

MANAGING THE UTILIZATION OF PREVENTIVE MEASURES FOR FIRE RESISTANCE IN THE HOSPITALS

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Abstract

The study analyzed the current situation of public hospitals in the capital of Baghdad exclusively and diagnosed the resources available; especially after the high demand for these hospitals as a result of the citizen's need to review the hospital to take care of them, especially after the Corona pandemic. Eight major hospitals in Baghdad were selected to determine the current reality of providing fire safety tools or equipment and what are the preventive measures needed to reduce it. The results after practical study showed many defects and weaknesses in the current situation due to their reliance on the traditional management to manage and provide all preventive measures and safety tools, which was also confirmed by the results of the field survey that indicated a large gap and absence of an internal protection system against fire accidents. The study concludes by suggesting basic alternatives to improve the safety of hospital buildings, including improving system evaluation, establishing a management system for firefighting equipment, periodic monitoring and accident analysis, and establishing a reliability management system for safety training. The study recommends to activating a new management system to improve the current utilization in Iraqi public hospitals.

Keywords:

Management;
Hospital;
Fire fighting;
Preventive measures;
Relative Important.

1 Introduction

The hospital environment is a mixture of multiple risks that occur in different parts of the hospital, such as physical, chemical, or biological hazards [1]. There are many causes of fire accidents in hospitals, so it is necessary to provide multiple means to preserve the lives of patients and employers in hospitals [2]. Fires occur in hospitals for different reasons, which depend on the type of materials and different equipment that contribute to the occurrence of a fire disaster. Kodur introduced eight main causes that lead to hospital fires, as shown in Fig. 1 [3]. Regardless of the effects of the risks, all risks must be identified before the accident occurs on different axes, for example; a weak strategic plan is another risk for safety management for any building. So evaluating strategies is essential in fighting fires.

Brzezińska and Bryant presented a dedicated methodology based on a simulation method to assess the level of fire safety in sustainable buildings. Using this methodology was based on the ideas mentioned in the British Standard (PAS 911) for the year 2007, the study was able to combine the characteristics of the criteria of known strategies with the on-site study approach in order to reach an appropriate method of evaluation. The results of the study indicated that it is possible to apply this approach to a range of industrial fire safety assessments too; there is flexibility in modifying its paragraphs to meet the specific needs required in different industries [4].

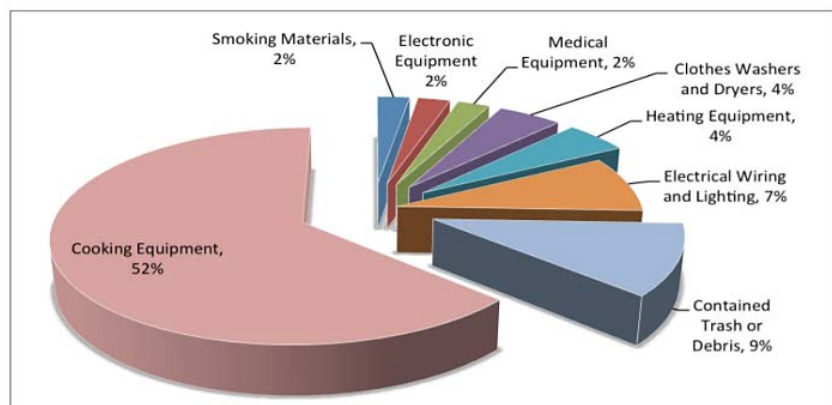


Fig. 1: Main Causes of Hospital Fires, Kodur et al, 2019 [3].

Osvaldová presented different methods concerning fire prevention, by evaluating the properties of flammable materials. Different methods were evaluated for fire prevention. New methods for assessing flammability properties about the identification of correct assessment test criteria. The simplest of these criteria was weight reduction. Applying materials with moisture content, plasterboard, wood or by applying a damper, evaluation criteria are no longer objective [5].

