

Örgütsel Davranış Araştırmaları Dergisi

Journal Of Organizational Behavior Research Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 91S2357



INVESTIGATION OF FIRE SAFETY MANAGEMENT APPROACH BASED ON THE RISK ASSESSMENT

Hamed AKBARI¹, S. Nafisseh ESHAGH HOSSEINI², Amir ADIBZADEH¹, Hesam AKBARI¹, Abdolvahed BAZMARA^{1*}, Mohammad Hassan NASERI³

¹ Health Research Center, Lifestyle Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran.
² Department of Surgery, School of Medicine, Kamkar-Arabnia Hospital, Qom University of Medical Sciences, Qom, Iran.

³ Atherosclerosis Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.

*Corresponding Author:

Email: vahed.bazmara@yahoo.com

ABSTRACT

Background: Most of the global fire events have occurred due to default in Fire Safety Management or FSM, that is the main aspect of safety of fire. Various risk assessment methods developed in the field of fire safety management over time. This indicates a failure of the FSM. Objective: The aim of the current study is to assess the approaches related to fire risk. investigation of hospitals facilities, the target of recognizing and removing fire create main risks, and necessities of the present regulation and legislation. Methods: This cross-sectional descriptive study and all score of items using a checklist were conducted in 15 hospitals of the selected Hospitals of Tehran and Tabriz. In this study numerous research activities performed such as recognizing the collection of factors which presented in hospital facilities a hazardous type of facilities in fires; checking hazardous places to fires in hospitals; discovering the task of hospitals top management in regard hospitals facilities; understanding the concept and meaning of management of fire risk as well as the task of fire safety responsibles and inspections as a hazard reduction planning process to verify the adherence of present hospitals to fire safety laws and regulations. Therefore, it resulted in the improvement of a qualitative risk assessment of fire. Results: This article indicated that because of the combination of various risk factors of hospitals, facilities are high-risk for occurrence of fire. Also, the fire risk assessment performed 72 items including seven main partitions, containing exit doors, fire doors, systems of fire protection, hazardous materials, electrical, housekeeping and other cases. Conclusion: This study showed better conception of the role of hospitals top managers concerning facilities of working safe hospitals and it suggested remedial actions for hospital managers to prevent the occurrence of fire and crisis. The present research highlights the obedience of present hospitals to fire safety laws and regulations to guarantee the least safety level for people in total of hospitals properties. It helps to increase comprehend the potential risks and dangers existing in hospitals.

Keywords: Fire, Risk assessment, Hospital, Hazards, Prevention measures.

INTRODUCTION

Nowadays, fire safety is an important issue in the various public places of all around the world. Safety is introduced as measures of security used for protect the physical assets, clients, and staff as well as decrease the probability of damage without eliminating a total of risks and also

Örgütsel Davranış Araştırmaları Dergisi Journal of Organizational Behavior Research Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 91S2357

its measures must be investigated for removal of the risk and hazard to a level below the limit specified acceptable. (DelliFraine et al., 2013) In fact, fire is something can occur in any structure such as home, workplace and various hospitals. Fire of Hospital occurs with alarming or warning frequency and destructive potential impact in hospitals throughout the global. (Purkiss and Li, 2013) Generally, a hospital control solid substance such as nasal cannulae, and endotracheal tubes as well as the greatest hospital use of chemical compounds, even gastrointestinal gases, rich in methane which are prone to that are flammable in the laboratory and nature but different causes such as heating because of overloading electrical, gas in the kitchen, smoking in bed and poor storage of flammable liquids may be consequence to fire. (Fires, 2008; Chowdhury, 2014) Fire in any kind of occupancy would possibly have the cause harm to its occupants and serious damage comprising loss of human life and property. Hence, highly secure facility in hospitals and work entitles preparing a safe place can be created for occupants and patients as well as the many of reports fire disasters shown that these disaster events result of the danger and potential fire threats in the hospitals. (Arturson, 1992) Numerous studies have reported that the 75% of general hospital workers are exposed with high risk and 17% are vulnerable to some occupationally associated diseases. (Bennewith *et al.*, 2004) It seems that working in different hospitals and institutes can have an impact on the health and productivity of the staff's. In the United States (US) and several other countries reported that 9000 health workers are exposed to occupational injuries with the loss of direct is around 1,200 million and the loss of indirect is about 120 million. (Hatam et al., 2012) For this reason, In order to reduce the national wastage, the governments have a clear task and role to handle the risk originated by fires. Also, great health care is crucial for protecting both the workers' health and the hospital patients in workplaces because of the presence of flammable liquids or gases materials which can be the initial cause of fires and as well as cause more financial damages and casualties in the hospitals and other places. (Everson, 2008) Moreover, because of the presence of valuable and expensive electronic equipments and fire can cause more financial losses in hospitals, Low fire risk in the building is associated with its structure, contents, and occupants which may be considered to be very safe from fire. Occupants play an important role in decrease the fire hazard and if precisely their behavior during evacuation of the theoretical framework followed. (Bates and Gawande, 2003) Hence, fire safety is a crucial factor in hospitals and its safety management is necessary to pay particular attention and also incaution, Habits, working incautiously in unsafe situations and deficient knowledge are Important factors in the occurrence of occupational accidents. (Vidor et al., 1989) It has been noted that good work training with an emphasis on the various aspects of fire safety management can be very effective in motivating the workers and removing the problems of them.

