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HOSPITAL FIRE ACTION PLAN COMPONENTS AND CHECKLIST IN SELANGOR, MALAYSIA

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Abstract

Hospital fire safety is a major concern when designing them, therefore they are considered a critical facility. Hospitals contain various people with different conditions, which requires a special focus on fire safety. Many fire accidents have happened in Malaysian hospitals, which led to the investigation of why it happens and how to act when it occurs. The research aims to study the hospital's fire action plan and determine the major elements of this topic while providing a fire action plan checklist. The methodology used for this research is qualitative research using semi-structured interviews with four participants. The qualitative analysis, thematic analysis was used to present the themes of the fire action plan using NVIVO software. The findings of this study provided 6 themes for the fire action plan such as communication, firefighting systems and design, immediate actions and activation, monitoring and control planning, and roles training and awareness and 5 themes for the fire action plan checklist such as complying with hospital design and regulation standards, continuity of operation, defined roles and responsibilities, fire training, inspection and maintenance of the hospital. A clear plan must be taught to all staff so that the casualties are minimum.

Keywords: Fire Action Plan, Thematic Analysis, Hospital, Checklist, Fire Safety, and NVIVO Software

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INTRODUCTION

The majority of the established infrastructure in a healthcare environment is made up of hospital structures, which are crucial to a nation's ability to offer healthcare services. The majority of hospital structures are made to endure for numerous years and offer many patients "temporary" housing and functional operations (Kodur et al., 2020). Over the past few years, there have been numerous fire accidents all over the globe, understanding the properties of combustible materials, the causes of fire, and the high-risk areas for ignition and the safety plan in facilities is of the utmost importance given that these incidents have resulted in significant losses in terms of both life and property (Hamida & Hassanain, 2019). Fire hazards in facilities are those that could start accidentally or on purpose and endanger people's lives, the structure itself, and their belongings. Stakeholders are becoming more and more worried about this (Ebekozien et al., 2021). Immediately after a fire starts in a hospital, evacuation and firefighting efforts must be made. As a result, an essential of hospital fire safety is the fire department coverage for hospitals (Liu et al., 2023).

Since the early 20th century, fire safety has been researched and has undergone significant scientific advancement, particularly as a result of significant losses brought on by sporadic but catastrophic fires (Ornstein et al., 2007). One of the main considerations of many governments is fire safety, particularly in light of the numerous fire tragedies that have occurred recently in healthcare institutions (Agus Salim et al., 2023). Therefore, Codes and standards have been created to articulate this issue, such as the International Fire Code and the National Fire Protection Association. To assure safety from fire in the hospital the term fire safety comes to light, the component of fire safety can be taken from the codes and standards, for this research will focus on fire action plan in hospitals, due to the spread of fire and having casualties in such incidents it creates a question of what is wrong and what is happening that when fire a occurs there are high losses in property and people.

LITERATURE REVIEW

Hospitals are the focal point of the nation's healthcare system, and they are in charge of delivering 24/7 medical treatment every day of the week. Any type of interruption to medical operations and operations makes the health system vulnerable (Fazel et al., 2022). Bakar (2006), stated that in the event of a building fire, the most important factor in building fire protection is human life as the greatest risk is to the users, while fire protection for structures can be identified, the need for sufficient means of egress is a vague science that can differ based on the type of occupancy, operation, and type of building, The primary concern is to guarantee the life safety of building residents.

Chow (2001), finds that there should be at least three components of a fire safety plan such as maintenance plan, a staff training plan, and a Fire action

plan. Also, he suggested an additional plan called the fire prevention plan. As stated by Chow the fire action plan is a part of the fire safety plan, the purpose of the Fire Action Plan is to provide all occupants with clear instructions on emergency protocols and other issues that are crucial to supporting fire protection and evacuations in emergencies within facilities, the majority of these things are likely to be in position, but the plan needs to make note of a few clauses that deal with how each service is going to execute them (The University of Edinburgh, 2023). NHS England (2013), stated that action plans for responding to fire emergencies should be created for every level of the organization and the areas it oversees. Della-Giustina (2014), Planning for emergencies is crucial to preventing catastrophic losses to individuals, assets, and facility functions. A well-thought-out emergency plan can make the difference between minor incidents turning into major ones. Along with the regular circumstances, each organization will have some inherent risks that should be taken into account during emergency preparedness.