Among the objectives of the required strategies, it is necessary to define safety management and define the priorities of its tasks and duties. Nardo's Study suggested a comprehensive model for safety management using a dynamics system approach based on the system applied in the Bhopal accident. This proposed model dealt with the nature of relationships for the focal reasons that contributed to the matter of this accident, including identifying the nature of the strategy and the type of decisions issued by it, the type of defect in the safety devices, the experience and incompetence of employees, and benefit from the relevant literature that studied the Bhopal accident in detail. The result of the study indicated that the simulation model showed how to manage the main factors to make a safe situation. The study recommended how to strengthen these important aspects by using them to reduce accidents and to secure the building's safety and employees [6].

It is necessary to prepare plans for the protection and prevention of fire accidents to prevent human and material losses. The hospital administration bears the main responsibility for maintaining the safety of patients, through the provision and application of procedural measures to combat fires and work with the appropriate safety management for each building in the hospital. We do not exclude the employees working in the safety unit from their important role in following up on their responsibilities during maintenance periods and emergencies to save the largest possible number of potential victims without referring to the instructions that take a long time to review [7].

Shastri's study was equipped with data that confirmed few hospitals that have new systems and modern technology, yet these hospitals remain unqualified for safety management and the application of preventive measures against fire. The following are a set of errors and difficulties that were identified as fire risk factors [8]:

- 1) There are no approved automated systems for firefighting.
- 2) There is no deterrent law for those who cause fire errors.
- 3) A short-term plan for fire prevention measures.
- 4) There is no periodic maintenance for the management of firefighting equipment.
- 5) Weakness of the efficiency of workers in the field of safety.
- 6) The presence of quantities of combustible materials that are stored in the buildings.
- 7) Weak or absence methodology in how to manage and overcome accidents.
- 8) Weak interpretation of legal and administrative issues related to how to manage security systems and provide safety.

Novrial study stated the protection system for passive fire that includes the minimum standards required [9]:

- 1) Execution hospital buildings with fire-resistant building materials.
- 2) Providing various life-saving equipment through (safety signage, emergency door provision, emergency staircases, installation of emergency lights, evacuation route...etc).

Salleh's study Influenced factors and barriers to managing fire safety and preventive measures for fire-related incidents in Asian hospital buildings were the three topics that emerged from the review. Factors influencing and barriers to managing fire safety and fire-related preventive measures in Asian

hospital buildings were categorized into technical, administrative, and legislative factors. This study recommended an exploratory sequential mixed-methods approach as part of the implications for further newest studies [10].

Many models for evaluating fire safety performance in all different buildings have been developed, knowing that they represent difficult characteristics in the design and implementation and determine the appropriate type to apply all safety measures and protection from fire accidents. Park study showed that there are other characteristics called "soft characteristics" such as architectural design features, which can effectively affect the performance of safety and the implementation of preventive measures from fire accidents [11].

Despite the numerous studies in different countries, the methods of fire prevention control have not been improved by the leaders of institutions and those responsible for the application of safety. Therefore, Vong & anh study tried to find useful solutions to enhance safety systems and enhance the quality of different activities and build the most effective and fire-resistant to combat it as much as possible. One of the most important solutions developed by the study is the need for safety officials to pay attention and perform their tasks without interruption, and take the initiative in absorbing fire accidents, and increasing the management's activities regarding fire prevention and combat it by increasing the awareness of the population and continuing to influence others [12].

Alim study used a qualitative descriptive approach through interviews. It recommended the necessity of hospital administration commitment to existing policies and planning by collecting all health and safety data, providing professional advice, conducting training, installing fire extinguishers, and installing dangerous signals on all dangerous equipment. Based on the evaluation of employees' compliance with work performance, the study suggested that hospital administrators increase the efforts of professionals and pay incentives for proper implementation in the health and safety management system of hospitals [13].

Many researcher recommended the necessity of paying attention to periodic maintenance and increasing its budget, in addition to updating this budget tab to suit the current situation, as well as setting up a special system for incentives for maintenance engineers in order to attract technical and engineering staff to work on the maintenance division's staff [14].

It's necessary to raise people's awareness about the safety measures that must be taken during the outbreak of fires inside and around buildings and other fire prevention methods that must be adopted for their safety. Noah et al, 2017 [15]. And develop fire prevention measures such as tightening safety precautions and supervising work methods. With specific targeting of firefighting with low fire risk, revision of non-combustible material quality regulations or use of insulating regulations, installation of sprinklers in cold storage, mandatory installation of automated utilities regardless of floor space [16].

