

Nontherapeutic areas and their role in hospital surge capacity in facing disasters

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Abstract

Background: Unexpected events, accidents, wars, other natural, and unnatural disasters threaten human life. Hospitals especially emergency departments are the first line dealing with the disaster victims and on the other hand, are often full of patients. The purpose of this study is evaluating surge capacity of Isfahan Al-Zahra Hospital in facing disasters with the usage of nontherapeutic areas potential in a time of crisis.

Materials and Methods: First, nontherapeutic areas having the conversional potential to be used as therapeutic areas were defined and then with applying standard formulas, and patient admission capacity was calculated.

Results: After calculating, it was determined that there is a potential of hospitalization of 240 patients at the stadium next to the hospital, 100 patients in clinics, 1,000 patients in the indoor parking, and 3–4 thousand patients in the open space area.

Conclusion: Hospital current capacity could be increased significantly in case of facing disasters through providing instructions, and pre-prepared plans.

Key Words: Disaster, nontherapeutic spaces, surge capacity

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INTRODUCTION

Disaster dates back to the age of the earth and are now a part of people's lives.^[1] In the past 50 years, more than 10,000 cases have been reported in the world and a full of 5 billion people were affected by the disaster.^[2] In addition to massive economic, social, and psychological damages, fatality disaster is also considerable. In the last 10 years more than 700 thousand people worldwide have lost their lives as well as more than one and a half million people injured due to disasters.^[3] Iran is the fourth disaster-prone countries in Asia and the tenth in the world^[4] so that during the past 90 years more than

180 thousand people died just in the earthquake and many times that injured.^[5] In the 2003 Bam earthquake for instance, more than 40 thousand people have lost their lives, and more than 30 thousand injured.^[6] One of the unfortunate results of disasters is the huge number of victims in the affected region for whom the health system as the main trustee responsible is to manage all public health measures.^[7] Hospitals as the first line of health sector response to disasters and emergencies, especially in the acute phase are always faced with a mass influx of victims. In many communities, the response capacity of health system particularly in the field of hospital is limited to meet the daily

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needs.^[5] Therefore, in disasters with lots of victims, hospital resources are not able to meet the needs of them and overcrowding hospitals led to poor performance.^[8] In this context, the main tasks of hospital are to continue providing services. This means that in addition to providing services to patients who already have been hospitalized, the hospital within a short period should increase its capacity to admit the mass of accident victims. One of the main solutions to improve the response of hospitals is to strengthen the surge capacity.^[9] Surge capacity can be defined as follows: The ability to provide adequate resources includes three main components, staff, stuff, and structures in order to provide suitable care during a mass influx of victims of major accidents or disasters.^[10]

Owing to the vulnerability of Iran in disasters,^[5] strengthening the capacity of country's hospitals in the face of unexpected events is inevitable. One of the main components of the surge capacity is the physical structure of hospital. On account of possibility of injury in therapeutic areas and the need to increase the reception capacity, use of nontherapeutic areas as a therapeutic area in Hospital Disaster Plan is always taken into consideration.^[11] This study aims to assess the increase of surge capacity of Isfahan Al-Zahra Hospital in field of physical structure and to evaluate therapeutic use of nontherapeutic areas as a solution for enhancing the surge capacity.

MATERIALS AND METHODS

The in hand research is a cross-sectional study. At the beginning of the study, a team of experts in the fields of emergency medicine, construction, engineering, nursing facilities, and medical records to assess surge capacity was formed, a briefing was held and objectives, and methods of work were explained. The second step is to check the documentation of the hospital last year, and the calculation of "bed occupancy rate" monthly and yearly, and to compare with the number of active hospital beds by which the assessment team estimated the number of empty beds in the hospital in the period of study. Subsequently the assessment team put step in a field study of therapeutic and nontherapeutic areas where can increase the capacity during a mass influx. Health facilities include VIP, private rooms, and a central clinic of the hospital, and nontherapeutic sectors include a courtyard, a chapel, an auditorium, an office building, a parking lot, and gym. In the feasibility of change nontherapeutic areas and increase the capacity of therapeutic areas, the assessment team has considered the following considerations: Structural and nonstructural safety, emergency

evacuation routes, access to life lines such as water, electricity, and telephone.

