

Research Paper

Investigating Characteristics of Hospital Building Fires in Iran



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ABSTRACT

Background: Building fires are the most common threatening and distressing hazard in hospitals. Fire is one of the top 10 hazards that threaten Iranian hospitals. Nevertheless, no study has been done on the features of fires in Iran hospitals. So, this study aimed to investigate the characteristics of fires taking place in Iranian hospitals.

Materials and Methods: In this cross-sectional study, news related to fire broke out in Iranian hospitals was retrieved from the archive of 5 reputable Persian news agencies using the Persian search terms: "Fire", "hospital", and "clinic". Quantitative content analysis was used to assess retrieved news text. Data gathered by the Emergency Operation Center of the Iranian Ministry of Health and Medical Education were also studied.

Results: In total, 86 incident reports were assessed for the period spanning from 2005 to 2020, with more than half accessed just through reputable news agencies. The electrical short circuit was the most reported incident cause, and the medical care environment was the most reported place of incident. Twenty-five incident reports indicated that partial or complete emergency evacuation was executed.

Conclusion: It is imperative to raise awareness about the lack of an integrated mechanism for registering such incidents. Future research can be conducted designing a critical registry system that collects, analyzes, and disseminates hospital incident data.

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Introduction

As a large building where sick or injured people receive medical treatment, a hospital can symbolize social progress [1, 2]. Regarding the world disaster reduction campaign on “hospitals safe from disasters”, hospitals are integral to economic development and community stability. In addition, hospitals offer psychological advantages for a community because they can bring a sense of well-being and security to people [3, 4].

Meanwhile, many factors, including their complex and specialized services, occupancy level, and specific equipment, make hospitals vulnerable to emergencies and disasters [5, 6]. However, the vulnerability of a hospital is associated with particular hazards and its locality. Some reports from Latin America and the Caribbean have stated that almost half of healthcare facilities are in disaster-prone areas [7]. Although healthcare facilities in developed countries are less vulnerable than their counterparts in developing countries, they are just as vulnerable to some specific hazards. For example, 7% of hospitals and 9% of primary healthcare facilities in the United Kingdom are in flood-prone areas [8, 9]. According to the [World Health Organization \(WHO\)](#) report “hospitals safe from disasters: Reduce risk, protect health facilities, save lives”, five hospitals in London were evacuated partially or completely due to fire incidents during 2007-2009 [7]. Based on data gathered by the US Fire Administration, 275 hospitals were evacuated during 1971-1999, and more than half of these evacuations resulted from internal hazards. Noticeably, 23% of these mentioned evacuations were due to internal fires [10].

Building fires are distressing because they can endanger human life and destroy property [11-15]. The frequency of hospital fires and their potentially serious consequences in recent years is distressing [16]. Some common reasons may be known as the origin of hospital building fires. The most common causes are electrical short circuits, heating due to electrical overload, cooking oil or gas in the kitchen, stored flammable liquid, arson, or smoking in bed. These causes can be categorized into three different types: Flammable liquids, small spark or heat initiates from equipment that is operating at a short distance from O₂-dependent patients, and oxygen delivery methods for transferring O₂ gas and liquid carry pure O₂ [11, 17].

As mentioned above, it is evident that in-hospital fire is a concerning hazard for all healthcare facilities, even for hospitals in developed countries [13, 14]. Although

evidence suggests that addressing fire safety issues in hospital structures is not a high priority, the multiple functionalities of hospitals, which make them complex buildings, are the reasons for concern. In addition, the structure of hospitals in Asian countries is getting bigger [14], which may make them more vulnerable. Health facilities in Asia have recently encountered fire-related disasters [15].

In recent years, evidence from an initiative using an adapted version of the “hospitals safety index” has assessed Iran hospitals’ preparedness against disaster, revealing that fire is one of the top 10 hazards threatening healthcare facilities [18-20]. Although a fire in a hospital is one of the most common hospital hazards in Iran hospitals, limited research [20-23] has been done on this matter. At the same time, no study has been conducted on the features of occurred fires in hospitals in Iran. Thus, this study aims to investigate the characteristics of fires in Iranian hospitals.

This innovative research represents a new effort to examine the features of hospital fire incidents in Iran. With no established system for collecting and analyzing data on such incidents in healthcare facilities, the current study has taken a unique and innovative approach by utilizing news agencies as a primary source of information. This approach provides a fresh viewpoint, shedding light on the causes and outcomes of hospital fires in Iran and filling a critical gap in the existing literature. By leveraging news agencies as a data source, this research offers a novel and comprehensive understanding of the hospital fires in Iran. The study advances our knowledge to develop effective fire prevention and safety measures in healthcare settings.