To maintain a hospital building successfully, a proper organizational structure and an adequate grasp of each employee's responsibilities. The scheduling of maintenance activities significantly impacts maintenance costs. Insufficient planning and scheduling for maintenance work indicate that the organization is not relying on preventive maintenance [17].

In a recent study for wood, how searched on the causes of fires that occurred recently in Iraq. This study recommended that chemical risks are the responsibility of hospital management, and that it should conduct an appropriate investigation to find out the reasons that led to this disaster and how to provide opportunities and rapid response to emergencies by adopting an approach to confronting risks and how to properly manage them for Safety of chemical processes and control of flammable and explosive materials [18]. Fire protection of building structures is a necessary part of preventive measures aimed at ensuring fire safety and fire resistance of buildings and facilities [19].

Mahdi study is the last study in Iraq, identified forty two factors affecting maintenance and categorized them into six groups to determine the maintenance practices in public hospital buildings such as faulty design and lack of funding which are the most significant factors[20].

2 Main problems

Iraq suffered during the past year from two major fire accidents in big hospitals, one of them occurred in Al-Khatib Hospital in Baghdad and another one in Al-Hussein Hospital in Dhi Qar Governorate, which led to the death of nearly 200 people. The causes of this fire accident are attributed to various factors that led to this disaster, including the lack of a strategy, appropriate evacuation, unavailable of fire system protection, quality and type of material used to build these hospitals besides the weakness awareness for hospital employers and guests, that need to develop all strategic safety

planning in Iraq and deliver all safety and security procedures carefully to avoid various accidents, but there are always unlimited opportunities for different accidents to occur.

Public hospitals in Iraq are divided according to health departments; the number of Iraq's health departments is 20 health departments within all Iraq's governorates as shown in Fig. 2, while Fig. 3 shows the three classification of health departments in Baghdad [21].

A study conducted in Iraq tried to highlight the importance of maintenance in general and the maintenance of hospital buildings in particular, in addition to evaluating the maintenance management of these buildings on the basis of the extent to requisite functions of the process of management including planning, organizing, directing, and control are achieved. The results of the study revealed many defects and weaknesses in the administrative functions, especially in the planning and organizing functions, including the absence of periodic maintenance and the lack of engineering staff, especially the construction of them, as well as the root problem.

Health directorate	Government hospital for 100000 population	Population/ government Hospital	Total hospitals (government+private)	Private hospitals	Government hospitals & Specialized centers with inpatients		
					Total	Non teaching hospitals	Teaching hospitals
Baghdad / Al-karkh			30	16	14	10	4
Baghdad/Al-Rusafa			62	37	25	15	10
Medical city			12	0	12	8	4
Ministry Headquarter*			1	0	1	1	0
Baghdad total	0.6	164691	105	53	52	34	18
Basrah	0.5	218877	21	7	14	8	6
Nineveh	0.5	218163	21	3	18	13	5
Maysan	0.8	130219	10	1	9	8	1
Al-Dewaniya	0.7	135905	13	3	10	8	2
Diala	0.5	191443	12	3	9	7	2
Al-Anbar	0.7	143424	16	3	13	9	4
Babylon	0.8	120729	23	5	18	14	4
Kerbela	0.7	142594	13	4	9	6	3
Kirkuk	0.5	187005	11	2	9	8	1
Wasit	0.6	181439	9	1	8	6	2
Thi-Qar	0.4	245120	12	3	9	6	3
Al-Muthanna	0.6	171381	6	1	5	3	2
Salah Al-Deen	0.7	152596	13	2	11	10	1
Al-Najaf	1.0	96867	21	5	16	13	3
Total without Kurdistan region	0.6	164553	306	96	210	153	57
Erbil	1.2	81428	49	25	24	18	6
Duhok	1.7	59192	32	9	23	18	5
Al-Sulaimaniya	1.7	59957	63	25	38	27	11
Grand total	0.7	136102	450	155	295	216	79

lbn-Sena hospital

Fig. 2: Health department for all Iraq's governorates, Number of hospitals, governmental hospital ratio per 100000 of the population according to governorate [21].