Chow (2001), stated that to handle the total responsibility of the property and daily safety management, a fire safety manager should be hired. The management ought to have some experience fighting fires because they are expected to be capable of guiding the firemen to the afflicted area, the fire action plan according to Chow includes clearly outlined steps to be taken in the event of a fire, the fire action plan ought to contain steps such as contact the fire brigade, gather people and direct them to secure locations, fight the fire, help the fire brigade, and a roll call is conducted at the assembly location for particular structures like schools or karaoke.

NHS England (2013), stated that the emergency action plan especially is for the ward, department, and space, also, the detailed local fire emergency action plan includes the steps to be done when the fire is discovered, the steps to be done when the alarm is heard, precise information on how to evacuate, all the exit locations and the equipment needed for evacuation, and firefighting gear location. Also, the guide recommends details that need to be presented, such as plans of the property, the arrangement of vital equipment, and details on the fire and safety systems, services, and environmental systems, as well as the hazardous items. It will be necessary to create fire emergency action plans to guarantee that, in the case of a fire, the facility and its personnel act in a way that ensures the security of all concerned parties and achieve the goals of reducing service interruption, and environmental and building damage.

According to Bakar (2006), Chow (2001), NHS England (2013), The Centers for Disease Control and Prevention (2023), The University of Edinburgh (2023), and University of Strathclyde (2023), the fire emergency plan emphasizes key actions such as triggering alarms, evacuating without using elevators, and only allowing trained staff to fight fires. It highlights the importance of clear roles in contacting emergency services, shutting down critical equipment, and handling

high-risk areas like chemical storage. Proper evacuation procedures for disabled people, visitors, and at-risk individuals are crucial, with designated fire marshals and wardens overseeing the process. Escape routes, assembly points, and communication with emergency services must be well-documented. The plan also includes contingency measures for system failures and procedures for re-entry or alternatives if re-entry is not possible.

RESEARCH METHODOLOGY

Qualitative approach will be used to conduct the research. The research will depend on gathering data from conducting interviews with fire experts and specialists and gather the data from them. The data gathered will be arranged to create a checklist for assessing the fire action plan in hospitals.

For conducting this research, collecting data from conducting interviews with fire experts and specialists to investigate what is the most important component of fire action plan in hospitals. The strategy for this research will be a qualitative method strategy, the method contains interview approaches for primary data.

Primary data

The design of the interview questions will be dependent on the research objectives, the questions that will be asked are used to able to answer the research questions, and the questions will be open-ended to allow room for conversation in the interview and help both the interviewee and interviewer to ask and mention every detail that help fulfilling the research objective. The research questions will be divided into different sections, each of which will be to answer a specific topic. The interview questions are split to three parts, Part one: introductory questions, these will be asked to identify the interviewee's, Part two: key questions, will be used to obtain data related fire action plan, and Part three: key questions, will be used to obtain data related Fire Action Plan checklist.

ANALYSIS AND DISCUSSION

The research aims to find the essential components of fire action plan, and establishing a fire action plan checklist. This leads to the use of thematic analysis for the data collected, NVIVO software was used for the analysis process from creating codes, themes, and to presenting the results. This section will present the data collected, the analysis method, and the discussion of the data in relation to literature. The data analysis will follow the thematic analysis six-phase method mentioned (Byrne, 2022). The interview has been conducted with four participants.

Respondents Background Information

This part represents the background information about the people who participated in the interview. Table 1 represents the background information of each individual.

Table 1: Interview participant personal information

Participant number	Workplace	Educational level	Years of experience	position
1	UKM Specialist Children's Hospital	Master	6-10	Hospital emergency manager
2	Pantai health group	Degree	11-15	Safety Officer for Health Group
3	Fire and Rescue Department of Malaysia	Ph.D.	20-25	Head of Fire Safety Approval
4	Hospital Cyberjaya	Degree	16-20	Hospital Fire Safety Officer

From Table 1 we can see that participant 1, 2, and 4 currently work in a hospital and are responsible for its safety, participant 3 currently works for the Malaysian National Fire and Rescue Department under the government. All participants have degrees, also all participants have 10+ years of experience except Participant 1 who has 6-10 years of experience.

