J Anal Res Clin Med, 2018, 6(3), 139-44.
doi: 10.15171/jarcm.2018.022, *http://journals.tbzmed.ac.ir/JARCM*

Original Article

Are our hospitals safe against disasters? An evaluation of hospital safety index in Tabriz, Iran

Rouzbeh Rajaei-Ghafouri[1], Samaneh Mirzahosseini[1], Mahboub Pouraghaei*[1]

[1] *Emergency Medicine Research Team, Tabriz University of Medical Sciences, Tabriz, Iran*

Article info
Article History:
Received: 18 July 2018
Accepted: 25 July 2018
ePublished: 31 Aug. 2018

Keywords:
Disasters,
Hospitals,
Safety

Abstract

Introduction: Iran's hazard level against disasters is estimated to be 8 out of 10. The Farsi version of Hospital Safety Index (FHSI) has been designed by the World Health Organization (WHO) to simply scan the hospital safety standards for disasters. This study was designed to investigate the uncertainty about the safety level of hospitals in Tabriz, Iran, against disasters and the importance of the issue.

Methods: In this study, 21 hospitals in Tabriz City were evaluated. The items in the hospital safety index (HSI) were provided with a checklist. The collected data were entered into the SPSS statistical software. Finally, the safety levels of the hospitals were determined and compared with one another.

Results: The average hospital safety score was 6.70 ± 1.16. Only 6 hospitals were in good condition, with the 4 cases being non-academic hospitals. The functional safety of the hospitals was acceptable, and the structural and non-structural safety levels were modest. The highest and lowest scores were related to functional safety and structural safety, respectively. The rate of safety of general hospitals was significantly higher than that of the specialized hospitals with rates 7.07 ± 1.03 and 5.75 ± 0.88, respectively. There was no significant correlation between the number of hospital beds with the level of safety score.

Conclusion: The results of this study indicated the weak safety of Tabriz hospitals against disasters, especially in structural aspect. However, the probability of occurrence of various disasters in this area including earthquakes, extreme cold weather, etc. is very high. So, it seems to be necessary to attract attention to change policies about hospital management.

Citation: Rajaei-Ghafouri R, Mirzahosseini S, Pouraghaei M. **Are our hospitals safe against disasters? An evaluation of hospital safety index in Tabriz, Iran.** J Anal Res Clin Med 2018; 6(3): 139-44. Doi: 10.15171/jarcm.2018.022

Introduction

Iran, as a vast country, faces various disasters. The global reports have shown that Iran is in the risk class of 8 out of 10 regarding the prevalence of disasters.[1] About more than 109000 dead and 150000 injured in the past 40 years represent the bad state of Iran against disasters.[2] During these years, 53 million individuals have been affected by disasters in Iran.[3,4]

Disasters also affect health systems in addition to damaging the general population and infrastructures. Structural, nonstructural, and functional components of hospitals can affect the occurrence of disasters. In disasters, in addition to life-threatening consequences and damage to property and equipment, the hospital's function for the acceptance of injuries is lost. This can increase the deaths induced by disasters.[5]

Hundreds of hospitals and health centers are destroyed or lose their function worldwide due to disasters annually. In addition to the economic dimension, the destruction or inactivation of the hospital will lead to insecurity and social instability.[6]

* **Corresponding Author:** Mahboub Pouraghaei, Email: pouraghaeim36@gmail.com

The importance of hospitals and other health care providers is beyond the role they play in saving lives. They are a powerful symbol of social progress and a prerequisite for development and economic stability.[7,8]

Risk assessment includes recognizing hazards, vulnerabilities, and capacities, and is the first step in improving the hospital preparedness against disaster. This assessment should be carried out in three structural, non-structural, and functional sections.[1]

The World Health Organization (WHO) has designed the Hospital Safety Index (HSI) to check the security of hospitals against disasters, which is used as a quick, simple, and inexpensive tool. HSI examines 145 items in hospitals. These items are in three structural, non-structural, and functional parts. Health centers are classified into three categories of low safety, moderate safety, and high safety with score ranges of less than 34, 34-66, and more than 66, respectively.[9]

Iran with more than 900 hospitals is among the first three Middle East countries.[10] The Iranian Ministry of Health uses the Farsi HSI (FHSI) in its program to assess the safety of hospitals. This index has been designed and developed by the Ministry of Health. Studies have shown that the use of FHSI as an indicator in assessing and improving hospital safety is useful for preparing disasters.[11] Fortunately, now it is considered as the hospital accreditation index.[12]

An investigation was conducted among 224 hospitals from August 2012 to 2013. The results indicated that 122, 102, and no hospitals were in the low, moderate, and high level of safety, respectively.[4] Another study found that over the past 10 years between 2001 and 2011, 119 cases of disaster have resulted in serious dysfunction and injury in 1401 health centers, causing 127 deaths or injuries among health workers.[13]