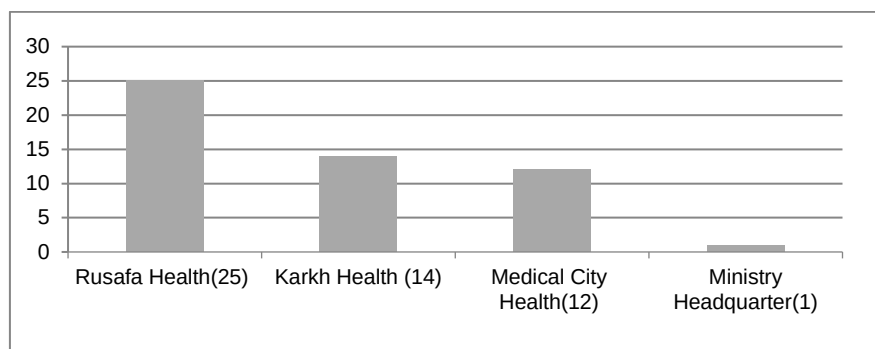


Fig. 3: Health department in Baghdad public hospitals (researcher).

3 Hypotheses of the research

The hypothesis of the research depends on the existence of the weakness in the application and provision of safety tools in preventive measures for reduces fire accidents in public hospitals. There are old obstacles that still persist and prevent the availability or activation of benefiting from safety tools in preventive measures in the implementation of maintenance management functions. The study supposes a lack of a clear managerial organization in the implementation of preventive measures.

4 Aims and objectives

Fire protection of building structures is a necessary part of preventive measures aimed at ensuring fire safety and fire resistance of buildings and facilities [22]. The research aims the level of readiness for hospitals in preventive measures to reduce fire accidents to prevent potential fires in public hospitals. The study also includes several objectives:

- Identifying obstacles that delay the safety management situation improvement in Iraq and what is the best scenario to reduce these obstacles.
- Concluding proposals that can be developed for activate the current situation in public hospitals.

5 Methodology

To achieve the objectives above, the study directed the following methodology:

- Personal interviews with the directors and engineers working in the engineering affairs department in Baghdad health department, and different public hospitals in the capital of Baghdad.
- Searching to introduce the weaknesses and challenges that are required to be available at present time.
- Conducting a field survey about the systems and methods of maintaining hospital buildings, to investigate about the availability of safety and preventive measures.
- Collecting information and data from the participating samples working in public hospitals in Baghdad.
- Developing a best scenario to reduce all the main obstacles and prepare the best proposals that can be developed to activate the current situation in hospital administration.

6 Limitations of the study

The limitations of the study are:

- Spatial boundaries: The study was applied only to eight public hospitals in the capital of Baghdad, as shown in Table 1.
- Temporal boundaries: The study was conducted from 2021 till 2022.
- Objectivity boundaries: The topic was discussed in four axes:
 - i. Availability of structural and electrical safety requirements and fire fighting and warning systems.
 - ii. Extent to which preventive measures aimed at reducing fire accidents are applied.
 - iii. Obstacles that prevent the availability and application of safety measures and optimal visualization to avoid these obstacles.
 - iv. Suggestions to take advantage and develop safety procedures in public hospitals.

Table 1: Baghdad hospitals -Area of study (researcher).

Table 1: Baghdad hospitals- Area of study (Researcher):			
No.	Hospital Name	Sub strict	No. of beds
1	Baghdad teaching hospital	Al - Rusafa	998
2	Teaching Hospital of Al Karama		445
3	General Teaching for Al Kindi hospital Hospital		333
4	Maternity Teaching for Al Alwaiya hospital		332
5	General Hospital of Al Nuaman		220
6	General Hospital of Al Karkh	Al- Karkh	198
7	General Teaching for Al Yarmuk hospital		770
8	Al Imamian of Al Kadhimiya Medical City		630
Total of beds			3926

7 Selected sample of the practical study

A questionnaire has been prepared considering the main aspects affected on the level of readiness in Baghdad public hospitals for application and availability of preventive measures for reduce fire accidents. Described effective aspects based on importance three point likert scale, the scale description is 3 = Available, 2 = Not Enough, 1 = Not Available [23]. Fifty five questionnaire forms were distributed to the selected sample working in eight public hospitals in the capital of Baghdad, received only 40 completed answers as shown in Table 2. The response rate was equal to 73 %. Details of

respondents and information are shown in Table 3. Adopted these features mentioned to ensure access to the appropriate answers in the field of implementation and maintenance, and to make their observations that can help to achieve the comprehensiveness of the research results.

