International Journal of Hospital Research 2017, 6(1): 30-35
http://ijhr.iums.ac.ir

doi 10.15171/ijhr.2017.05

Research Article

IJHR

Open Access

Assessment of Structural and Non-structural Safety in Farabi Hospital (Iran); 2014-2016

Roghayeh Chamani Cheraghtapeh[1], Abdolreza Babamahmoodi[2], Zahra Hashemi Dehaghi[3*]

[1] Clinical Nurse, Farabi Hospital, Tehran, Iran. [2] Health Research Management, Health Research Center, Baqiyatallah University, Tehran, Iran. [3] Faculty of Management and Accounting, South Tehran Branch, Islamic Azad University & Eye Research Center, Tehran University of Medical Sciences, Tehran, Iran.

Abstract

Background and Objectives: Incident endangering patient health both reduce the quality of health services and impose considerable financial loads on hospitals and health systems. Along with examining the risks, the hospital managers need to continuously monitor the patient safety situation in their settings and increasingly improve their patient protection standards. The present study is aimed at assessing the level of functional, structural, and non-structural safety in Farabi eye hospital between 2014 and 2016.

Methods: The study was carried out using qualitative methods. Study population comprised of different hospital wards and the data was collected by directly observing the wards. The data was collected using Hospital Disaster Risk Assessment (HDRA) checklist recommended by the World Health Orhanization (WHO).

Findings: While functional safety level was found to be 91.83%, non-structural and structural safety levels were recorded at 31% and 58.7%. The total stately level was below 50% of the standard (47.59%). The safely condition was found to be on an improving trend.

Conclusions: Although the safety situation shows gradual improvement based on 3-year data, much work and intensive focus is required to approach the standard level.

Keywords: Patient safety, Structural safety, Non-structural safety, Hospital, Quality of health care

Background and Objectives

The hospital is responsible for providing health services to patients and health care seekers.[1] Hospitals and the personnel of health centers are not isolated from the outside world and they are directly affected by a variety of crises. This is a key concern given the unique condition of hospitals that host patients, medical facilities, and medical equipment.[2] In addition to the public and infrastructures, risks may influence service providing systems as well. Structural, non-structural, and functional elements might be affected by the risks and the disasters caused by them. In addition to personnel and patients' casualties and damages to equipment and facilities, after a disaster, hospitals may lose their capability to admit patients, which in turn lead to higher death toll. Risk assessment includes identifying risks, vulnerabilities, and capabilities, and it is the first step in improving hospitals crisis plan. Continuous implementation of assessment plant generates the required information for upgrading the system.[3]

The assessment can be done in 3 fields of structural, non-structural, and functional. In line with the UN's biannual campaigns in 2008 and 2009 named "Hospitals Safe from Disaster," the World Health Organization (WHO) codified and introduced a tool to assess risk of disasters in hospitals based on experiences in Central and South American countries like Mexico, Cuba, Bolivia, and other Caribbean countries. Structural vulnerability includes damages to the building of hospital and structural/construction elements, and improving these vulnerabilities needs different physical supports like foundations and support walls and beams. These elements might be the weakness of the hospital in the face of disasters like earthquake, flood, and storm. Non-structural vulnerability is about the elements that are essential for proper function of the

*Corresponding Author: Zahra Hashemi Dehaghi, Faculty of Management and Accounting, South Tehran Branch, Islamic Azad University & Eye Research Center, Tehran University of Medical Sciences, Tehran, Iran. Tel: +989122832919, Email: hashemi_mitra@yahoo.com

hospital – e.g. cooling/heating system, ventilation, paging system, water, facilities, installations, decoration, and electricity. Organizational and managerial vulnerabilities refer to human resources and organizational management that are essential for provision of specialized services and fulfillment of the tasks necessary for proper function of the hospital. A safe condition is realized when the risk taken by the individuals is attenuated or eliminated. Safety is the process of detecting and managing the risk.[3]

Safety management is an organized attitude toward risk management in the organization, proper organizational structure, liabilities, policies and organizational procedures.[2,4] Top and mid-managers are responsible for ensuring safety in the hospital so that minimum losses should be sustained in the case of an accident.[5] Many organizations like the Joint Commission on Accreditation of Healthcare Organization (JCAHO) put emphasis on necessity of safety in healthcare organizations.[6] Necessity of safety assessment in hospitals, although accidents are rare, lies with the heavy financial load caused by crisis in hospitals.[7] To improve readiness, hospitals are required to observe safety and professional health standards.[7]

