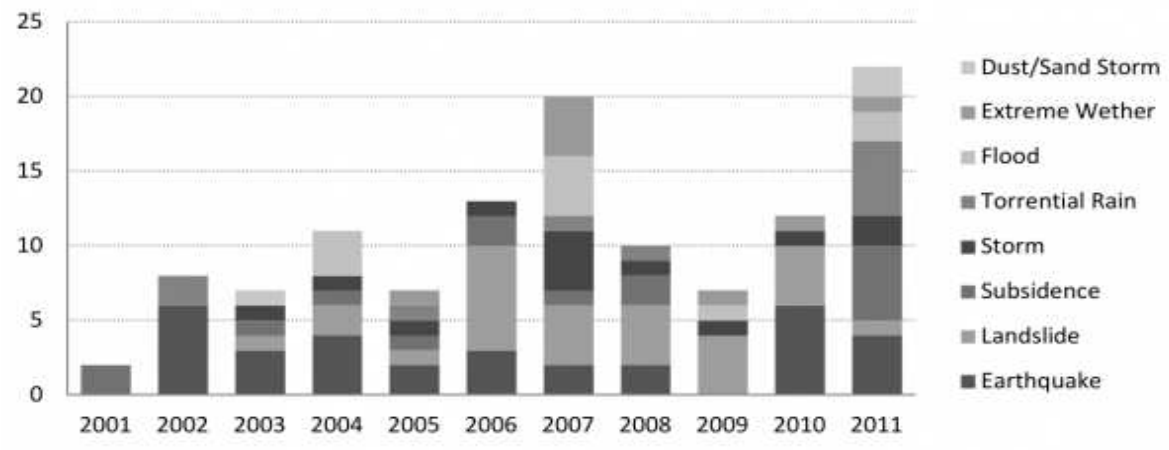

Figure 2: Occurrence of Natural Hazards with an Impact on Primary Health Care Facilities in Iran 2001-2011 (Source: Ardalan, 2013)

A key criterion for hospital readiness involves having a comprehensive disaster plan, this first begins with a comprehensive risk assessment and hazards vulnerability assessment to identify the most likely threats to a particular hospital. Readiness continues to mitigation, preparedness, response and recovery phases (Kaji, 2006). To avoid the impact of disasters on hospitals, it is vital that they have appropriate disaster management strategies to mitigate the adverse impacts. The aim of a comprehensive hospital disaster plan are to: enable the hospital to effectively manage a disaster, provide continuity of basic societal functions, minimise the physical

damage to a hospital, as well as minimise loss of life, injury or illness of hospital personnel and human suffering of the persons affected (Kaji, 2006).

A comprehensive hospital disaster plan includes all hazards, all disciplines/phases, and all levels/related organizations in the disaster management process (Koeing and Schultz 2010). Nevertheless, it is important not to regard the plan as the entire essence of emergency preparedness, but rather as one essential element in a spectrum of activities (Adini *et al*. 2006). Having a disaster plan does not equal complete preparedness (Kaji and Lewis 2006); however, a comprehensive disaster plan is considered the backbone of a hospital's preparedness. One important aspect of a comprehensive disaster plan is an all-hazards approach, which refers to the consideration of any incident or event that could pose a threat to human life, property or the environment (ASTM 2009). An all-hazards approach does not mean being prepared for any and all hazards that might manifest in a particular community, including a hospital. Instead, it means that there are common needs and responses that are required in disasters, such as the need for the treatment and triage of victims that can be addressed in a general plan; this type of plan can provide the basis for responders to prepare for these types of unexpected events. The plan provides a framework for responding to various types of disaster; however, planners typically only address the kinds of disasters that might be expected to occur (Waugh, 2005).