Table 2: Sample size (researcher).

No.	Hospital Name	Forms distributed	Forms arrived	Answers percent %
1	Al Yarmuk general teaching	7	6	15.0
2	Al Kindi general teaching hospital	5	5	12.5
3	Al Karkh general hospital	6	6	15.0
4	Al Alwaiya maternity teaching	7	3	7.5
5	Al Karama teaching hospital	8	5	12.5
6	Al Nuaman general hospital	7	6	15.0
7	Baghdad teaching hospital	6	6	15.0
8	Al-Imamian Al-Kadhimiyyain medical city	9	3	7.5
Total forms		55	40	100 %

Table 3: Specifications of the Selected Sample (researcher).

No.	Jobs	Disciplines				
		Number	(10-20) years	More than 20 year	B.-Sc.	M. Sc.
1	Medical electronics	4	1	2	2	1
2	Electrical installations	3	2	1	3	0
3	Electro-medical systems	4	2	2	3	1
4	Mechanics	4	3	1	2	2
5	Plumbing	1	0	1	0	1
6	Refrigeration and air-conditioning	3	3	0	2	1
7	Carpentry	1	1	0	1	0
8	Bricklaying	2	0	2	2	0
9	Automotive work	6	1	3	3	1
10	Technical management	7	1	4	4	1
11	Endoscopy Department	5	1	2	3	0
12	Sterilization Department	3	1	2	3	0
13	Stomatology Department	4	1	1	2	0
14	Medical images services	2	2	0	2	0
Total		40	19	21	32	8
Percentage %		100	47.5	53.5	80	20
Total Percentage %		100 %	100 %		100 %	

8 Preparation of Questionnaire

The questionnaire questions were prepared through a theoretical literature review related to the characteristics that deal with hospital maintenance and basic functions, focused on the Alwaheeb study because it covered most of the criteria and factors mentioned in all previous studies [24]. The questionnaire form consisted of:

- 1) Personal information, such as academic achievement, years of experience in the maintenance field, and current job position.
- 2) Considerations to evaluate the level of readiness in the application and availability of preventive measures to reduce fire accidents in hospitals, and indicate the level of maintenance management and obstacles and opportunities to discuss them.

The questionnaire form has been checked and examined by three experts to verify the validity and contents of the questionnaire form.

9 Statistical Analyses

Using IBM SPSS (Statistical Package for the Social Sciences) Statistics 26 software to carry out data analysis, the results answers have been clarified in the forms of tables with arithmetic mean for each requirement, and find the relative important indices by using the following equation [25].

$$RII = (\sum_{i=1}^5 f_i * Ni) / (\sum_{i=1}^5 Ni) \quad (1)$$

Where:

f_i - repeat answer for the questionnaire paragraph,

N_i - questionnaire sample size,

i - number intimates order.

The contents of the questionnaire form consists of the considerations below:

A. What is the current situation of availability safety tools and equipment in preventive measures applied in Iraqi public hospitals for accident resistance, in two aspects:

- Availability structural and electrical safety requirements and conditions in 37 urgent requirements. Statistical results are shown in Table 4.
- Availability of fire fighting and warning systems in 30 urgent requirements. Statistical results are shown in Table 5.

B. What are the obstacles that prevent the provisions and application of safety equipment and application of preventive measures?

C. What is the best scenario as a proposal that can be developed to activate the utilization of the safety tools in preventive measures applied in Iraqi public hospitals for accident resistance?

Table 4: Structural and electrical safety requirements results.

