

Emergency response of Iranian hospitals against disasters

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Abstract

Objective: Hospital emergency management is a continuing process requiring the monolithic integration of planning and response attempts with local and national schemes. The aim of current study was to assess emergency response of hospitals against disasters in Tabriz.

Methods: A cross-sectional study was conducted in Tabriz city, during 2016 in Iran. The study population included all hospitals in Tabriz city. 18 hospitals were assessed. Hospital emergency response checklist was used to collect data. Tool components including: command and control, communication, safety and security, triage, surge capacity, continuity of essential services, human resources, logistics and supply management and post-disaster recovery. Data entry and analysis was done using SPSS-20.

Results: The results showed that emergency response of hospitals were 54.26 percent in Tabriz. The lowest response rates were related to Shafaa hospital (18.89%) and highest response rates was related to Razi hospital (91.67%). Components of hospital emergency response were assessed between 48.07% (Surge capacity) to 58.95% (Communication).

Conclusion: Based on WHO checklist, only emergency response of hospitals were 54.26 percent in Tabriz. So, Hospital emergency responses against disasters have to be improved and should be 100 percent. It is essential to design a comprehensive framework for hospital emergency response.

Keywords: Hospital emergency response, Evidence based disaster management, Disasters.

Introduction

Hospitals and health centers are complex and potentially vulnerable establishments, dependent on outer support and supply lines. Medical care organizations play a critical role in providing communities with necessary medical care pending all types of disaster. Depending on their domain and nature, disasters can lead to a quickly increasing service demand that can break down the functional capacity and safety of hospitals and the health care system at large [1-4]. The events of September 11, 2001, and the devastation from Hurricanes Katrina and Rita highlight the importance of hospital disaster preparation and response. Prior disasters have provided perspective on current challenges in evidence based disaster management. Confusion over roles and responsibilities, weak communication, lack of planning, suboptimal education, and a lack of hospital coalition into community disaster planning are some formerly recognized major problem areas [5, 6]. Disaster may be defined as a natural or man-made event that results in a misbalance between the supply and demand for resources [7-9].

Globally, in 2012 there were 357 reported natural disasters affecting 123 million people and eventuating in US\$157 billion in economic damage [10]. This estimate of the human complication of disasters is likely a coarse underestimate due to remarkable under-reporting that happens [11]. The World Health Organization Regional Office for Europe has created the hospital emergency response checklist to assist hospital and emergency managers in responding impressively to the most likely disaster scenarios. This tool comprises current hospital-based emergency management principles and best practices and integrates superiority action needed for quick, effective response to a critical event based on an all-hazards approach [1, 12]. The tool is structured according to nine key domains including: Command and control, Communication, Safety and security, Triage, Surge capacity, conjunction of essential services, Human resources, Logistics and supply management and Post-disaster recovery [12].

Hospital emergency management is a continuing process requiring the monolithic integration of planning and response attempts with local and national schemes. The recommendations predetermine in this instrument are common, applicable to a range of possibilities and based on an all-hazards approach [1].

In earthquake of Bam, the city was destroyed, left over 40,000 dead and around 30,000 injured, as well as devastating approximately 20,000 homes, leaving more than 45,000 people homeless [13]. Although in Bam, devastated two of the Bam's hospitals, it spared the frame of a new facility under construction at the time [14]. Within 36 hours, an estimated 8,000 injured were evacuated to hospitals through the country's 13 states. Restoring critical health services, at expenditure of US\$10.7 million, is expected to take several years [14, 15].

The 1999 earthquake in Turkey left more than 44,000 people injured [16]. The 2001 earthquakes in El Salvador left 1,159 dead and 8,122 injured. Nineteen hospitals (63%) were destroyed and six were completely evacuated [17]. Hurricane Ivan struck the little Caribbean nation of Grenada in the West Indies in September 2004. In Gujarat, India, a massive 7.9 magnitude earthquake killed 20,000 and injured 30,000 people in 2001. In the most affected region, Kutch, all health facilities crumbled [14].

The 1971 San Fernando, California earthquake, almost 90% of the deaths occurred in hospitals. Every district in Syria, health care was recognized as the number one priority among all philanthropic needs in surveys done in 2013 and 2014. When Mount Merapi in Central Java, Indonesia, exploded in October 2010, the lava flows and ash plumes hit many people unprepared. Because many people declined to leave their homes or returned while the eruptions were still continuing, more than 300 people were killed during the disaster [14, 15, 17].