Another aspect of a comprehensive disaster plan is to consider all phases of the disaster management cycle. An effective hospital disaster management plan must be constructed in four stages of emergency management, which are: (1) mitigation, (2) preparedness, (3) response, and (4) recovery (Adini,and *et al* 2003). For example, the hurricanes of 2004 that struck Florida provide useful insights into what can go wrong even when such an event has not been taken into account. Hurricane Charley, a weak Category 4 storm, made landfall in Charlotte County along the western coast of Florida. A regional medical center located in the area sustained significant damage to its roof and windows, resulting in rainwater infiltration into patient rooms and other medical service areas. As the storm passed through the area, the hospital lost its main power, resulting in the activation of its emergency power generators. However, the generators only had enough diesel fuel to keep the facility operating for 28 hours. A backup emergency generator and fuel tank (Nathan, 2004).

2.3. CHALLENGES FOR HOSPITALS DISASTER MANAGEMENT

In terms of the importance of hospital disaster events, there are some barriers that work against disaster managers when trying to manage such events. Yarmohammadian *et al*. (2013) state there are internal and external barriers that disaster managers must face. Some internal barriers for hospitals include; a lack of encouragement and motivation between hospital and management staff, a lack of a universal language between staff, the high cost of implementation of emergency equipment for incident events a lack of competitive atmosphere for the excellence and progress involvement of administrative managers in daily activities, also a lack of recognition amongst staff for the need for crisis management, as well as a lack of knowledge about dealing with natural disasters in hospitals amongst disaster managers (Milsten, 2000). Also there are some external barriers that disaster managers must face, such as a lack of commitment amongst managers and a lack of managers with sufficient authority to oversee the plan's implementation, the absence of statutory requirements, the involvement of different decision making authorities, a lack of appropriate administrative culture for managing crises, weak communication and coordination of crisis teams, and the lack of an emergency incident command system in the country at a higher level (Yarmohammadian *et al*., 2011).

3. RESEARCH METHODOLOGY

This research is based on secondary data analysis that aims to explain and define disaster impacts on hospitals. This study used journals, books, and databases to gather information regarding the context, the local pre-disaster availability of hospitals and health facilities, and the sudden impact of natural disasters on the hospitals. This research is a qualitative study, which was conducted by variety literature in terms of natural disasters and impact of those events on hospitals. In this study researcher concentrate on the impact of natural disasters on hospitals, hence two types of disasters such as earthquake and flood are considered. At this point, the primary data collection and analysis has not yet been completed, which will be collected by semi-structured interviews with some relevant expert views regarding hospital disaster management. Thus this qualitative research is purely adopted a qualitative data collection strategy, and consider a variety of secondary sources accessed through the Internet and academic databases.

4. THE IMPACT OF NATURAL DISASTERS ON HOSPITALS

According to the WHO (cited by Noralfishah *et al*, 2015), hospitals play critical roles in disaster events in that they provide communities with essential medical care. However, depending on the nature and impact of disasters, the demand for health care services can rapidly increase and can overwhelm the functional capacity and safety of hospitals. There are different impacts that can be seen in disaster events, such as the impairment to hospital functions, the direct impact on patients and health equipment, and the physical damage to hospital buildings (Ardalan and Schnelle, 2016). In disaster events, patient documents and medicine can be affected and it is particularly important to protect these in an incident. Also, supplying food and necessary medicine, especially in the early hours of the disaster, is crucial and must also be considered by disaster managers (Nakhaei *et al*, 2014). In particular, disasters can have two different impacts on hospitals. The first was identified by the Disease Control Priorities Project (2007) which noted a range of damage and loss,, such as the loss of health equipment, a failure in a hospital's energy resource, a lack of staff, difficulty in accessing patients' documents (for example, medical records), and issues in accessing the hospital building. For example, the earthquake that struck Mexico City in 1985 resulted in the collapse of 13 hospitals. In just three of the hospitals' buildings, 866 people died, 100 of whom were health personnel, and nearly 6,000 hospital beds were lost across the city's metropolitan facilities. Furthermore, as a result of Hurricane Mitch in 1998, the water supply systems of 23 hospitals in Honduras were damaged or destroyed, and 123 health centers were affected. Finally, Peru reported that nearly 10% of the country's health facilities suffered damage as a result of El Niño events in 1997–1998.