No.	Requirement	A.M	RII%	Rank
1	The entrance to the facility is suitable for the use of emergency teams	2.31	77.00	25
2	The building is divided into fire sectors by fireproof walls, doors and floors.	2.41	80.33	17
3	Each floor includes at least two fire sectors to allow horizontal evacuation.	2.32	77.33	24
4	The materials used in the construction of walls, ceilings, and their coverings are non-combustible materials.	2.52	84.00	5
5	Sites that contain special dangers - such as intensive care rooms – are equipped with exits and double protection means.	2.56	85.33	1
6	Ventilation and air conditioning ducts are fitted with dampers to prevent the spread of fire and smoke.	2.47	82.33	11
7	Natural and mechanical ventilation works in the event of a fire to renew the air in the basement, lobbies, corridors, and exit towers.	2.13	71.00	32
8	The building is protected from lightning strikes.	2.28	76.00	27
9	Circuit breakers are insured against the dangers of diamond and arc.	2.48	82.67	10
10	The electrical wiring is suitable in terms of diameter for the type of use and is insulated and protected against damage or high current.	2.53	84.33	4
11	Switches and sockets are intact and secure, and the current used in the appliances has been grounded.	2.33	77.67	23
12	The building is equipped with elevators for daily use.	2.48	82.67	9
13	Equipping the building with back-up lighting that works in the event of a power outage in the basement and escape corridors.	2.49	83.00	8
14	The building is equipped with an emergency elevator (in case the building height is more than 6 floors or 20 meters).	2.54	84.67	3
15	The building is equipped with a back-up generator that operates in the event of a power outage	2.55	85.00	2
16	Elevators are equipped with fans for ventilation.	1.79	59.67	35
17	Elevators are equipped with a means of communication.	2.42	80.67	16
18	The elevator room is equipped with a manual hoist for the elevators.	2.5	83.33	7
19	The building is equipped with emergency doors.	2.39	79.67	19
20	Emergency doors are suitable in terms of capacity compared to the number of residents of each area.	2.43	81.00	15
21	Emergency doors are suitable in terms of installation material and opening direction.	2.51	83.67	6
22	The building is equipped with an evacuation facility for patients confined to their beds.	2.15	71.67	30
23	The building is equipped with an internal emergency staircase.	1.69	56.33	36

24	The staircase conforms to the specifications in terms of number and the presence of balustrades.	2.44	81.33	14
25	The building is equipped with escape corridors.	2.26	75.33	28
26	The escape corridors are constructed of materials that are protected from fire and smoke.	2.34	78.00	22
27	The escape corridors are equipped with water sprinklers - if the length of the corridor is more than 30 meters	2.29	76.33	26
28	The facility has storage warehouses.	1.65	55.00	37
29	Warehouses are independent of the building.	2.01	67.00	34
30	The hospital has a central kitchen.	2.14	71.33	31
31	The kitchen is identical in terms of location.	2.45	81.67	13
32	The hospital has a central laundry.	2.22	74.00	29
33	Laundry is identical in terms of location and fixtures.	2.1	70.00	33
34	The hospital has departments that use radiology and nuclear medicine.	2.46	82.00	12
35	Radiology departments are appropriate in terms of location.	2.36	78.67	20
36	The hospital has medical gas supplies.	2.4	80.00	18
37	The gas sourcing room is suitable in terms of location and equipment.	2.35	78.33	21
Total		2.32	77.25	37

Table 5: Extinguishing and alarm systems requirement results.