The method used in calculating and estimating the number of increasable beds in therapeutic and nontherapeutic areas is space for fitting a therapeutic bed standard. According to this standard, the space required for each bed in the emergency department is usually 10–20 and the minimum can be 7.15 m². The distance between two beds in emergency should be 2.4 m², so the space occupied by each bed has been considered 10 m².^[12]

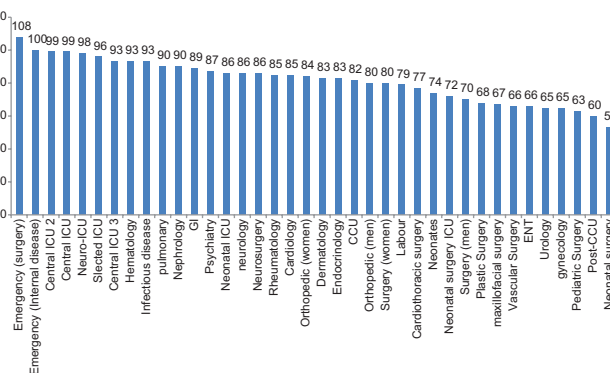
RESULTS

Review of hospital documents and reports in 2012 showed that the average number of active beds in this year have been 700. The average bed occupancy rate has been 80% during the year studied, and on average 20% of the hospital beds have had no patients. So during the period under review, there were averagely 140 beds available in the hospital. The information on bed occupancy rate in different parts of the hospital in 2012 has shown in Table 1.

Considering the standard "space for fitting a therapeutic bed" the team estimated that 10% of total hospital bed capacity can be increased by minimizing the distance between the beds, abolishing the private rooms, and use the unused spaces. Estimates showed that a potential for increasing 70 beds in therapeutic areas is possible. In total, with efficient use of existing inpatient treatment space as well as clinics, the hospital is able to add averagely 310 beds to active beds without the use of nontherapeutic areas.

In the evaluation of operable nontherapeutic areas to increase capacity, the following results were obtained:

Table 1: Isfahan Al-Zahra Hospital bed occupancy rate in the wards, 2012



Next to the hospital, there is a large indoor stadium which has a gym, and several office rooms. Also on the north side of the hospital there are four levels of parking garage with each level built along the slope of the hill and not on the top of each other, used by doctors and hospital personnel which can be brought into play in times of crisis as a convenient place for putting beds or even hospitalization on the ground. In the hospital, there is a large open space with grass and asphalt carpet that can also be used as a space to place beds and facilities. Regarding to the space of each nontherapeutic areas, and standards cited, the number of increasable beds in nontherapeutic areas for stadium, parking, and outdoors respectively estimate 240, 1000, and 3500 patients. The results of this study indicates that the physical structure of therapeutic and nontherapeutic areas with the appropriate changes will have additional capacity for 5000–6000 patients in times of disaster.

DISCUSSION

One of the features of natural and unnatural disasters or epidemics is mass influx of victims to hospitals.^[4] Various studies show that although the bed occupancy rate depends on several factors which are different in various hospitals, but the daily capacity of many hospitals is not 100% occupancy.^[13] The study also showed that on average 20% of the hospital's active beds in the past year were empty for all time, and in the mass casualty incident, the hospital could bring this part of capacity into play. As said by US National Center for Health Statistics, on daily average 26% of the hospitals bed capacity in the US is ready to accept patients, as well.^[14]