5. DISCUSSION

As identified, hospitals can suffer a range of damage to equipment, utility supplies, patient documentation, staff and patients through natural disaster events, and all of these impacts can decrease or prevent the treatment of injured people by the health service. For instance, the continued operation of healthcare facilities after earthquakes depends on the available utility systems as the majority are supplied from main grids and networks, such as electric power, water supply, and telecommunications. As demonstrated in Figure 3.0, a disaster can have a long-term impact; for example, there are two different types of damage to hospitals, namely direct and indirect, and the sum of these two types comprise the total cost of a disaster.

Direct damages refer to the loss of materials, hospital beds, medicines, and destroyed health equipment; thus it refers to damage that is the immediate consequence of a disaster and usually remains for a long period after a disaster event. Natural disasters can cause serious damage to health facilities, water supplies, and sewage systems, and as such, have a direct impact on the health of the population dependent on these services. In the case of structurally unsafe hospitals and health centers, natural disasters jeopardize the lives of hospital occupants and limit the capacity to provide health services to disaster victims. There are important lessons to be learned from past natural disasters. Hospital administrators must first have a clear and complete understanding of the types of disaster that can affect their facilities, specifically the magnitude and probability of an occurrence. Given these exposures, they must identify the vulnerable areas of the hospital complex, particularly those parts that provide essential support to the facility: namely, the electrical rooms, air handling equipment, fire protection systems, medical gasses, and communications. Finally, once exposures and vulnerabilities are identified, they must establish a cost-effective mitigation plan to minimize the risks.

Several methods are available to determine the optimal amount of funding to invest in order to reduce the risks posed by natural hazards. Such an investment in mitigation aims to ensure that a hospital is able to fulfill its essential role as a provider of critical care to victims following a natural disaster (Nathan, 2004). Therefore, the type and magnitude of a natural disaster determine the impact on a hospital, in terms of their water and food supplies, sewage systems, access to buildings, access to patient documentations, and medical supplies. The immediate health burden depends on the nature of the hazard. In the aftermath of a major disaster, authorities must meet extraordinary demands with resources that may not even begin to meet basic health needs, and that often have been drained by the immediate emergency response. Although disasters related to natural events may affect the transmission of pre-existing infectious disease, the imminent risk of large outbreaks in the aftermath of natural disasters is often overstated.