NO.	Requirement	A.M	RII%	Rank
1	Availability of an alarm system	1.16	38.67	15
2	The alarm system is installed according to approved plans from approved consulting engineering offices.	1.24	41.33	12
3	Suitable alarm system in terms of wipers.	1.24	41.33	11
4	Appropriate distribution in terms of the type of detectors.	1.21	40.33	14
5	The manual alarm units are well distributed.	2.12	70.67	5
6	Alarm linked channels and ventilation system.	1.26	42.00	10
7	The alarm is linked to the extinguishing system.	1.04	34.67	16
8	The alarm is linked to the emergency doors.	0.07	2.33	30
9	Provides a suitable control panel.	0.94	31.33	18
10	Provides warning bells.	1.34	44.67	7
11	Provides manual fire extinguishers.	2.51	83.67	1
12	Suitable fire extinguishers for the type of use.	0.95	31.67	17
13	Distribution and locations of extinguishers are appropriate.	2.42	80.67	2
14	The firefighting system is installed according to approved plans from approved consulting engineering offices.	0.8	26.67	29
15	Provides water hoses.	2.31	77.00	4
16	Water hoses conform to the specifications in terms of the materials they are made of.	1.31	43.67	9
17	Distribution of water hoses is appropriate.	1.22	40.67	13
18	Availability of dry tubes. need	1.42	47.33	6
19	Provides automatic water sprinklers.	0.81	27.00	28
20	Water sprinklers are suitable in terms of covering a single sprinkler.	0.85	28.33	23
21	Water sprinklers are suitable in terms of extinguishing agent.	0.92	30.67	21
22	Water sprinklers are suitable in terms of installation method.	0.91	30.33	22
23	Provides main fire pump with proper power.	1.32	44.00	8
24	Feed the main pump with electricity according to the instructions.	0.82	27.33	27
25	Provides an auxiliary fire pump with appropriate power.	0.93	31.00	19
26	Provides a diesel fire pump.	2.4	80.00	3
27	Provides an independent water tank for firefighting used with the appropriate capacity.	0.83	27.67	26

28	Provides an automatic gas immersion extinguishing system.	0.84	28.00	25
29	Suitable gas extinguishing system for the type of use.	0.92	30.67	20
30	Availability of a pre-dive warning system.	0.84	28.00	24
Total		1.23	41.06	30

Depending on the contents of the questionnaire form that was previously referred to we collected and analysed data. The important results discussed below depended on the final percentages of the relative importance index RII for all considerations.

10 Results discussion for the availability of structural and electrical safety requirements and conditions

It is clear from Table 4, the requirements of structural safety and electricity were mostly available in Baghdad hospitals, with an arithmetic mean 2.32, and relative important index equal to 77.36 %. The five important requirements and conditions are represented by numbers 5, 4, 10, 13, and 15 arranged in descending order as shown below:

A. Sites contain special dangers - such as intensive care rooms - are equipped with exits and double protection. This requirement ranked first with a relative important index equal to 85.33 %.

B. The materials used in the construction of walls, ceilings, and their coverings are non-combustible materials, which was the second rank with a relative important index equal to 85.00 % in all hospitals under study.

C. The requirement, the electrical wiring is suitable in terms of diameter for the type of use and is insulated and protected against damage or high current, with relative important index equal to 84.67 % In all hospitals under study.

D. The building is equipped with an emergency elevator in case the building height is more than 6 floors or 20 m with a relative important index equal to 84.33 %.

E. The building is equipped with a back-up generator that operates in the event of a power outage with a relative important index equal to 84.00 % in all hospitals under study.

The research attributed this result to the fact that many patient treatment devices operate with electricity, and medicines need a certain temperature to be preserved, in addition to the fact that the electric current may be cut off during critical periods such as conducting operations, which makes the hospital administration work on that the building must be Equipped with a backup generator that works in the event of a power outage.

11 Results discussion for availability of fire fighting and warning systems

Table 5 shows the requirements of firefighting and warning systems that were available in Baghdad hospitals, with an arithmetic mean 1.23, and a relative important index equal to 41.06 %. There are a number of alarm systems available in these hospitals, but five important requirements are represented by numbers 11, 13, 26, 15, 5 arranged in descending order as mentioned follows:

A. Availability of manual fire extinguishers with a relative important index equal to 83.67 % in all hospitals under study, the results attributed to conclude that manual fire extinguishers are one of the main safety methods that It is easy to provide and use in hospitals.

B. Appropriate distribution and locations of extinguishers, with a relative important index equal to 80.67 %. It concluded that there are regulatory bodies, whether inside or outside hospitals, following it monitors the distribution of extinguishers represented by the safety unit or other units, which makes the distribution and locations of extinguishers are appropriate and easily accessible.

C. Providing a diesel fire pump ranked fourth in terms of existence. It is available in hospitals with a relative important index equal to 80.00 %, the researcher attributed this result to the fact that the availability of standby generators but with high cost of these pumps in terms of insurance and maintenance.

D. The appropriateness of fire extinguishers for a type of Usage, ranked third in terms of availability in hospitals with a relative important index equal to 77.00 %.