OBJECTIVES

In this regard, because of the important role of hospitals in risk control, preventing the fire and protecting people the objective of this study is to investigation of fire safety management approach based on risk assessment in the hospitals of Tehran, Iran in order to identifying, reduction and removing the fire hazards in hospital places and fundamental meeting regulation of the present legislation and requirements as well as enhance the comprehension

of the potential dangers present in the Hospitals of Tehran and Tabriz to realize the deficiencies and better the condition.

METHODS

The present cross-sectional study designed to assess the level of fire safety in the selected Hospitals of Tehran and Tabriz that the number of hospitals for this study was considered to be 15 hospitals. In the first step in order to achieving real results, it was required from the hospitals safety and health unit to provide all of the fire documentation including procedures, instructions, fire extinguishing designs and etc. In the second step, we visited all the parts of the hospitals In order to evaluate the level of fire awareness of the individuals of hospitals which were selected between pharmacy, laboratory, nursing, and staff radiology. Besides, in the study, a checklist of 72 questions was used (appendix). All items in the checklist of this paper were relieved by the expert researchers at hospitals and the item was evaluated to be either yes or no. Then, scored one if it was yes and zero if it was no. The total score of safety was assessment as a plus of all score of items in the aforementioned checklist. (Ramachandran, 1999) Previously, the validity and reliability of the questionnaire had been confirmed by Mohammad A. Hassanain et al in (2009). As well, the data were collected through the checklists which were completed in hospitals. Also, the questionnaires were completed by the researcher during the inspection from all parts of the hospitals in order to evaluate the level of fire safety.

Management of Fire risk

Risk is a specific unfavorable event happens during a particular challenge and leads to critical and non- critical injuries for patients and occupants of constructions and causes the serious damages to buildings. The first aim of the management of risk is the conservation of the whole of an organization's resources like persons, profits, and assets. So, the important issue to the industries are the raised worry toward the security and safety subjects and the considerable increase litigation that main cause of risk management reported. (Haddow et al., 2017) Risk reduction is the society general objectives of fire risk management (FRA) that can be concluded by performing the prevention of fire necessary actions which would decrease the number of fires meaningfully and which would reduce the damage and injury toward fire with installing passive and active fire protection actions. (Hassanain, 2009) Professional facilities top managers are required to formal and periodic inspection of patients, facilities, and their associated processes to recognize fire potential risks and causes and latent ways for the fire extension could be decreased. The purposes of FRA are to guarantee that the prepared exits number is adequate for the renter burden as well as construction contents and inner finishes will not create a high fire load. In this regard, the dependability of features of building structure as fire barriers or obstacles and the preparation of system of fire detection, fire suppression and smoke management procedures. (Muckett and Furness, 2007)

Fire safety risk assessment of hospital

In this research as showed qualitative of FRA, that hospitals can be evaluated for the objective of recognizing, removing and reducing fire hazards, and meeting the least basic necessaries of the present universal law that these is requirements for obligatory provisions. These requirements are lowest level to protectant the safety and health of the people and ordinary



Örgütsel Davranış Araştırmaları Dergisi Journal of Organizational Behavior Research Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 91S2357

display a settlement among favorability of economic and safety. (Della-Giustina, 2014) The purpose of implement FRA is to guarantee that design specialists and facility responsibles of hospitals are monitoring the fire safety responsibilities according to the laws and that those hospital facilities with complete satisfactory of maintain installation of fire protection equipment that are in an usable situation. Risk assessment study comprises 72 items to evaluating the categorized in seven main partitions including fire doors, systems of fire protection, electrical, Fireproof doors, hazardous material, the order in the environment and other cases (miscellaneous), respectively.