Materials and Methods

In this cross-sectional study, news related to fire in Iranian hospitals was retrieved from the archive of reputable Persian news agencies: [IRNA](#) [24], [Tasnim](#) [25], [ISNA](#) [26], [Mehr](#) [27], and [ILNA](#) [28]. The search words were the Persian terms of “fire”, “hospital”, and “clinic”. These news agencies are published electronically and are ranked as the top 5 news agencies according to the ranking of the press and information of the [Ministry of Culture and Islamic Guidance](#) [29]. No time limitation was considered, and news for all fires in hospitals or other healthcare facilities was retrieved.

Quantitative content analysis was used to assess the retrieved news texts. The research methodology involved systematic and objective data analysis to extract mean-

ingful insights from textual or visual content [30]. It employed statistical techniques to quantify and analyze the frequency, distribution, and patterns of specific variables or characteristics within the content. Quantitative content analysis is often used in social sciences, marketing, media studies, and communication research to study messages, images, or texts in a structured and systematic manner. Researchers use predefined categories, coding schemes, or software to analyze large datasets. The results are typically presented in numerical or statistical form, allowing for rigorous and empirical examination of patterns, trends, and relationships within the content [30, 31].

The “Emergency Operation Center of the Iran Ministry of Health and Medical Education” data about fires in healthcare facilities was also consulted to obtain additional information. Two researchers with at least 5 years of experience in hospital safety issues extracted the information from the news texts. All gathered data included the name of the hospital, name of the city where the incident took place, number of active beds in the hospital, date of the incident, time of the incident, number of injured and fatalities, the known cause of the incident, the reported vulnerability that led to the incident, the location of the incident, intentional or unintentional nature of the incident, were imported in an Excel file. To obtain information about the characteristics of the hospitals involved in the fire incident, such as the type of specialties and subspecialties and the number of active beds, we used the “Hospital Management Office System” and “Service Excellence” webpage supervised by the Ministry of Health and Medical Education of Iran [13]. If more information was needed and the required data were not announced in the report, or the provided information was incomplete or under review, we contacted the hospital’s secretary of the “incidents and disaster risk management committee” through the contact number provided for each hospital on the mentioned webpage. Reports obtained from news agencies that did not mention the hospital’s name were discarded.

3. Results

Out of 86 retrieved reports of hospital fire building, 50 reports (58%) were evaluated through reputable news agencies, 16 reports (18.6%) were accessed through information obtained from the Emergency Operation Center (EOC) of the Ministry of Health and Medical Education, and 20 reports (23.3%) were obtained through both mentioned sources (Table 1).

The obtained reports happened between 2005 and 2020, most related to 2018 (20 cases, 23.3%), and the least to 2005 and 2011 (one case each, 1.2%). During 2006-2010, 2012, and 2014, no report of an incident was found (Figure 1).

Regarding the frequency of the hospital building fires by month, the highest number of incidents occurred in August (14 reports, 16.3% of cases) and the lowest in April and November (4 reports each month, 4.7% of cases) (Table 2).

The most incidence reports were retrieved from Tehran Province (n=20). The frequencies of incidents in other provinces were as follows: Khuzestan (n=9), Khorasan Razavi (n=8), Fars (n=6), Bushehr, Gilan, Hormozgan, and Ilam (n=4 in each province), Sistan-Baluchestan and West Azerbaijan (n=3 in each province), East Azerbaijan, Arak, Qazvin, Golestan, Isfahan, Lorestan, and Mazandaran (n=2 in each province), and Alborz, Ardabil, Kerman, Kermanshah, Kurdistan, Qom, and Semnan (n=1 in each province) (Table 3).