E. Manual warning units are distributed well, with a relative important index equal to 70.67 %. It attributed this result to the fact that the manual warning units are an important part of the alarm parts, they are the simplest types of warning, and therefore almost any hospital is not free of these units.

12 Results discussion for the obstacles of the prevent provision and application of safety equipment

The final results indicated many obstacles that prevent the provision and application of safety equipment and application in preventive measures, like a discrepancy in the availability of firefighting and warning systems for public hospitals in Baghdad, there are several obstacles noticed and appeared in the results for this consideration, as shown in Table 5:

A. The warning related to emergency doors it is not available in hospitals with a relative important index equal to 2.33 %, the researcher attributes that because installed systems are relatively old and have not been provided with the appropriate technology.

B. The warning related to the firefighting system came in second ranked and it is not available in hospitals with a relative important index equal to 26.67 %. It is lacking of availability in hospitals.

C. The warning related to the firefighting system, it is not available in hospitals with a relative important index equal to 27.00 %, the researcher attributes this to the same as the previous one.

D. Providing automatic water sprinklers it is not available in hospitals, with a relative important index equal to 27.33 %.

E. Provides an independent water tank for firefighting use with the appropriate capacity is the fifth requirement and not available in firefighting and warning systems for public hospitals in Baghdad with relative important index equal to 27.67 %.

13 Conclusions and recommendations

Based on the results of this study, weaknesses in the system were identified, its safety level improved, and thus, effective in reducing the social and economic consequences of accidents. The study recommends the necessity of paying attention to periodic maintenance and recommends a set of important recommendations that must be provided by the hospital administration because they have a full responsibility in providing and creating safety measures. trying to select the best scenario as a proposal that can be develop to activate the utilization of the safety tools in preventive measures applying in Iraqi public hospitals for accidents resistance and caring in the following aspects:

1) Introduce modern methods and techniques adopted in different countries to solve the absence of the ability to have it, for example, preparing a hypothetical scenario to evacuate the hospital, this test prepared periodically, and this aspect was largely neglected.

2) Provide safety requirements without regard to their cost or its difficulty, for example, the automatic sprinkler system, which is an important and effective safety means in maintaining the integrity of the building, but its cost is very high compared to traditional tools used to prevent fire accidents.

3) Pay more attention to the maintenance of safety systems. Safety it does not end when the devices and requirements are provided, but rather continues to maintain those devices by: a competent authority as stipulated by the regulation, and it's not only light maintenance carried out by safety departments in hospitals.

4) Take measures to ensure that the appointment of safety personnel is limited to: Qualified persons by making a job description that includes qualifications, conditions, and tasks for job.

5) Take the initiative to establish suitable escape corridors for evacuating patients and patients with their families.

6) Appropriate attention to service facilities such as kitchens, and laundries, because they are reasons to cause dangers in the building as a result of the various daily uses of these facilities.

7) Reduce, as much as possible the use of decoration coatings will prevent the use of flammable ones completely.

8) Obey the regulations that prevent the presence of warehouses inside the main building of the hospital and the initiative to remove it in order to prevent the dangers that may cause in the event of an accident.

9) It is important to install mechanical ventilation systems in order to get rid of harmful gases resulting from combustion, to contribute to reducing bottlenecks and human and material losses.

10) Take care of operating rooms and intensive care. It is equipped with its own emergency exit due to the criticality of the inpatients' situation.

11) Pay attention to recording accidents and injuries and losses for the role of this in planning for the future and working to record working hours without accidents because this system has a positive effect in motivating workers to maintain the safety of the building.

12) Draw up public safety policies and motivate workers functionally, it must be adhered to, such as establishing the principle of compliance with safety as a binding condition for the renewal of the contract of employment.

13) Work on getting their affiliated departments to obtain quality certificates because of their qualitative impact on improving work in general and safety in general specials.

14) Set a clear and enforceable labour law that include: Prohibited acts, tasks assigned to each employee, and penalties for violators of those laws.

15) Raising awareness among citizens of the importance of safety in general, and taking into account the privacy of hospitals

16) Introducing safety concepts into educational curricula, allocating postgraduate certificates and specialized courses to obtain a safety professional certificate in the field of health and building safety.

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