FRA via the advanced assessment apparatus would be capable to recognize the zones of concern which are so vital to safety, and which proffer the great potential for contravention of hospitals. Moreover, surveyor would be able to recognize fire possible risk, latent fire causes and powerful ways for the fire extension at the hospitals. Through inspections evidence, it was reported that facilitate for expansion of a plan of suitable measures of remedial in the long-term, middle, and short to improvement for existing situation of fire safety strategy in the hospitals was under the review. It is certain that decrease fire happening, or keep losses to a minimum rate should be considered. In this study, it was showed the fundamental approach followed in performance safety risk assessment of fire in buildings of hospitals and the advantage concluded from the assessment results was represented.



RESULT

This cross-sectional study was conducted in seven parts consist of (a,b,...,g) reviewing the fire safety status in the Selected Hospitals of Tehran and Tabriz. The fire safety condition was assessed via interviewing and inspection from different parts of hospitals using by a checklist compares 72 questions namely fire doors, fire protection systems, electrical, Fireproof doors, hazardous material, the order in the environment and other causes. In addition, every partition comparison diverse questions was used in order to assess the awareness level of fire in aforementioned hospitals. After completing the checklist items by researcher, responses were gathered to create a total score for a group of hospital items, either yes or no for the items was considered. Then, scored one if it was yes and 0 if it's response was no. The results revealed that fire safety status in selected Hospitals was according to the table table 1 for different partitions A, B, C, D, E, F, G respectively. Also, the total means was 47.85 percentage of regarding with fire awareness were found Hospital. Therefore, level of fire awareness condition of the study population in this article had associated with the level of education.

Taple 1. beere wear between siseted nospitals			
Mean in 15 hospitals(%)	dimensions		
55.82	Exit doors		
49.74	Fire protection systems		
63.75	Electrical		
11.08	Fireproof doors		
48.84	hazardous material		
57.72	housekeeping		
48.00	Other cases		
47.85	Total score		

I ADIE I. SCUTE MEAN DELWEEN SISCIEU NUSDITAIS	Table1: S	Score Mean	between	slscted	hospitals
--	-----------	------------	---------	---------	-----------

DISCUSSION

Finally, the factors of this article that exhibited a hazardous type of facility in hospital buildings fires has identified. The possible risky parts were identified as fires in hospitals as laundry room's visitor rooms and hospital kitchens. Siu Ming Lo et al. (1999) proposed in the "Fire Safety Assessment System for Existing Buildings" study that the fuse fire safety assessment approach based on risk rating techniques could be used part of a safety assessment tool for existing buildings. (Lo, 1999) Tseng Wei-Wen et al. (2011) proposed "fire safety design for small-scale hospitals" in 2011, according to the emergency response rules and emergency management in the hospital, which included a number of fire safety management approaches, such as shelters during Evacuating people and will improve fire safety for small-scale hospitals. Also, The Ying-Yueh Chen et al, in 2012 concluded that "Choice of fire safety management to improve the fire safety of presence of buildings" showed that this study is a method based on the risk of human behavior for safety assessment of fire, so for all types of building cannot be applied, and they concluded that fire safety management measures could be effective in improving the safety of existing buildings. In addition, Kanchan Chowdhury and his colleagues in 2013 proposed that fire alert in Indian hospitals provided suggestions for a change in system performance that is consistent with the US Fire Protection Association, which is likely to prevent fire in all hospitals in the countries Developing the world with hot weather is feasible. This article has concluded the role managers in operating facilities of hospital. (Chowdhury, 2014) Also, for the active and passive fire protectant systems, hospital managers have the assurance to develop an implement emergency answers plan as well as allocate a fire safety manager, trained wardens and perform planned maintenance. As further, hospitals' visitors and visitors must be made familiar with the places of systems of fire safety like the emergency exit doors and fire exiting. This data needs to be exhibited in noticeable locations in overall hospital facilities, and openly written in all suitable languages. In this regard, the concept of fire risk management has discussed in this paper and inspections of fire safety protection is as a risk reduction plan to guarantee the adherence of presence hospitals to regulation of fire safety. In addition defined as a systematic procedure that fire safety examiners can monitor whilst leading the safety inspection of fire. This method includes recognizing latent fire dangers, potential avenues and powerful reason of fire for the happen of fire. The instrument of FRA performed 72 sectors to evaluate, in seven major partitions, consist of exit doors, fire doors, systems of fire protection, hazardous materials, electrical, housekeeping and other cases. The article highlights the accordance of presence hospital to fire safety lows to verify the least safety level for visitors in total hospital places.