Methods

This descriptive study was performed on 21 hospitals in Tabriz City, Iran, during 2016-2017. In this study, all hospitals in Tabriz were evaluated by a group consisting of two experts from the Center for Crisis Management called as emergency operation center (EOC) of Tabriz University of Medical Sciences and two experts from the field of technical management of Tabriz University (civil and electrical engineers). Experts in the HSI training course have been impressed. They then attended a meeting to get the checklist complete. The various indicators included in the hospital safety standard checklist (developed by the WHO and updated by the Ministry of Health for the conditions in Iran) were collected and then entered the statistical software designed for this study. Eventually, the safety scores of hospitals were determined and compared with each other. This study was also registered with ethics code 46179/D/5 at the regional ethics committee of Tabriz University of Medical Sciences.

All demographic information was collected and the data were analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA).

For statistical analysis of the study population, the mean ± standard deviation (SD), frequency, frequency distribution, and circular diagrams and histograms were used. To examine the relationship between the variables studied, appropriate statistical tests such as Pearson regression, chi-square, analysis of variance (ANOVA), and t-test were used according to the type of variables.

Results

21 hospitals in Tabriz were evaluated by the HSI criteria. The hospitals included 10 academic hospitals (university associated), 6 public hospitals, and 5 non-governmental centers. Eight of the hospitals were specialized, all of which being among the academic centers.

The mean age of hospitals in Tabriz was 36.86 ± 15.19 years in the range of 9-65 years. The average number of hospital beds approved was 228.6 with 193.00 ± 193.38 beds in the range of 45-800 beds. The average number of active beds in the hospital was 189.16 ± 11.00 beds with the range

42-607 beds. The average occupancy rate of hospital beds in normal conditions was 83.55 ± 12.52% in the range of 64%-100%.

Various hazards such as earthquakes, flood, severe weather conditions (extreme cold and extreme heat), dust, epidemics, and biological threats are likely to occur in this region (Figure 1).

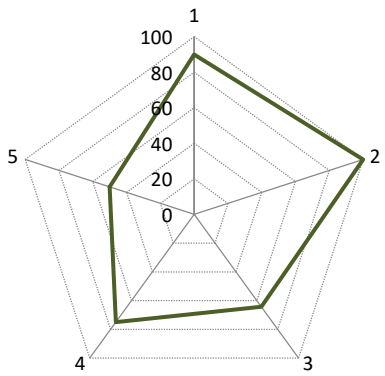

Figure 1. Distribution of the likelihood of occurrence of various dangers in the hospitals in Tabriz
1- Geological, 2- Climate, 3- Social, 4- Biological, 5- Technological

The mean functional safety of the hospital was 67.14 ± 12.52 in the range of 0-100. The mean non-structural safety of the hospital was 56.14 ± 12.05 in the range 30.5-84.6. The mean structural safety of the hospital was 52.73 ± 17.34 in the range of 15.83-84.17. Regarding the mean scores of the three functional, non-structural, and structural safety aspects, the highest and lowest scores were related to functional safety and structural safety, respectively. The average score of hospital safety was 6.70 ± 1.16 in the range of 0-10.

There was no significant relationship between lifetime of the hospital building and hospital safety score (P = 0.140). There was no significant relationship between hospital type and lifetime of building (P = 0.360). However, the mean lifetime of public educational hospitals was higher than other hospitals with values 41.90 ± 15.18 and 67.00 ± 15.22, respectively, with 31 public hospitals and 33.00 ± 14.91 nongovernmental hospitals.

Hospital bed occupancy rates were the same according to the type of hospital, and no significant difference was observed (P = 0.590). The number of hospital beds was significantly higher in public hospitals than in other hospitals (P = 0.040).

There was no significant difference in the safety class of hospitals according to the type of hospital (P = 0.053). According to the type of hospital, the highest scores were allocated to non-academic public hospitals, private hospitals, and finally academic governmental hospitals with values 7.50 ± 1.22, 6.40 ± 1.16, and 1.60 ± 1.10, respectively. There was a significant difference between non-academic hospitals and academic hospitals (P = 0.010) (Figure 2).

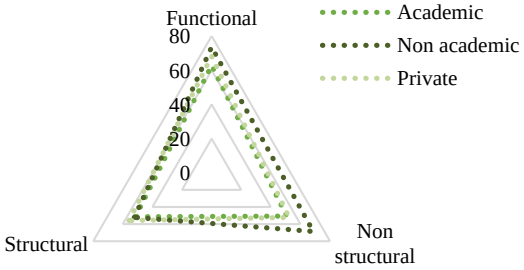

Figure 2. Distribution of safety axes according to the type of hospitals in Tabriz

Comparing the safety score of specialized hospitals to general, the safety score of general hospitals was significantly higher than specialized hospitals with scores 7.07 ± 1.03 and 5.75 ± 0.88, respectively (P < 0.0001). There was no significant correlation between the number of hospital beds and the level of safety (P = 0.080) (Table 1).