Considering the frequency of fires on weekdays, reports indicate that the highest number of events occurred on Saturdays (20 cases, 23.3%), and the lowest number happened on Wednesdays (7 cases, 8.1%). Regarding the occurrence of fires on holidays and weekends, the obtained reports showed 56 cases (65%) on weekdays and 26 cases (30%) on weekends (Thursday and Friday). Only

Table 1. Frequency of reported hospital building fire in Iranian healthcare centers based on the source of information (before 2020)

Source of Reports	No. (%)
News agency	50(58.1)
Emergency operation center	16(18.6)
News agency and Emergency operation center	20(23.3)
Total	86(100)

Table 2. Frequency of reported hospital building fire in Iranian healthcare centers based on the month of the incident (before 2020)

Month Gregorian (Iranian) Calender	No. (%)
April (Farvardin)	4(4.7)
May (Ordibehesht)	10(11.6)
June (Khordad)	7(8.1)
July (Tir)	10(11.6)
August (Mordad)	14(16.3)
September (Shahrivar)	5(5.8)
October (Mehr)	7(8.1)
November (Aban)	4(4.7)
December (Azar)	8(9.3)
January (Dey)	5(5.8)
February (Bahman)	5(5.8)
March (Esfand)	7(8.1)
Total	86(100)

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4 cases (approximately 5%) occurred on official holidays in the Iranian calendar [32] (Figure 2 and Table 4).

Most incidents happened between 12:00 and 18:00 (n=29), and the lowest frequency was related to 18:00 to 24:00 (n=15) (Table 5).

Considering the number of injuries and deaths caused by hospital fire buildings, 74 events were reported without casualties, and 77 were reported without fatalities. The highest number of casualties (n=35) was related to the incidents that occurred on September 27, 2016, in Razi Hospital, and the highest number of fatalities

Table 3. Frequency of reported hospital fire building in Iranian healthcare centres (before 2020)

Name of Province	Frequency per Province (%)
Alborz, Ardabil, Kerman, Kermansha, Kordestan, Qom, Semnan	1 event in each province (8.1)
East Azarbayejan, Arak, Ghazvein, Golestan, Isfahan, Lorestan, Mazandaran	2 events in each province (16.3)
Sistan & Balochestan, West Azarbayejan	3 events in each province (7)
Bushehr, Gilan, Hormozgan, Ilam	4 events in each province (18.6)
Fars	6(7)
Khorasan Razavi	8(9.3)
Khuzestan	9(10.5)
Tehran	20(23.3)

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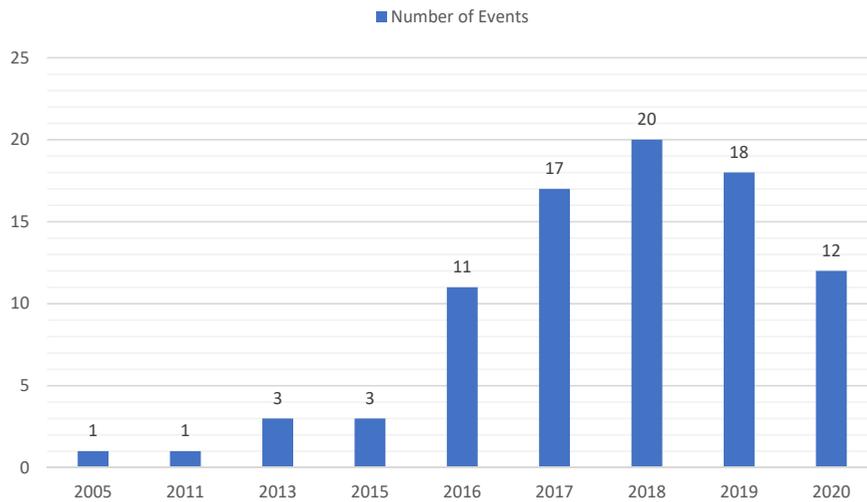


Figure 1. Frequency of reported hospital building fires in Iranian healthcare centers based on the year of the incident (before 2020)

(n=19) was associated with the deadly incident on July 30, 2016, in Sina Athar Clinic.

Regarding the cause of reported incidents, 56 reports did not mention any specific cause or just reported the cause of the incident under investigation. However, the electrical short circuit was the most reported cause (17 cases, approximately 20%). Other reported causes included infrastructure related (4 cases, 4.7%), oxygen cylinder explosion (2 cases, 2.3%), arson (2 cases, 2.3%), sewage gas explosion (2 cases, 2.3%), ventilator explosion (1 case, 1.2%), high temperature (1 case, 1.2%), using a cooking flame in a tent set up in the hospital yard (1 case, 1.2%), smoking in hospital’s room (1 case, 1.2%),

gas leakage (1 case, 1.2%), and cooking flame in hospital medical department (1 case, 1.2%) (Table 6).