Findings of the study showed that level of fire safety awareness in hospital staff, most of the staff did not have adequate information about fire safety, approximately 70% of the staff were not trained about fire controlling. (Hassanain, 2009) The accordance between the results of current article and the present one display that the fire safety condition has not better situation in this hospitals.

CONCLUSIONS

Finally, the determination of fire safety status and its relevant factors are significant in all of the hospitals. According to the inspections and results of the checklists, there were no fire



Örgütsel Davranış Araştırmaları Dergisi Journal of Organizational Behavior Research Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 9182357

doors, automatic Sprinkler system, smoke doors and documentation including procedures, instructions, fire extinguishing designs and etc in most of the hospitals. Also, the results indicated that the level of fire safety awareness in the selected Hospitals of Tehran and Tabriz had the dependence with educational level and work tenure. So, the staff with higher educational surface and job circumstance had a higher level of fire awareness. But we should know that it is impossible to provide an entirely safe working environment, is almost impossible because of the high costs, etc. Therefore, in this paper, it attained that a qualitative FRA should be development, wherever by existing hospitals can be evaluated for the objective of recognizing and reducing fire main risks and conference of the lowest provisions of the existing global law. So, it's suggested that hospitals managers should put short-, intermediate-and long term corrective actions plans in their plans to improve the fire safety status in all parts of the hospitals. In other hand, all information (including training, procedures, instructions, fire extinguishing designs and etc) must be documented.

FOOTNOTE

S.

Authors' Contribution: Abdolvahed Bazmara, Hamed Akbari and Amir Adibzadeh: designing and conducting the study and writing of the manuscript; Nafisseh EsHagh Hosseini and Hesam Akbari: analysis of data and writing of the manuscript; Abdolvahed Bazmara: designing and conducting the study; Mohammad Hassan Naseri: analysis of data

Conflict of interests: The authors declare that they have no conflict of interests.

Ethical Approval: This study and were approved by Baqiyatallah University of Medical Sciences (Reference No. 91012906).

APPENDIX.

Checklist for fire risk assessment in selected Hospitals

	Fire safety approach in hospital			
A. Exit doors				
01	The building is such that the capacity of the exit door on the ground with the number			
01.	of emergency exit doors is proportional to the capacity of the outlet personnel.			
02.	Self-contained doors are healthy in the outlet paths where people are leaving.			
02	Exit doors can be opened from the exit without using the key, or special knowledge			
05.	and effort.			
04.	The maximum distance to an outlet is 23 meters.			
05.	Exit doors are from the entrance to the exit door until the exit door is drained.			
06.	External exit doors are directly diverted to the drain outlet of the gutter.			
07.	Output symbols include output dumps all the time.			
08.	Exit signs are available in rooms or areas that require two or more exits.			
09.	The exit symptoms are in a way that can be seen from the distance of 23 meters of the			
	exit symptoms.			
10.	Signs of departure are always on.			
11.	There are no obstacles in the way of the exit doors.			
12.	Emergency exit slope is one of the obstacles.			
13.	The entrance door width is less than 82 cm.			