Safety index of the hospital is designed to survey safety, determine priorities of programming, and prevent damage to heath care centers in the wake of accidents and disasters. Indeed, hospital safety index indicates the probability that a hospital can remain functional in the outbreak of disaster. To preserve and improve functionality, hospitals need to devise a readiness plan for accidents and crises. Along with improving their knowledge about risks, managers need to improve capability and standards of their organizations and control the risk of accidents.[8] Through examining structural, non-structural, and functional indices of the hospital, managers are able to picture the status quo and probable scenarios of crises.[9] The present study is an attempt to assess functional, structural, and non-structural safety status in Farabi eye hospital in 2014-2016.

Methods

A case-study applied work was carried out and depending on the situation; quantitative and qualitative research methods were used. Study population was comprised of different wards of Farabi eye hospital in Tehran, Iran in 2014-2016. Data gathering was done through observation and filling out the WHO's hospital risk index checklist known as Hospital Disaster Risk Assessment (HDRA). The index has been used in more than 1000 hospitals in South and Central America and Caribbean countries like Peru, Bolivia, and Mexico.[10] The index measures safety and readiness level of hospitals against disasters and crises.[11] It also can be used to assess, compare, and categorize hospitals in terms of functional, structural, and non-structural safety.[12]

The checklist consists of 5 chapters and measures 145 safety indices in the hospital. It was filled out by the author based on observations. The headlines include general information of hospital; A: Risks (geographical, climate, social events, biological, technological); B: Functional safety (there are a crisis committee in the hospital and an operational plan to handle internal/external risks, probable medical operations, preserve and reestablish vital services, access to medicine/equipment, and resources); C: Non-structural safety assessment (vital system, electrical system, communication system, water system, fuel supply, medical gasses, heating and ventilation system in critical wards, office equipment [fixed, mobile], medical and lab equipment, medicines and diagnostic material supply, architectural elements); D: Structural safety assessment (previous events effective on safety of the hospital, structural system safety, and type of construction materials). Safety is categorized by the checklist at low, average, and high levels.[13] Performance, structural, and non-structural indices were obtained based on descriptive statistical analyses in Excel. Conclusion was made based on safety score for each year, which was also used to determine safety class (Table 1).

Results

Safety class of the hospital was determined at first and then disaster and emergency safety were determined at functional, structural, and non-structural levels for 3 consecutive years (Table 2). The findings showed improvement of the hospital in terms of safety during the 3 years. Afterward, probability of each risk group was obtained (Table 3). Based on the findings, probability of

Table 1. Safety Level Score

Safety Class	Safety Score (Minimum)	Safety Score (Maximum)
10	91	100
9	81	90
8	71	80
7	61	70
6	51	60
5	41	50
4	31	40
3	21	30
2	11	20
1	0	10

Source: Hospital safety index: guide for evaluators. 2nd de . World Health Organization and Pan American Health Organization; 2015.

Table 2. Disasters and Emergency Safety Assessment in Farabi Hospital During 2014-2016

	2014	2015	2016	Percent Increase From 2014 to 2016
Functional safety level	52.13	60.29	100	91.83
Non-structural safety level	59.23	59.01	77.61	31.03
Structural safety level	49.89	48.89	79.17	58.69
Safety score (weighted)	52.64	54.21	54.18	2.93
Safety score (non-weighted)	55.31	58.64	84.90	53.50

Table 3. Risks Incidents in Farabi Hospital During 2014-2016

Risk	2014	2015	2016
Geological	86.67	73.33	53.33
Climate	42.86	38.10	33.33
Social unrests	42.86	47.62	47.62
Biological	37.4	5.87	66.67
Technological and human made	45.10	41.18	37.25
Total	44.30	40.84	47.64

geological, climate, social unrest, biological, technological, and human-caused risks and total probability of risk were obtained (Figure 1).