Also, the 1990 earthquake in Costa Rica, Typhoon Haiyan struck the Philippines in 2013 and the Great East Japan Earthquake and Tsunami on 11 March 2011 were important events, recently [14]. Therefore, assessing of hospital emergency response against Disaster is necessary with emphasis on approach of evidence based disaster management. The aim of current study was to assess emergency response of hospitals against disasters in Tabriz.

Methods

A cross-sectional study was conducted in Tabriz city, during 2016 in Iran. The study population included all hospitals in Tabriz city. The following hospitals were assessed: Emam-Reza, Razi, Sina, Shahid Madani, Shohadah, Taleghani, Alavi, Kodakan, Alzahrah, Noor-e-Nejat, Alinasab, Shams, Shariyar, 29 Bahman, Shafaa, AmirAlmomenin, Mahallati and Behbodi. Of 18 hospitals, 5 hospitals were private, 8 hospitals were public, 2 hospitals were social security, 2 hospitals were charity and one hospital was military.

Hospital emergency response checklist was used to collect data that it was developed by World Health Organization Regional Office for Europe. The instrument is designed to assist hospital administrators and emergency managers to respond effectively to disasters [12]. The following checklist components were identified:

1. Command and control (7 questions)
2. Communication (9 questions)
3. Safety and security (10 questions)
4. Triage (10 questions)
5. Surge capacity (13 questions)
6. Conjunction of essential services (8 questions)
7. Human resources (15 questions)
8. Logistics and supply management (10 questions)
9. Post-disaster recovery (8 questions).

Table 1. Characteristics of studied hospitals

	Hospital name	Number of beds	Hospital ownership	Hospital specialty
1	Emam-Reza	664	Public- Teaching	General
2	Razi	586	Public- Teaching	Psychiatry
3	Sina	280	Public- Teaching	General
4	Shahid Madani	240	Public- Teaching	Cardiology
5	Shohadah	255	Public- Teaching	Orthopedics
6	Taleghani	98	Public- Teaching	General
7	Alavi	63	Public- Teaching	Ophthalmology
8	Kodakan	109	Public- Charity	Pediatrics
9	Alzahrah	160	Public- Teaching	Obstetrics and Gynecology
10	Noor-e-Nejat	90	Private	General
11	Alinasab	290	Social security	General
12	Shams	206	Private	General
13	Shariyar	144	Private	General
14	29 Bahman	85	Social security	General
15	Shafaa	64	private	General
16	AmirAlmomenin	120	Public- Charity	General
17	Mahallati	154	military	General
18	Behbodi	56	private	General

Checklist validity was measured by indicators of Content Validity Ratio (CVR) and Content Validity Index (CVI). CVI was found to be 87 percent and CVR was found to be 85 percent. Data collection was conducted by two researchers. Researchers are member of road traffic injury prevention research center and IceHM in Tabriz University of Medical Sciences. Also, they are experts in accreditation of hospital. They conducted interviews with hospital administrators, emergency and disaster managers and assessed the documentations, evidence and observations. Checklist rating scale including 3 options (action review, progress and completed). Descriptive statistics were used to present quantitative and qualitative variables respectively. Data entry and analysis was done using SPSS-20. The emergency response of hospitals was rated between 0 and 100 percent (action review=0, progress=50 and completed=100). Name of hospitals are shown according to α_1 to α_{18} , secretly.

Ethical considerations

The project proposal was presented to the Road Traffic Injury Prevention Research Center at Tabriz University of Medical Sciences, and was approved by the latter's ethical committee.

Results

In this study, 18 hospitals were assessed in Tabriz city. The results showed that mean emergency response of hospitals were 54.26 (18.28) percent from 100 percent. The maximum and minimum rate of emergency response was 91.67 and 18.89 percent, respectively. The emergency response rates of hospitals, according to domains were between 48.07 (25.21) and 58.95 (22.39) percent that those were related to surge capacity and communication respectively. Other results are shown in table 2.