Fire Action Plan Components

This part is focused on the components of the fire safety action plan for hospital, the question focuses on the action to be done also the plan required to be implemented before the fire or after it occurs. The interview questions and answers are put into NVIVO software to generate the codes. For this part, there were 6 themes generated.

Theme 1: Communication

This theme represents the internal and external communication for the hospital in case of fire incidents. This theme has 2 codes representing the participant's actions and hospital implementation of this theme.

Contact BOMBA. This code is one of the first actions to be done by the hospital team, as the team is required to inform the fire department of the incidents in case the alert system does not work. Participant 3 stated *"The staff need to have proper communication to call BOMBA."* Also, participant 1 stated *"Whatever alarm that triggered inside our fire control room, it will automatically be detected through them. So, they will call us saying that they receive a... is there any fire in your building. So, they will call BOMBA and send."*

Having knowledge and details of the emergency contacts. The importance of detailed information on the emergency contacts as the hospital needs to know which is the closest BOMBA and hospital. Participant 1 stated *"Then you need to know all the emergency contacts around your facility. So you need to know where is the nearest BOMBA, where is the nearest police station, where is the nearest other hospital."* The standards and guidelines and researchers have discussed that hospitals must have a communication plan for their facility. International standards such as NFPA 99 (2020), discussed that one of the hospital's main topics of fire prevention is Information technology and communication systems. Also, Della-Giustina (2014), stated that to achieve the goals of the program the hospital must communicate with the community fire department. NHS England (2013), found that one of the elements that must be in the action plan is alerting the fire and rescue services if needed. Agus Salim et al. (2023), found in their research one of the issues is ineffective internal and external digital communication networks

Theme 2: Firefighting System and Design

This theme has 4 codes representing. Firstly, fire alarm. This element in the plan is vital due to it is role in alerting. Participant 1 stated *"If there's a fire we immediately my staff that stationed inside the fire control room will notice an alarm Yeah."*

Passive and active firefighting system. Participant 3 explained that the first method of firefighting is through the passive system *"First by using a passive. Passive, right? Passive, yeah. We need to... We need... to make sure all the passive system in terms of the structure, in terms of building, in terms of material are not support the fire ignition."* In addition, Participant 1 stated that there must be knowledge of the available firefighting systems within the hospital. "The knowledge of the firefighting system available inside the hospital. you need to know also the okay the firefighting system available if it's actually the active system."

Special requirement for disabled. Participant 3 mentioned hospitals have special requirements for design, he stated *"Sometimes... the deaf person, the blind. They have to use, they, they, and we call it, you know, in hospital building, and one of the special requirements is a light. Lighting alarm."*

Reduce fire load. Participant 3 stated *"In terms of the compliance to the regulation to prevent the fire ignition in hospital building so our fire load in hospital building must be reduced fire load."* The participants have mentioned different areas of design and fire systems that are implemented in their hospitals, 2021 IBC (2020), stated that one of the requirements for hospitals is to have a fire alarm system. 2021 IFC (2020), states that a layout plan must contain Manual fire alarm boxes. In addition to that, NHS England (2013), and University of Strathclyde (2023), stated that, in the event of a fire one of the first activities is to

raise the alarm. Moving to one of the most important firefighting elements is the Passive and active firefighting systems. The participants mentioned that their hospitals have different types of fire suppression systems. The previous literature mentioned that no hospital is authorized for operation if it doesn't contain passive and active firefighting design. 2021 IBC (2020), stated that hospital facilities must have a passive design, such as Smoke barriers, Corridors must be continued and separated, and means of egress. NHS England (2013), stated that the action plan must contain the location of acceptable zones of absolute and partial safety. Bakar (2006), Fire Protection: passive and active are important in terms of reducing fire risk and hazard, also he studied the passive design, however, issues arise when these systems are neglected. Agus Salim et al. (2023), found in their research one of the issues is insufficient care of "active" fire suppression systems. Due to it is functionality, hospitals have a lot of people with special needs, Participant Three stated that there must be aiding design for blind and deaf. 2021 IFC (2020), stated that the plan must have life strategy Protocols for evacuating residents, especially those who require assistance. Also, Hassanain et al. (2017), stated that the fire active system must have Emergency lighting One of the building design restrictions is the fire load in the hospital, The UBBL of 1984, mandates that all buildings construction materials must possess the required level of fire resistance. Also, 2021 IFC (2020), provided data on the Interior finish material and furnish. Agus Salim et al. (2023), found in their research that Combustible materials and electrical problems were found to be the primary causes of fire.