Regarding the level of damages to the healthcare facility, 47 reports (54.7%) did not mention the damages or reported damages under investigation. In the rest of the reports, the level of damage was insignificant in 29 cases (33.7%) and significant in 10 cases (11.6%).

Of the 86 reported fires, 16 (18.6%) did not mention the location of the fire. In the rest of the reports, the highest number of fires occurred in the medical care environment (19 cases, 22.2%), hospital warehouse (18 cases, 20.9%), the area outside the main hospital building, including the

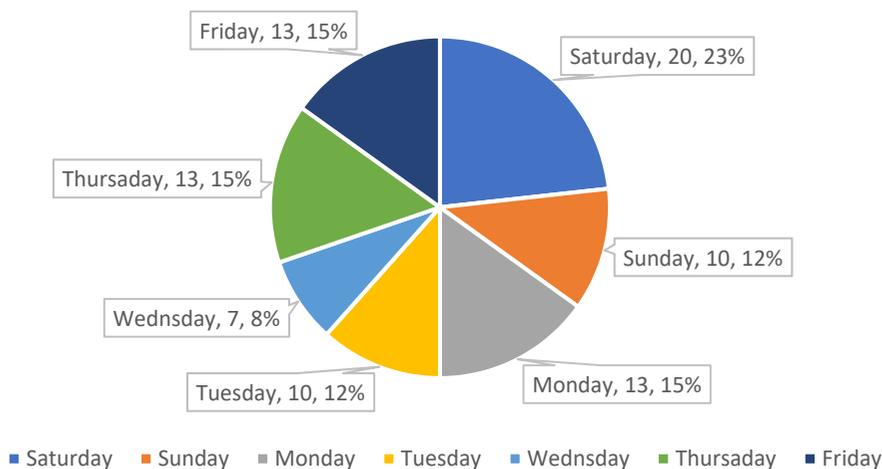


Figure 2. Frequency of reported hospital fire buildings in Iranian healthcare centers based on days of week (before 2020)

Table 4. Frequency of reported hospital building fires in Iranian healthcare centres based on weekdays, holidays, and weekends (before 2020)

Day	No. (%)
Weekdays	56(65.1)
Holidays	4(4.7)
Weekends	26(30.2)
Total	86(100)

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Table 5. Frequency of reported hospital fire building in Iranian healthcare centres based on time of the incident (before 2020)

Time	No. (%)
0000–0600	19(22.1)
0600–1200	23(26.7)
1200–1800	29(33.7)
1800–2400	15(17.4)

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courtyard, unfinished building and parking (10 cases, 11.6%), hospital infrastructure (9 cases, 10.5%), and hospital kitchen (5 cases, 5.8%). Resting pavilion for medical care personnel, para-clinical departments, central sterilization room (CSR), and pharmacy, each where two reported incidents are located. The hospital's facade was also the location of one of the reported incidents (Table 7).

Fifty-one reports (59.3%) did not indicate whether the incidents were intentional or unintentional or just reported under investigation. Thirty-three reports (38.4%) put into words that the incidents were unintentional, and two (2.3%) claimed they were intentional. Twenty-five (29.1%) reported incidents expressed that partial or complete emergency evacuations of the hospital were done following the incidents, while in 45 incidents, the emergency evacuations were not performed. The rest of the reports (16 cases, 18.6%) did not mention this issue.

Discussion

Using reports from reputable Iranian news agencies and registered information in the emergency operation center (EOC) of the Ministry of Health and Medical Education, this paper has provided important features of hospital fire buildings in Iran. Most retrieved reports

were obtained through reputable news agencies, and only one-fifth of them were obtained through the data of the EOC. Although the news agencies used in this study are the most respected in Iran according to the ranking of Press and Information of the Ministry of Culture and Islamic Guidance [29], the regained information does not have sufficient credibility for research purposes. However, due to the lack of a centralized database that collects and analyzes incident information, the researchers tried to access important features of such incidents using quantitative content analysis from the present released data. The most important achievement of this research is highlighting the lack of an available central system for recording, analyzing, and disseminating the important features of healthcare incidents at the national level.