Table 2. Emergency response rate of hospitals, according to domains in Tabriz city

Domains	N	Minimum	Maximum	Mean	Std. Deviation
Command and control	18	14.29	92.86	56.34	22.83
Communication	18	22.22	94.44	58.95	22.39
Safety and security	18	15.00	100.00	54.34	22.33
Triage	18	25.00	85.00	56.66	19.09
Surge capacity	18	.00	88.46	48.07	25.21
Continuity of essential services	18	12.50	100.00	55.20	23.70
Human resources	18	30.00	93.33	56.67	18.32
Logistics and supply management	18	15.00	95.00	51.56	23.98
Post-disaster recovery	18	12.50	100.00	52.08	23.77
Total	18	18.89	91.67	54.26	18.28

The emergency response rate of hospitals, according to ownership showed that maximum and minimum rate of emergency response among hospitals were related to military (67.22) and charity hospital (49.44 ± 9.42) percent, respectively. Post-disaster recovery was 71.87 (39.7) percent, which it was related to charity hospital. Surge capacity of private hospitals was very low (36.92 ± 32.93 percent). Also, Logistics and supply management of charity hospital was 27.50 (3.53) percent that it was very low. Other results are shown in table 3.

Table 3. Emergency response rate of hospitals according to ownership

Domains	Mean (SD)				
	Private (n=5)	Public (n=8)	Social security (n=2)	Charity (n=2)	Military (n=1)
Command and control	47.14 (22.92)	61.60 (24.42)	53.57 (15.15)	46.42 (25.25)	85.71
Communication	53.33 (22.08)	56.94 (26.84)	66.67 (7.85)	61.11 (23.57)	83.33
Safety and security	52.00 (24.13)	56.02 (27.85)	45.00 (7.07)	55.00 (14.14)	70.00
Triage	55.00 (21.50)	60.62 (19.89)	47.50 (24.74)	45.00 (7.07)	75.00
Surge capacity	36.92 (32.93)	48.55 (23.07)	63.46 (13.59)	40.38 (2.71)	84.61
Continuity of essential services	56.25 (32.17)	59.37 (25.44)	50.00 (8.83)	43.75 (17.67)	50.00
Human resources	50.00 (13.33)	57.91 (24.09)	71.66 (2.35)	56.66 (14.14)	50.00
Logistics and supply management	51.00 (16.73)	55.00 (30.93)	51.60 (11.87)	27.50 (3.53)	75.00
Post-disaster recovery	47.50 (25.23)	50.78 (23.48)	59.37 (13.25)	71.87 (39.7)	31.25
Total	49.45 (19.27)	56.01 (23.09)	57.67 (0.14)	49.44 (9.42)	67.22

In this study, the emergency response rates of hospitals are shown in figure 1. The emergency response rate was less than 50 percent in 7 hospitals. The emergency response of 18 hospital was 18.89 percent. This means that only, 18.89 percent have the potency of emergency response against disasters. The next categories of hospitals (4 hospitals) about 55 percent have the potency

of emergency response. The emergency response rate of 5 hospitals was between 61 and 67 percent. Finally, two hospitals compared to other hospitals were very good.