7

14	Exit doors or corridors for access to the exit door are provided wherever the number		
14.	of residents exceeds 10 people.		
15.	Where smoke doors are controlled by certain systems and sensors, doors are designed		
	with an anti-lock signal.		
16.	Where exits are controlled by certain systems and sensors, manual anti-lock devices		
	(batons or axes) are located 100-120 cm above the security door.		
17.	Where door exits are controlled by certain systems and sensors, the door locks are		
	released by activating fire alarm systems or automatic sprinklers.		
18.	In the event of a defect in the power supply, the output light is automatically supplied		
P	Fine protection systems	Vos	No
D. 10	An automatic Sprinklan autom is quailable throughout the building	105	NO
19.	An automatic Sprinkler system is available throughout the building.		
20.	Maximum distance to fire extinguisher caps is 25 meters.		
21.	and instantly used		
22	There is no harrier to easy access to fire extinguishers		
22.	All nortable nortable nortable fine extinguishers are installed at a height of 1.5		
23.	All portable, portable, portable fire extinguishers are installed at a height of 1.5		
24	Fire extinguishers are semiced annually and all semices are labeled on it		
24.	All water source control values for automatic Sprinkler systems and water flow		
25	switches on all Sprinkler systems are monitored electronically when the system has 20		
20.	or 20 Sprinkler Sprinkler Sprinkler Springs		
26	There are no colors on Sprinkler series		
20.	In each of the critical parts of the hospital (kitchen laundry engine room etc.)		
27.	capsules are appropriate to the capacity of the site.		
	Automated fire extinguishing systems for the kitchen equipment are serviced at least		
28.	every 6 months and after system operation Records are available		
29.	Automatic fire extinguishing systems such as Sprinkler and are activated in the event		
	Of a fife.		
30.	riammable connections and Sprinkler series for kitchen equipment are tested at least		
	Unice a year. Hand held fire extinguishers, weighing more than 18 kilograms, are not installed		
31.	more than 1 meter above the ground		
	The system records all inspections tests maintenance and repairs are kept at least 3		
32.	vears		
33	3 feet of free space around the fire hydrant box is considered		
34.	Fire alarm systems are installed in the entire building and hospital departments.		
35.	Fire alarm systems are installed in hospitals with more than 3 floors.		
С.	Electrical	Yes	No
36.	All equipment, power cables are connected to the system and connected annually.		
	The system must be measured every year and its resistance should be kept below 10		
37.	ohms.		
38.	Interface cables do not replace permanent wiring		
	Interface cables and flexible wires are not applied to buildings and do not extend		
39.	through wells callings and floors		



Örgütsel Davranış Araştırmaları Dergisi Journal of Organizational Behavior Research <u>Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 91S2357</u>

40	Interface cables are directly connected to an authorized outlet, wired wire or a multi-		
40.	plug adapter.		
41	Except for optional extension cables, each of the other extension cables is connected to		
	an electrical device.		
42.	Consumption of all extension cables is subject to standard capacity.		
43.	Extension cables do not include connectors		
44.	Interface cables are installed on the ground when electrical appliances are used on the		
	ground		
45.	All electrical system fuses are equipped with a life jacket.		
46.	All electrical panels have a cooling fan.		
47.	Electric motors are maintained and protected from excessive accumulation of oil, dirt,		
10	waste, and waste.		
48.	Temporary emplacements installed in the building are fully authorized.		
49.	The doors leading up to the panels of the electrical control panel are		
	indicated with a clearly visible and legible mark under the title (electric room).		
D.	Fireproof doors	Yes	No
50.	Fireproof doors and smoke doors do not lock/lock, which would otherwise be		
	unusable.		
51.	All fire doors are changed and not repaired		
52.	By swinging, the anti-burglar door closes completely and closes automatically.		
53.	Horizontal and vertical sliding and rolling fire doors are inspected and tested annually		
	to confirm proper operation and complete closure. Records have been kept.		
54.	When the magnetic hold-open devices are damaged on the anti-fire doors, the door		
	remains closed.		
55.	Blinds, fabrics and other ornamental accessories are flame retardant and non-		
	combustible		
E.	hazardous material	Yes	No
56.	Storage of flammable and combustible liquid racks is carried out on a regular basis		
57.	Flammable and combustible liquids for maintenance and operation of equipment that		
	stores more than 10 gallons in a liquid storage cabin.		
58.	The LP-gas container is not used in basements and in the upper floors under poultry		
п	spaces unless their location has an approved ventilation system.	17	
F.	Order in the environment	Yes	NO
59.	Storage/storage of combustible materials in the building is maintained in a completely		
	regular and orderly manner.		
60.	Storage/storage of heating appliances is separated by a spacer or guard until the fire		
	does not occur.		
C 1	storage/storage at a distance of 60 cm or more under the root is maintained in areas		
61.	of the building where Sprinkler does not exist and at least 45 cm below the Sprinkler		
62	Combustible materials are not stored in the outlet and outlet englowing.		
02.	Combustible materials are not stored in heilers, machanical rearrant enclosures.		
63.	compusible materials are not stored in pollers, mechanical rooms of electric		
C A	Combustible waste containers lawon then 150 liters are switched for resultation		
04.	The waste is disposed of at the place of consumption and discharged daily		
60.	Disposal Containers are removed and disposed of daily		
00.	Disposal Containers are removed and disposed of daily		1



AKBARI et al.