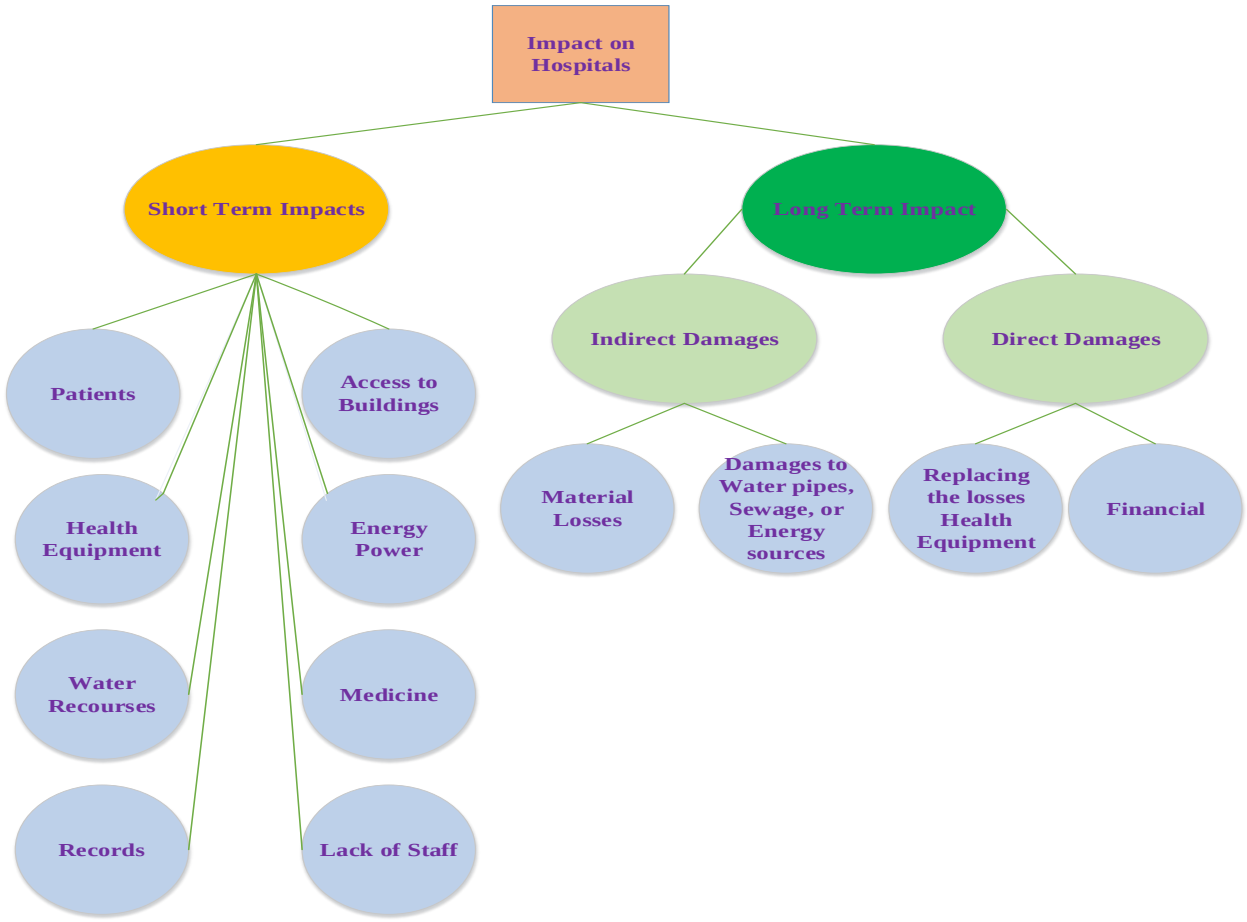

Figure 3: Summary of Impact of Disasters on Hospitals
(Source: DCPP, 2007)

6. CONCLUSIONS

Disasters are not likely to decrease in the foreseeable future; therefore, a sustained effort is needed to minimize risk by reducing vulnerability through prevention and mitigation and by increasing capacity through preparedness measures. In previous experiences, such as earthquakes, floods, or tsunamis, the importance of hospitals have been critically important. Previous strategies employed by health authorities and relief groups to reduce further morbidity and mortality following natural disasters may be helpful in similar future events; however, this must be comprehensively evaluated for each disaster plan. Due to the geographical and geological situation of these previous incidents, it could be argued that further disaster events are inevitable. Nevertheless, many lessons should be learned from previous natural disaster events and how planning could be applied to future incidents. Therefore, planning for natural disasters depends on the type and magnitude and its consequent impact on hospitals' water and food supplies, sewage systems, access to buildings, access to patients' documents, and medical supplies. The immediate health burden depends on the nature of the hazard. In the aftermath of a major disaster, authorities must meet extraordinary demands with resources that might not begin to meet even basic health needs and that often have been drained by the immediate emergency response. Disasters related to natural events may affect the transmission of pre-existing infectious disease, but the imminent risk of large outbreaks in the aftermath of natural disasters is often overstated. Therefore, comprehensive and effective disaster management is highly important for hospitals and health centers. During a disaster, it may become necessary to evacuate non-ambulant and ambulant patients; thus the response to disaster including evacuation procedures should be well established. Nevertheless, this research can contribute to the existing knowledge for managing better health centers during disasters, and mitigate the impact of natural disasters in hospitals.

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