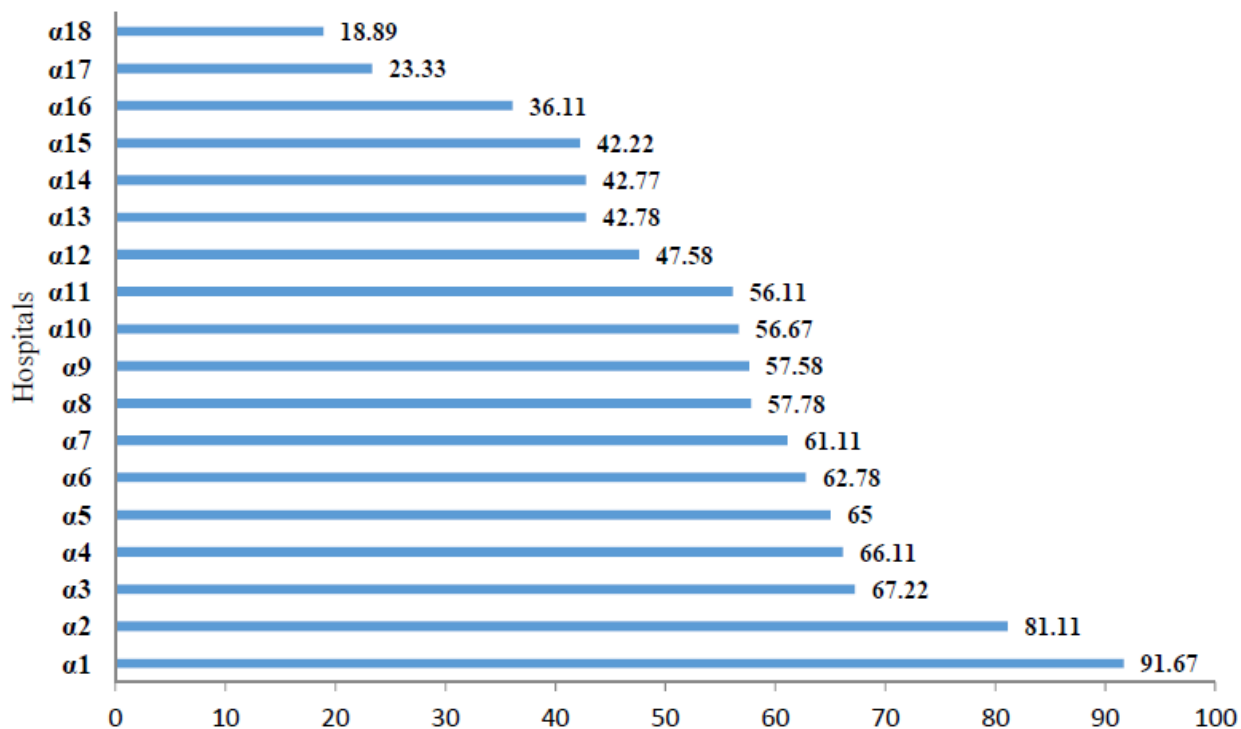


Figure 1: The emergency response rate of hospitals

Discussion

In many cases the occurrence of disaster is inevitable [18]. Also injury resulting from the disaster is common and sometimes outside the control [19]. In addition to importance of disaster prevention arrangements, it is very important to prepare for meeting the requirements during the incident. One of the main requirements at the time of disasters is to deal with victims and treatment of their injuries. Hospital emergency is known as the main source to encounter these needs and effective disaster relief [20]. The study findings showed that the mean hospital emergency response was 54.26 percent. The results of similar studies in Iran aren't match to our findings. One of these studies (2015) was conducted in six teaching hospitals affiliated to Qazvin University of Medical Sciences based on the same instrument. Its result showed that mean hospitals emergency response was 71.90 percent [21]. Also, Hasanpoor et al in 2013, performed similar study in 13 hospitals in Alborz province. According to their results the hospital emergency response rate has been reported to be only 44.17 percent [22]. In addition to the differences of studies results, it is the same in all that the rate of readiness is low. Since there is probability of occurrence 31 out of 40 known case of disaster in Iran (especially, Tabriz is a disaster-prone area), the low level of preparedness to response against disaster is dangerous [23].

Lower average emergency response in Alborz and Tabriz compared to Qazvin is due to the geographical situation of hospital. On the other hand, type of hazards is significant. Qazvin is facing floods and Alborz and Tabriz are facing earthquake.

Djalali et al, conducted the study aimed to compare hospital readiness in the field of functional

capacity, between Iran and Sweden. Their results indicated that Iranian hospitals were categorized in level B (functional capacity 36-65 percent). According to their results low preparedness was due to lack of contingency plan and limitation in resource availability. Also, they reached to this conclusion that the level of hospital preparedness is related to socioeconomic characteristics of research setting [24]. The instrument used in this study has dimensions such as surge capacity, human resources, logistics and supply management, and post-disaster recovery. These dimensions may be affected by amount of resources, construct status of organization, human resources, transportation, etc [25].