Although the hospital empty capacity can be considered as part of the hospitals resiliency and can admit patients at the time of disaster, but in many disaster the number of victims is huge, and capacity of hospitals in the affected area will be overwhelmed quickly. In these situations, hospitals have to use unusual strategies to provide minimum medical care including triage, primary medical care, and initial stabilization of patients in excess of current daily staffed hospital capacity.^[12]

One of the planned strategies which help to improve the hospitals resiliency is to utilize nontherapeutic areas, and unused therapeutic areas to admit patients.^[15] Current study shows if appropriate planning and preparation happens, the admission capacity will significantly increase. According to the guideline suggested by US Department of Health and Human Services, the proposed surge capacity is 500 beds for adults and children per one million covered population

of the region. One of the guidelines' criteria to calculate the surge capacity has been access to medical facilities to provide primary care.^[16] Due to the constraints of therapeutic areas in this hospital, in comparison the results of current study with the standard recommended, in terms of physical structure the hospital is able to obtain the necessary surge capacity in order to provide minimum service standards for 700 thousand people in the region. However, the increase in hospital surge capacity is not limited to physical spaces, and the essential preparation in the field of stuff, and staff is also required.

Based on studies of Hick *et al.* in 2004, those nontherapeutic areas that have the basic infrastructure to become therapeutic areas can be utilized as therapeutic areas. But it is important that these areas must be strengthened, and should be turned into therapeutic areas with at least acceptable standards treatment for patients by the establishment of vital features. Table 1 lists the infrastructure [Figure 1].^[12]

There is no immediate space around the hospital which in all of these properties to be available; each other have their own advantages making them proper for specific groups of patients and victims. For instance, if a large number of walking wounded rush to the hospital, it is possible to set triage, and outpatient treatment for them outdoor but it is not true for patients with serious injury or illnesses. Outpatient treatment in open space takes pressure off the emergency and will save the hospital physical space, and facilities for the treatment of critically ill patients.

Moreover, this open space can be employed for patients' relatives worry about their families and crowd in the hospital, or around it. On the other hand, if the hospital is also involved in the accident and buildings

- Ability to lock down facility
- Adequate building security personnel
- Adequate lighting
- Air conditioning ventilation
- Area for equipment storage
- Biohazard and other waste disposal
- Communication capability
- Door size adequate for gurneys
- Electrical power with backup
- Family areas
- Floor and walls adequate
- Food supply/preparation area
- Heating
- Laboratory/ specimen handing area
- Laundry area
- Loading dock
- Oxygen delivery capability
- Parking for staff/visitors
- Patient decontamination areas
- Pharmacy areas
- Proximity to hospital
- Toilet facilities/ showers/waste
- Tow-way radio capability
- Water supply
- Wired for information technology/internet access

Figure 1: Infrastructures of a nontherapeutic area that has the potential to become a therapeutic area

destroyed, open space around the hospital will be the best place to establish a field or a new hospital.

Roofed parking space has more advantages than the open space. As cited before, the hospital has a four-story parking garage which is located next to each other but at a higher level. Considering that the wall surrounding the parking lot is short and has not extended to the ceiling, it is necessary to extend the walls by tents for hospitalization. In comparison between a roofed and open space, the first one is better for establishment of patients and even outpatients both in summer and winter. In addition, disasters that lead to skin infections among victims such as explosion of a chemical plant, and the mentioned roofed parking garage could be a suitable place for establishment of the decontamination teams. The indoor stadium, proper for every season, is an equipped space with the most features listed in Table 1. Consequently, there is an ideal space for the longer hospitalization and proper for the patients who are waiting for land or air evacuation.

When all is said and done, the conducted study shows at a possible disaster Isfahan Al-Zahra Hospital in terms of the physical structure has the ability to admit about 5000–6000 additional patients. This article accomplished only in terms of physical location and structure, but for the hospital surge capacity it is necessary to study the other components, included staff and Staff. For more information especially the comparative ones, it is recommended to study about the other hospitals surge capacity in the country, and the results of these studies tested to maneuver.

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Conflicts of interest

There are no conflicts of interest.

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