67.	Storage of flammable and explosive liquids is kept on a regular basis		
G.	Other cases	Yes	No
68	New and existing hospitals have a valid address number that can easily be seen and		
00.	readable from the front of the street.		
69	There are no obstacles in the streets around the hospital for access to fire equipment,		
05.	such as a vehicle park.		
70	The access routes to the fire-fighting equipment have an unobstructed cross-section of		
10.	less than 6 meters		
71.	Drawn and approved fire safety plans are ready and kept in all departments.		
72	Employees are trained in emergency fire management procedures described in fire		
12.	extinguishing design and fire safety.		

References

- Arturson, C. (1992). Analysis of severe fire disasters. In *The Management of Mass Burn Casualties and Fire Disasters* (pp. 24-33). Springer, Dordrecht.
- Bates, D. W., & Gawande, A. A. (2003). Improving safety with information technology. *New England journal of medicine*, *348*(25), 2526-2534.
- Bennewith, O., Gunnell, D., Peters, T., Hawton, K., & House, A. (2004). Variations in the hospital management of self harm in adults in England: observational study. *Bmj*, *328*(7448), 1108-1109.
- Chen, Y. Y., Chuang, Y. J., Huang, C. H., Lin, C. Y., & Chien, S. W. (2012). The adoption of fire safety management for upgrading the fire safety level of existing hotel buildings. *Building and environment*, *51*, 311-319.
- Chowdhury, K. (2014). Fires in Indian hospitals: root cause analysis and recommendations for their prevention. *Journal of clinical anesthesia*, *26*(5), 414-424.
- Della-Giustina, D. E. (2014). Fire Safety Management Handbook. CRC Press.
- DelliFraine, J. L., Wang, Z., McCaughey, D., Langabeer, J. R., & Erwin, C. O. (2013). The use of six sigma in health care management: are we using it to its full potential?. *Quality Management in Healthcare*, 22(3), 210-223.
- Everson, C. R. (2008). Fire prevention in the perioperative setting: perioperative fires can occur everywhere. *Perioperative Nursing Clinics*, *3*(4), 333-343.
- Fires, R. (2008). Practice advisory for the prevention and management of operating room fires. *Anesthesiology*, *108*(5), 786-801.



10 *Örgütsel Davranış Araştırmaları Dergisi* Journal of Organizational Behavior Research Cilt / Vol.: 9, Sayı / Is.: S2, Yıl/Year: 2019, Kod/ID: 91S2357

- Haddow, G. D., Bullock, J. A., & Coppola, D. P. (2017). *Introduction to emergency management*. Butterworth-Heinemann.
- Hassanain, M. A. (2009). Approaches to qualitative fire safety risk assessment in hotel facilities. *Structural Survey*, *27*(4), 287-300.
- Hatam, N., Keshtkar, V., Forouzan, F., & Bastani, P. (2012). Patient safety culture status in teaching hospitals: a case of Shiraz University of Medical Sciences. *MEJSR*, 12(7), 970-975.
- Lo, S. M. (1999). A fire safety assessment system for existing buildings. *Fire technology*, *35*(2), 131-152.

Muckett, M., & Furness, A. (2007). Introduction to fire safety management. Routledge.

Purkiss, J. A., & Li, L. Y. (2013). Fire safety engineering design of structures. CRC Press.

- Ramachandran, G. (1999). Fire safety management and risk assessment. *Facilities*, 17(9/10), 363-377.
- Vidor, K. K., Puterbaugh, S., & Willis, C. J. (1989). Fire safety training: a program for the Operating Room. *AORN journal*, 49(4), 1045-1049.
- Wei-Wen, T., Kuo-Hsiung, P., & Che-Ming, H. (2011). Performance-based fire safety design for existing small-scale hospitals. *Procedia Engineering*, *11*, 514-521.