Accordingly, the mismatch between studies finding is justifiable based on specific research setting and its features. The least and highest mean between dimensions were related to surge capacity (48.07 ± 25.21) and communication (58.95 ± 22.39), respectively. The term surge capacity means hospital ability to manage a sudden influx of patients [26]. Kaji and Roger conducted a study aimed to determine disaster preparedness among hospitals in Los Angeles County. Their results showed only 29 percent of hospitals had a surge capacity of 20 beds. In Kaji and Roger's study, hospitals preparedness and surge capacity was limited due to a failure in integrate training and planning and a harshly limited surge capacity. Whereas, there was not constraint about availability of equipment and supplies [5]. Another study was done in US to investigate hospital preparedness for weapons of mass destruction incidents. The 87 percent of their participants believed that hospital emergency department could manage 10 to 50 extra patients at once [27]. The results of study carried out by Hasanpoor et al. demonstrated that least and highest mean were related to surge capacity (28.55 percent) and triage (70.30 percent), respectively [22]. The findings of study that was conducted by Asefzadeh et al. showed that command and control dimension had highest score (83.8 percent) and least score was related to logistics and supply management (57 percent) [21]. They performed the study among teaching hospitals, while our study was conducted among the hospitals with different ownership. This difference could be the main reason of findings mismatch.

Among the different type of ownership, military hospital (n=1) had the most emergency response (67.22 percent). Also the least emergency response was related to charity (n=2) hospitals (49.44 percent). The command and control, surge capacity, and communication were placed at the top of scores in military hospital. This may be affected by strict rules and regulations in military organizations. Ardalan et al. performed a study in title "hospitals safety from disasters in Iran: the results from assessment of 224 hospitals". Their findings showed none of studied hospitals were placed in high safety category. The best safety was related to hospitals affiliated to ministry of health (47.4 percent were placed in moderate and 52.6 percent in low safety category). The charity hospitals gained worst status (33.3 percent were placed in moderate and 66.7 percent in low safety category) [28]. Charity hospitals in Iran are faced with both capital and infrastructure problems due to weakness in revenue pooling, lack of supportive rules, and parallel activity of public organizations and NGOs.

Our study demonstrated that hospitals emergency response were at the moderate level. Emergency response score of 7 hospitals has not arrived to the 50 percent. The preparedness scores like 18.89 percent (α_{18} hospital) and 23.33 percent (α_{17} hospital) showed deplorable condition in mentioned

hospitals. According to the Richard`s arguments, at the time of disaster it is not sufficient to be prepare not even to 99 percent [29].

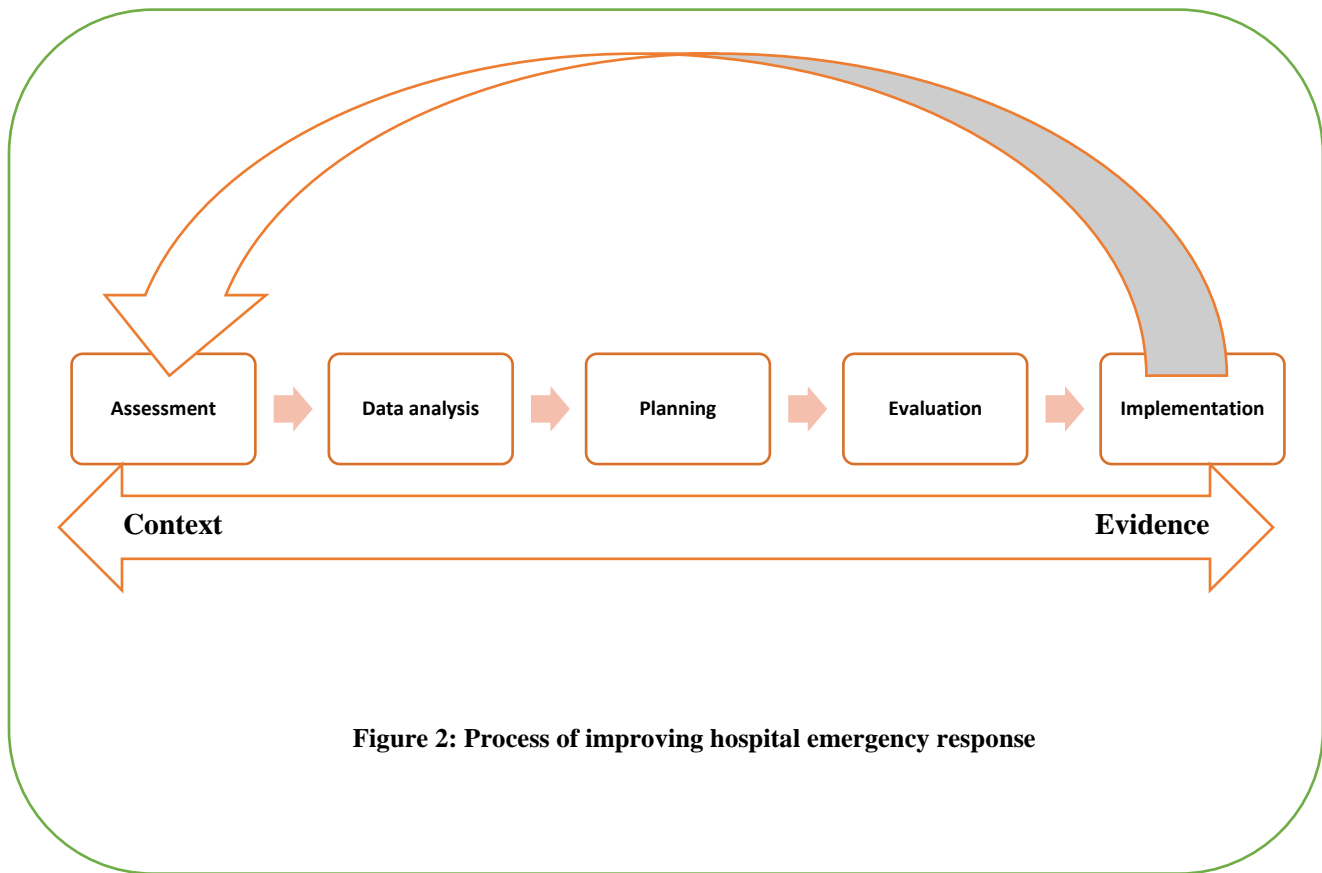
Readiness against disasters is similar to prevention and vaccination against diseases. So, if prevention and vaccination is defective, it may even be dangerous. Like to this, readiness against disasters has to be completed and this means that hospital emergency response must be 100 percent. Even 99 percent response is not enough.