As the results indicated, according checklist total risk scores followed an ascending trend during the term under study and there was a notable increase in biological risks. It is notable that the data was provided by experts and intuitively. Biological risks included epidemics and vermin swarms. Viral cases had gained more weight over the 3 years under study (corona virus). The findings showed decrease in structural risks following the increase of awareness, proper

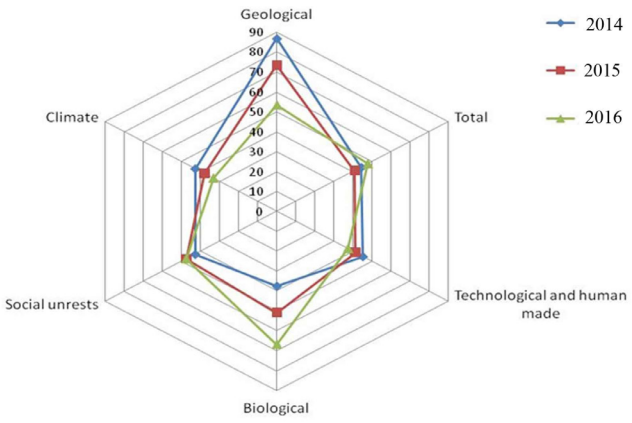

Figure 1. Probability of Incidence of Risk Groups in Farabi Hospital During 2014-2016.

planning for geological risks (earthquake, volcano, etc), vulnerability assessment, and seismic improvement in the structure of hospital.

Different fields of functional (Figure 2); non-structural (Figure 3) and structural safety (Figure 4) in Farabi hospital during 2014-2016 were examined. As illustrated, an improvement in programming and management is observed throughout the 3 years under consideration.

In general, non-structural assessment showed improvement of non-structural safety in the hospital, while readiness for crisis was not satisfactorily. Non-structural vulnerability as to architecture was at average level and at high level in terms of office equipment and furniture. To control vulnerability in equipment and tools section and improve safety, fixing the items by harnesses and screw fixtures, securing lockers, fixing shelves and computer sets by harnessing them are recommended. Since damages to architectural elements by crises causes serious issues in proper function of the hospital, it is essential to determine vulnerability of these elements to reduce vulnerability of the hospital. Among the architectural elements under study, doors, access ways, windows, and glass-made objects are notable. As to medical and lab equipment, the surveys needed to maximize their safety were carried out.

Farabi hospital is equipped with central heating and chiller systems and all the wards are ventilated; although ventilation system of some wards is not as effective as expected.

During the years under study safety level of the hospital was at average level and improving. This indicates that crisis management of the hospital is on the right track, while we should not forget that the structural safety condition of the hospital is as average level and expecting non-stop and complete services during crises (earthquake in particular) is not reasonable. In light of this, renewal and enforcing the building is recommended. It is notable that currently, several hospitals with old buildings are still functional. Age of the building of hospitals has almost nothing to do with quality of medical services they provide and this eliminates motivations to spend great deal of financial sources on renewal of the buildings. By completion of the new building of the hospital, structural condition of Farabi hospital will be improved in the future.

Discussion

Hospital safety assessment makes continuous survey and monitoring possible so that supervising operation to improve safety can be carried out in the shortest possible time. Obtaining safety index is the start

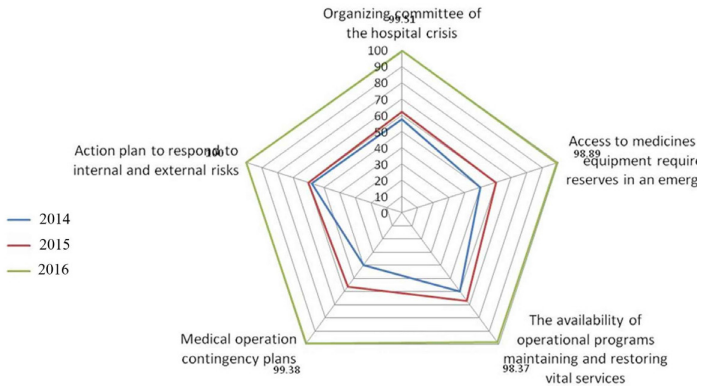

Figure 2. Different Fields of Functional Safety in Farabi Hospital During 2014-2016.