Effective disaster preparedness and improving response against hospital emergencies require using past experiences of healthcare centers in dealing with each event. In this way, it is necessary to use a systematic approach to learn from these experiences. If organizations do not have a framework for conducting after-action reviews and disseminating their lesson learned to the other partners, reducing the frequency and severity of future incidents could not be expected [33, 34]. Considering the hospital's accreditation standards in the Iranian health care system, all hospitals must analyze

Table 6. Frequency of reported causes of hospital fire building in Iranian healthcare centres (before 2020)

Cause of Hospital Building Fire	No. (%)
Ventilator explosion	1(1.2)
Extreme hot weather	1(1.2)
Using a cooking flame in a tent set up in the hospital yard	1(1.2)
Smoking	1(1.2)
Gas leak	1(1.2)
Cooking flame in hospital medical department	1(1.2)
Arson	2(2.3)
Sewage gas explosion	2(2.3)
Oxygen cylinder explosion	2(2.3)
Infrastructure related	4(4.7)
Electrical short-circuit	17(19.7)
Not specified	53(61.6)

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Table 7. Frequency of reported location of hospital fire buildings in Iranian healthcare centres (before 2020)

The Location of The Incident	No. (%)	
Not declared	16(18.6)	
Medical care environment	Operation room	2(2.3)
	General ward	9(10.5)
	Critical care ward	4(4.7)
	Clinic	4(4.7)
	Total	19(22.2)
Hospital warehouse	18(20.9)	
Out of the main building	10(11.6)	
Hospital infrastructures	9(10.5)	
Kitchen	5(5.8)	
Paraclinical area (MRI, CT-scan, laboratory)	2(2.3)	
CSR	2(2.3)	
Pharmacy	2(2.3)	
Pavilion apartment	2(2.3)	
Hospital façade	1(1.2)	

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their performance and take corrective measures in less than 72 hours after accidents (accreditation standards, measures A 2-5-2 and A 6-2-2). However, a nationwide registry system has no mechanism for recording hospital incidents such as hospital fires. Therefore, evidence-based measures could not be taken to improve hospital preparedness and response to emergencies [35].

In the United States, health departments such as hospitals and other related centers provide their after-action reports or improvement plans using the known approach developed by military systems and the Forest Service for managing wildland fires. This approach could effectively learn from experiences of real responses [7]. However, despite efforts to standardize the reporting framework, a review of the after-action reports showed that the structure of these reports is as different as the individuals who set the reports. In other words, the people who set up the reports are diverse [36-39].

Other fields have also found strategies for learning from unique and rare events that could be used as a model for improving the health system's readiness against emergencies. Aviation may be introduced as the most prominent example in this way. In recent years, aviation safety has been excitedly improved, and despite increasing the number of flights, the number of air crashes has dropped significantly since the aviation industry systematically identifies, records, and analyses the critical events for learning from them. These lessons could improve preparation and response in upcoming emergencies [20, 40]. Given what was mentioned about the importance of registering critical incidents in various fields, and because emergency management in healthcare centers is essential, it is necessary to have a vital incident registry system for collecting, analyzing incident data, and disseminating evidence gathered from each rare and unique event.

Considering the lack of evidence about incident management in healthcare centers, more information is required on the safety of hospitals in the field of hospital building fires. In a systematic review study on fire safety management in Asian hospitals, it has been suggested that studies should be conducted with an exploratory sequential mixed-methods approach to obtain more information on fire safety in hospitals [14]. Conducting such studies could use face-to-face interviews with hospital specialists and staff and may lead to in-depth findings on the hidden aspects of hospital building fires. However, as mentioned earlier, given the paucity of studies on hospital building safety against fire, it seems that conducting descriptive analytical studies following the establishment of an extensive national and even international critical incidents registry system has a greater impact on the attainment of useful evidence in this field.

Conclusion

The current study investigated the characteristics of hospital building fires in healthcare facilities in Iran. It explored the most important characteristics of such incidents, including time, date, and city of the incidents, the number of injuries and fatalities, cause and location of the incidents, level of damage induced by the incidents to the hospital, whether or not evacuation was performed, whether the incident was intentional or unintentional.

According to the current study, raising awareness about the lack of an integrated mechanism for registering such events in hospitals is more important than providing statistics on important features of hospital building fires in Iranian healthcare centers. Therefore, no robust evidence would be yielded for improving prevention, preparation, and response to such incidents. Future research can design a critical registry system that collects, analyzes, and disseminates hospital incident data to better understand the important features of hospital incidents and produce evidence for taking appropriate measures.

Ethical Considerations

Compliance with ethical guidelines

The present study was approved by the Ethics Committee of [Shahid Sadoughi University of Medical Sciences](#) (Code: IR.SSU.REC.1399.278).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

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