Conclusion

Also, with regard to importance of emergency department in reduction of casualties it seems reasonable to recommend hospital authorities take actions to improve the status quo. In this regard referring to the results of this study may be useful for determining those areas which need further attention. These areas are different based on hospitals ownership; surge capacity in private and public hospitals, safety and security in social security hospitals, logistic and supply management in charity, and post - disaster recovery in military hospital. We propose the following framework for improving level of hospital emergency response:

1. Assessment of hospital emergency response (Based on context)
2. Data analysis
3. Planning for hospital emergency response (100 percent response)
4. Implementation for hospital emergency response using scenario models (Based on the best evidence)
5. Evaluation of emergency response plan in hospital

The process shows that in beginning assessment must be done based on the context. Then, the evidence must be analyzed, systematically. In the third phase, the evidence should be appraised and we should plan for improving of emergency response. Afterward, the outcome of the decision taken and indicators hospital emergency response of must be evaluated. At the end of the process, the indicators will create and implement in hospital based on the best available evidence.



Role of funding

No financial support was prepared for this article.

Conflicts of interest

The authors report no conflict of interests.

Acknowledgements

The authors are deeply thankful to all the hospitals who took part in this survey and to Tabriz University of Medical Sciences and for organizational support. Also, we are deeply thankful to Road Traffic Injury Prevention Research Center affiliated to Tabriz University of Medical Sciences.

References:

1. World Health Organization (WHO), *Hospital emergency response checklist-An all-hazards tool for hospital*. World Health Organization (WHO) Regional Office for Europe: Copenhagen, Denmark, 2011.
2. Paul, J.A., et al., *Transient modeling in simulation of hospital operations for emergency response*. Prehospital and disaster medicine, 2006. **21**(04): p. 223-236.
3. Bish, D.R., E. Agca, and R. Glick, *Decision support for hospital evacuation and emergency response*. Annals of Operations Research, 2014. **221**(1): p. 89-106.
4. Deen, S., *Pakistan 2010 floods. Policy gaps in disaster preparedness and response*.