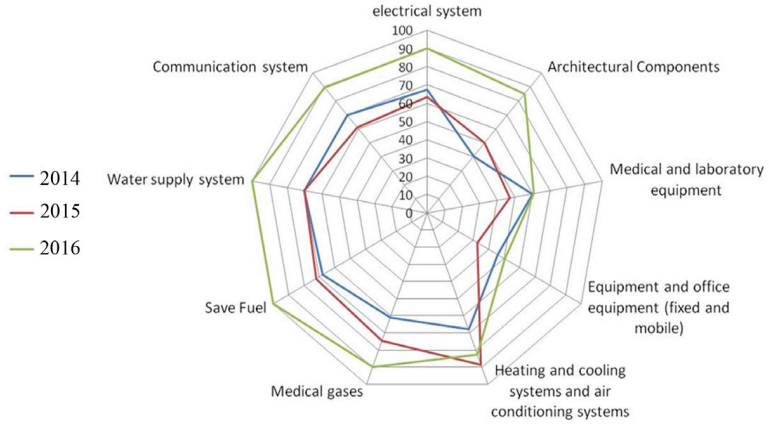

Figure 3. Non-structural Safety Assessment of Farabi Hospital During 2014-2016.

point of determining priorities for improving safety level of hospital and decreasing healthcare facilities vulnerability and risk. Through this, hospitals will be able to handle probable disasters much better. Any measure to improve safety index should be supported by the top management and all the affected wards. Personnel and managers' support ensures faster and more accurate access to information and provides assessment notes to the process.[14] In a risk analysis study in one of Tehran-based private hospitals, Jahangiri et al concluded that heating/cooling and ventilation systems of the hospital needed improvements like better wall and roof fixtures.[15]

Heidaranlu et al carried out a review study and argued that safety class of the hospital was C. They used different version of the WHO checklist from the one used here and clearly the safety level of the hospital under study was very low.[16]

Fazli carried out a similar study in the Iranian Red Crescent hospital in Mecca and reported that the hospital was at average level in terms of structural, non-structural, and functional safety[17]; their results are consistent with the present one. Non-structural elements (installations and special equipment's in particular) can be thought of as a chain and failure of one element may result in failure of the whole system.[18]

Mirzaei et al highlighted that Imam hospital was in better condition in terms of functional, non-structural, and structural safety. In general and despite differences in functional, structural, and non-structural fields, safety class of all the hospital was at average level based on whose guideline. The authors concluded that there was a need for improvement of safety level and decrease of probable risks in short-term.[19] Most of disaster scenarios assume damages to non-structural elements and no serious damage to the structure, which results in failure of the hospital functions. Although, the non-structural part of a hospital constitutes 80% of the expenses of building a hospital, making them safe is far less expensive.[20] Taking into account the safety costs sustained by the personnel and patients, costs of displacing them, and the damages caused by failure of services, the costs of making the non-structural element safe is quite justifiable.

The findings on non-structural safety assessment of Farabi hospital during 2014-2016 showed that water reservoir system was featured with enough capacity, secure

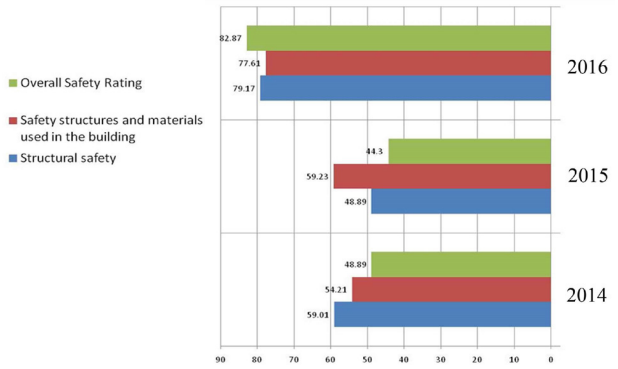

Figure 4. Structural and General Safety Assessment of Farabi Hospital During 2014-2016.

placement, suitable design, connection to main grid, and reliable pumping system.

Conclusions

As the findings indicated, safety condition had followed a steady increasing trend over the three-year period under study. The hospital safety indices (HSI) should be maintained to monitor the progress of hospitals in regards to hospital safety in the case of disasters. It is recommended that WHO continue advocacy of HSI, establish a HSI monitoring system, and add it to country profiles on WHO website.

Competing Interests

There authors declare no competing interests.

Authors' Contributions

All authors were involved in study design. RC and ZH participated in writing the first draft. AB contributed to data analysis and preparing the draft manuscript. All authors participated in reading and revising the draft and preparing the final manuscript.