Hospital safety scores were classified into three categories as good, moderate, and poor. Only 6 hospitals were in good condition, with the 4 cases being non-academic hospitals. Other hospitals were in the middle class.

Table 1. Rate of hospital safety level according to their type

Level / Type	Good [n (%)]	Modest [n (%)]	Poor [n (%)]
Academic	1 (10.0)	9 (90.0)	0 (0)
Non academic	4 (66.6)	2 (33.3)	0 (0)
Private	1 (10.0)	4 (80.0)	0 (0)

Discussion

The probability of occurrence of various disasters including earthquake, flooding rain, severe weather conditions (cold and extreme heat), dust, epidemics, biological threats, and overshoot of hospitals in this region is high.[14]

Most of the hospitals in Tabriz are in the low grades of safety index. These results, compared with previous studies, indicate progress in safety (2-4 and 18). Non-structural safety is very important in public buildings, especially in areas with high earthquake risk.[15] In a study conducted by Zaboli et al. regarding the vulnerability of the organization and the management of a selected hospital against the crisis, the results showed that the vulnerability of the hospital was modest in terms of the nonstructural factors.[16]

A study by Shojaei on examining the emergency exit system of the academic hospitals of Iran showed that emergency exit paths were identified in all hospitals, but signs and guidance boards were not clearly visible in all of them.[17]

The study by Jahangiri[10] showed that non-structural safety in the furniture, office equipment, and architecture sector was modest, but architectural components were more vulnerable. In this study, no emergency exit paths were found in any of the hospital buildings. Although there were more than one entry and exit door in some parts of the hospital, it was only possible to use as a door.

In order to reduce the vulnerability in the equipment sector and increase safety, a variety of stabilization methods can be used, including installing bracing, using screw fasteners, locking the coils, strapping shelves, and computerized equipment. Since the destruction of architectural components during a disaster could cause a serious disruption in hospital performance, determining the vulnerability of these components to the hospital risk reduction process is very important.

The assessment showed that the hospital vulnerability was almost in the average level. The vulnerability of financial resources and planning in resource management management was also average.[16] In a study carried out by Amini Ghazvini, although the efficiency of the resources was desirable, there was no program in the hospital for managing resources in emergency situations.[18] In the United States, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requires hospital centers to review their emergency disaster plans at least twice a year, with at least one being implemented as collective participation.[19]

The results of various studies depend on the region studied and the results are different for various regions. A study by Jagnarine in Caribbean showed that only 2% of the hospitals in the area were fully safe and 80% of them had an average safety record.[20] A study performed by Pisla et al. in Maldives indicated that the level of immunity was good and moderate in 24.6% and 62.7% of the hospitals, respectively.[21]

Conclusion

The present study showed that the safety status of hospitals in Tabriz was moderate based on FHSI. The safety of Tabriz hospitals is relatively better than the hospitals in the country. However, more effort is needed to achieve the desired situation. One of the problems with such studies is the lack of cooperation and accountability of hospitals to some of the questions. Given the existing experience, it can cause deliberate bias to hide some statistics. The FHSI can be used as a useful, prompt, and accessible tool for disaster preparedness and safety.[9] The information obtained from this indicator can be used by providing them to the authorities in charge of decision making and policy making, and organizing and planning the medical staff. The annual recurrence of this assessment can reveal the annual progress achieved in the field of hospital safety and remaining weaknesses.

Due to the shortage of hospital beds and medical equipment, examining and completing hospital safety defects is less important. Nevertheless, the probability of occurrence of various disasters in this area

(such as earthquakes, extreme cold weather, etc.) is very high.

However, at a low cost, especially in two functional and non-structural areas, hospitals can be prepared much more than before to prepare for disasters. Considering that the structural safety axis is placed in the lowest score, more effort is needed to retrofit and fix structural problems. It is also suggested that the safety score obtained from the form of an external evaluation, be added to the implementation steps and hospital plans.

Acknowledgments

The authors wish to thank Dr Ardalan because of extensive disaster-related research exploited in this study.

Authors' Contribution

In this study, Dr. Mirzahosseini was responsible for data gathering and analyzing and Dr Rajaei Ghafouri was in charge of designing and supervising the study. Moreover, Dr. Pouraghaei was responsible for conducting and criticizing the study and also correspondence of the study.

Funding

There was not any funding support.

Conflict of Interest

Authors have no conflict of interest.

Ethical Approval

This study was approved by the Regional Medical Ethics Committee of Tabriz University of Medical Sciences under the number 46179.