- International journal of disaster risk reduction, 2015. **12**: p. 341-349.
5. Kaji, A.H.L., Roger J and R.J. Lewis, *Hospital disaster preparedness in Los Angeles county*. Academic emergency medicine, 2006. **13**(11): p. 1198-1203.
 6. Kaji, A.H., K.L. Koenig, and R.J. Lewis, *Current hospital disaster preparedness*. JAMA, 2007. **298**(18): p. 2188-2190.
 7. Noji, E.K., *Disaster epidemiology*. Emergency Medicine Clinics, 1996. **14**(2): p. 289-300.
 8. Arnold, J., et al., *The perceived usefulness of the Hospital Emergency Incident Command System and an assessment tool for hospital disaster response capabilities and needs in hospital disaster planning in Turkey*. Prehospital and disaster medicine, 2001. **16**(S1): p. S12-S12.
 9. China, S., et al., *From disaster response to poverty reduction*. International Journal for Disaster Management & Risk Reduction Vol., 2008.
 10. Guha-Sapir, D., et al., *Annual disaster statistical review 2011: the numbers and trends*, 2012, UCL.
 11. *Global Humanitarian Assistance Report 2013*. Somerset: Development Initiatives, 2013.
 12. Sorensen, B., R. Zane, and B. Wante, *Hospital emergency response checklist: an all-hazards tool for hospital administrators and emergency managers*. 2011, 2013.
 13. Montazeri, A., et al., *Psychological distress among Bam earthquake survivors in Iran: a population-based study*. BMC public health, 2005. **5**(1): p. 1.
 14. *Pan American Health Organization, Safe hospitals: a collective responsibility; a global measure of disaster reduction*, 2009: World Health Organization. p. 32.
 15. von Schreeb, J., et al., *Foreign field hospitals in the recent sudden-onset disasters in Iran, Haiti, Indonesia, and Pakistan*. Prehospital and disaster medicine, 2008. **23**(02): p. 144-151.
 16. Kılıç, C. and M. Ulusoy, Psychological effects of the November 1999 earthquake in Turkey: an epidemiological study. *Acta Psychiatrica Scandinavica*, 2003. **108**(3): p. 232-238.
 17. Wisner, B., *Disaster and Development: El Salvador 2001*. 2001: Natural Hazards Research and Applications Information Center.
 18. Yamamura, E., Public sector corruption and the probability of technological disasters. *Economics of Governance*, 2013. **14**(3): p. 233-255.
 19. Kouadio, I.K., et al., Infectious diseases following natural disasters: prevention and control measures. *Expert review of anti-infective therapy*, 2012. **10**(1): p. 95-104.
 20. Tang, R., et al., Building an evaluation instrument for China's hospital emergency preparedness: A systematic review of preparedness instruments. *Disaster medicine and public health preparedness*, 2014. **8**(01): p. 101-109.
 21. Asefzadeh, S., A.S. Varyani, and S. Gholami, Disaster Risk Assessment in Educational Hospitals of Qazvin Based on WHO Pattern in 2015. *Electronic physician*, 2016. **8**(1): p.

1770.

22. Hasanpoor.E, et al., Hospital Emergency Response of Iran's Hospitals against Disasters: A Case Study in Karaj. *Hospital*, 2015. 14(4): p. 67-74.
23. Jahangiri, K., Y.O. Izadkhah, and A. Lari, Hospital safety index (HSI) analysis in confronting disasters: A case study from Iran. *International Journal of Health System and Disaster Management*, 2014. 2(1): p. 44.10
24. Djalali, A., et al., Hospital disaster preparedness as measured by functional capacity: a comparison between Iran and Sweden. *Prehospital and disaster medicine*, 2013. 28(05): p. 454- 461.
25. Troy, D.A., et al., Enhancing community-based disaster preparedness with information technology. *Disasters*, 2008. 32(1): p. 149-165.
26. Kaji, A., K.L. Koenig, and T. Bey, *Surge capacity for healthcare systems: a conceptual framework*. *Academic emergency medicine*, 2006. **13**(11): p. 1157-1159.
27. Treat, K.N., et al., *Hospital preparedness for weapons of mass destruction incidents: an initial assessment*. *Annals of emergency medicine*, 2001. **38**(5): p. 562-565.
28. Ardalan, A., et al., *Hospitals safety from disasters in IR iran: the results from assessment of 224 hospitals*. *PLOS Currents Disasters*, 2014.
29. Niska, R.W. and I. Shimizu, *Hospital preparedness for emergency response: United States, 2008*. 2011.