References

1. Arabloo J, Rezapour A, Ebadi Fard Azar F, Mobasheri Y. Measuring patient safety culture in Iran using the Hospital survey on patient safety culture (HSOPS): an exploration of survey reliability and validity. Int J Hosp Res. 2012;1(1):15-28.
2. Eisold C, Heller AR. [Risk management in anesthesia and critical care medicine]. Anaesthesist. 2016;65(6):473-488. doi:10.1007/s00101-016-0189-9.
3. Stolzer AJ, Halford CD, Goglia JJ. Implementing Safety Management Systems in Aviation. Ashgate Publishing, Ltd; 2011.
4. Mardani S, Tabibi SJ, Riahi L. Relationship between Safety and Staff Performance in Hospital. Int J Hosp Res. 2013;2(4):205-214.
5. Khandan M, Arab Z, Koohpaei A. High ergonomic risk of computer work postures among Iranian hospital staff: evidence from a cross-sectional study. Int J Hosp Res. 2016;5(1):29-34.
6. Joint Commission on Accreditation of Healthcare Organization (JCAHO). Comprehensive Accreditation Manual for Hospitals: The Official Handbook. Joint Commission Resources; 2008.
7. Royal S, Smeaton L, Avery AJ, Hurwitz B, Sheikh A. Interventions in primary care to reduce medication related adverse events and hospital admissions: systematic review and meta-analysis. Qual Saf Health Care. 2006;15(1):23-31. doi:10.1136/qshc.2004.012153.
8. Kaji AH, Koenig KL, Lewis RJ. Current hospital disaster preparedness. JAMA. 2007;298(18):2188-2190. doi:10.1001/jama.298.18.2188.
9. Ardalan A, Kandi Keleh M, Saberinia A, et al. 2015 Estimation of hospitals safety from disasters in I.R.Iran: the results from the assessment of 421 hospitals. PLoS One. 2016;11(9):e0161542. doi:10.1371/journal.pone.0161542.
10. Pfenninger E, Guzelel H. [Impact assessment of inadequate hospital disaster management : Reflection based on a risk model]. Anaesthesist. 2017;66(6):431-441. doi:10.1007/s00101-017-0281-9
11. Azami Aghdash S, Ebadi-fard Azar F, Rezapour A, Mirnia K, Azami A, Saadati M. Patient Safety Culture: A Meta-analysis of Hospital Data. Int J Hosp Res. 2014;3(4):209-217.
12. Ardalan A, Kandi M, Talebian MT, 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.8297b528bd45975bc6291804747ee5db.
13. Yarmohammadian MH, Atighechian G, Shams L, Haghshenas A. Are hospitals ready to response to disasters? Challenges, opportunities and strategies of Hospital Emergency Incident Command System (HEICS). J Res Med Sci. 2011;16(8):1070-1077.
14. 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. J Hosp. 2011;9(3-4):7-14.
15. Jahangiri K, Izadkhah YO, Lari A. Hospital safety index (HSI) analysis in confronting disasters: a case study from Iran. Int J Health Syst Disaster Manage. 2014;2(1):44-49. doi:10.4103/2347-9019.135368.
16. Heidaranlu E, Ebadi A, Ardalan A, Khankeh H. A scrutiny of tools used for assessment of hospital disaster preparedness in Iran. Am J Disaster Med. 2015;10(4):325-338. doi:10.5055/ajdm.2015.0215.
17. Fazli H . Vulnerability assessment for disaster management system the iranian red crescent hospital in the tamattoa hajj

in mecca in critical conditions. J Re Resc. 2011; 2(5):155-159.

18. Lakbala P. Hospital workers disaster management and hospital nonstructural: a study in Bandar Abbas, Iran. Glob J Health Sci. 2015;8(4):221-226. doi:10.5539/gjhs.v8n4p221.
19. Mirzaei FKH, Farasaty F, Zamani N. Investigation on the Safety Status and Preparedness of Ilam's Hospitals against Disasters in 2012. JIUMS. 2014;22(7):14-23.
20. Heidaranlu E, Ebadi A, Khankeh HR, Ardalan A. Hospital disaster preparedness tools: a systematic review. PLoS Curr. 2015;7. doi:10.1371/currents.dis.7a1ab3c89e4b433292851e349533fd77.

Please cite this article as:
Chamani Cheraghtapeh R, Babamahmoodi A, Hashemi Dehaghi Z. Assessment of structural and non-structural safety in Farabi hospital (Iran); 2014-2016. Int J Hosp Res. 2017;6(1):30-35. doi:10.15171/ijhr.2017.05.