References

1. Pan American Health Organization (PAHO). Natural Disasters: Protecting the Public's Health. Washington, DC: PAHO; 2000.
2. Ardalan A, Kandi M, Osooli M, Shamseddini A, Zare M, Moosavand Mirsanei R, et al. Profile of natural hazards in I.R.Iran. Tehran, Iran: Disaster and Emergency Health Academy, Iran's National Institute of Health Research and SPH of Tehran University of Medical Sciences; 2012.
3. Ardalan A, Rajaei MH, Masoumi G, Azin A, Zonoobi V, Sarvar M, et al. 2012-2025 roadmap of I.R.Iran's disaster health management. PLoS Curr 2012; 4: e4f93005fbcb34. DOI: 10.1371/4f93005fbcb34
4. Ardalan A, Kandi M, Talebian MT, Khankeh H, Masoumi G, Mohammadi R, et al. Hospitals safety from disasters in I.R.Iran: The results from assessment of 224 hospitals. PLoS Curr 2014; 6. DOI: 10.1371/currents.dis.8297b528bd45975bc629180474 7ee5db
5. Dargahi H. Organization and comprehensive hospital management. 1st ed. Qom, Iran: Omid Publications; 2009. [In Persian].
6. Cutter SL, Boruff BJ, Shirley L. Social vulnerability to environmental hazards. In: Cutter SL, editor. Hazards, vulnerability and environmental justice. London, UK: Routledge; 2012. p. 143-60.
7. International Strategy for Disaster Reduction. 2008-2009 World Disaster Reduction Campaign. Hospitals Safe from Disasters. Reduce Risk, Protect Health Facilities, Save Lives [online]. [cited 2009]; Available from: URL: https://www.unisdr.org/2009/campaign/pdf/wdrc-2008-2009-information-kit.pdf
8. Pan American Health Organization (PAHO). Hospital safety index: Guide for evaluators. Washington, DC: PAHO; 2008.
9. Hajavi A, Shojaei Baghini M, Haghani H, Azizi A. Crisis management in medical records department in Kerman and Borujerd teaching hospitals 2006 (Providing model) . J Health Adm 2009; 12(35): 9-16. [In Persian].
10. Jahangiri K. Disaster management system in Iran and selected countries. Tehran, Iran; Iran-Helal Institute of Applied Science and Technology; 2010. [In Persian].
11. World Health Organization. Hospitals safe from disasters: Reduce risk, protect health facilities, save lives. Geneva, Switzerland: United Nations International Strategy for Disaster Reduction (UNISDR); 2007.
12. Ardalan A, Najafi A, Sabzghabaie A, Zonoobi V, Ardalan S, Khankeh H, et al . A pilot study: Development of a local model to hospital disaster risk assessment. Hospital 2011; 9(3-4): 7-14. [In Persian].
13. Ardalan A, Mowafi H, Khoshsabeghe HY. Impacts of natural hazards on primary health care facilities of Iran: A 10-year retrospective survey. PLoS Curr 2013; 5. DOI: 10.1371/currents.dis.ccdbd870f5d1697e4edee5eda1 2c5ae6
14. Lakbala P. Hospital Workers Disaster Management and Hospital Nonstructural: A Study in Bandar

Abbas, Iran. Glob J Health Sci 2015; 8(4): 221-6. DOI: 10.5539/gjhs.v8n4p221

15. Dixit AM, Yatabe R, Guragain R, Dahal RK, Bhandary NP. Non-structural earthquake vulnerability assessment of major hospital buildings in Nepal. Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards 2014; 8(1): 1-13. DOI: 10.1080/17499518.2013.805629

16. Zaboli RA, Toufighi S, Seyedin SH, Malmoun Z, Hosseini Shokouh SM. Organizational vulnerability and management of clinical departments against crisis. Iran J Crit Care Nurs 2009; 2(3): 99-103. [In Persian].

17. Shojaei P. Disaster preparedness of training hospitals in Iran University of Medical Sciences in crisis 2006 [MSc Thesis]. Tehran, Iran: School of Management and Medical Information, Iran University of Medical Sciences; 2006. [In Persian].

18. Amini Ghazvini S. Methods of reducing risk in health centers against earthquake (Case study: Atieh Hospital) [MSc Thesis]. Tehran, Iran: Shahid Beheshti University; 2009. [In Persian].

19. 2007 comprehensive accreditation manual for hospitals: The Official Handbook [comprehensive accreditation manual for hospitals (CAMH)]. 1st ed. Oak Brook, IL: Joint Commission Resources; 2007.

20. Jagnarine S. Safe hospitals in Caribbean. Washington, DC: Pan American Health Organization, World Health Organization, Regional office for Americas; 2014.

21. Pisla M, Domente S, Chetraru L, Ostaficiuc R. evaluation of hospital safety in the republic of Moldova. Chisinau, Moldova: Republican Center for Disaster Medicine, World Health Organization, Regina Office for Europe; 2010.