Theme 3: Immediate Action and Activation

This theme represents the actual action done when a fire occurs. It has 5 codes.

Immediate notification of fire through the fire alarm. This code represents having stationed staff watching if any alarm is activated. Participant 1 stated "We need that if there's a fire, there's a fire We immediately my staff that stationed inside the fire control room will notice an alarm."

Hospital staff are the first to respond. Participant 1 stated *"So we are the first respond."*

In addition to that, participant 3 stated "The staff need to have proper knowledge. If they have to also help."

Determining major and minor disasters. Participant 1 stated *"What is the criteria of major disaster? What is the criteria of minor disaster? how are you gonna plan?"*

Activating the evacuation plan. Participant 3 stated *"Yeah, it's evacuation. Okay, they need to focus on evacuation. Okay. Action Plan is about evacuation."*

Confinement and compartment. Participant 3 focused on the confinement part. He stated *"Confine. You confine the compartment. You close*

the door. You close everything to confine the fire." The participants have mentioned different actions, researchers have highly focused on alerting the hospital as fast as possible. NHS England (2013) and University of Strathclyde (2023), stated that In the event of a fire one of the first activities is to raise the alarm. Following the actions of the staff, participants one and three stated that the staff are the first line of defence against fire, Della-Giustina (2014), stated that the fire program must prepare staff members for activity in an emergency. 2021 IFC (2020), states that a description of particular staff activities such as the steps for a defend-and place tactic. In addition. When alerting the hospital, the staff must be able to recognize the severity of the incident, Della-Giustina (2014), stated that a well-thought-out emergency plan can make the difference between minor incidents turning into major ones. On the other hand, Ong and Suleiman (2015a), found one of the errors and issues found in these fire incidents Ineffective post-fire disaster management. In addition. After all the actions have been done from alerting to ensuring the type of emergency, the staff immediately execute the evacuation. The participant stated that the action plan revolves around the evacuation. Liu et al. (2023), stated that immediately after a fire starts in a hospital, evacuation and firefighting efforts must be made. In addition, 2021 IFC (2020), also stated that the plan must provide the exact processes for evacuating. Kodur et al. (2020), state that there must be control for those who may be subjected and their possessions to fire. However, some of the evacuation is from one ward to the others on the same floor, Kodur et al. (2020), stated that the research found compartmentation and structural integrity are the final lines of defense. Also, NHS England (2013), required that the fire safety manual have information on any compartmentation space.

Theme 4: Monitoring and Control

This theme represents actions done during the hospital's daily operation.

Staff are always stationed in the fire control room. Participant 1 stated "If there's a fire, my staff that stationed inside the fire control room." Rahardjo and Prihanton (2020), stated that to ensure that the facility is always operational there must be sufficient supervision performed, also, Nugroho et al. (2020), stated that fire safety management must have monitoring of the fire safety systems and reactive monitoring.

Theme 5: Planning and Roles

Hospital roles and plans must be clear and determined in advance.

Contingency plan. Participant 1 stated that his hospital considered it as a section in the emergency response plan, he stated *"you will have your contingency plan."*

Emergency response plan. Participant 1 stated *"The highest level is emergency response plan. This is the structure that we read here. So this plan is actually the entire plan for everything."*

Emergency response team. Participant 3 stated *"Emergency response team actually has one team will activate if any happen disaster in hospital."* To have an effective action plan there must be clear roles and plans established in the hospital. According to the University of Edinburgh (2023), the fire action plan must cover certain topics, one of them being the Contingency plan in case any system fails. Moving to the emergency response plan, this plan represents the structure of fire response. NHS England (2013), stated that the plan must contain the quick dispatch of the Fire Response Unit. Also, participants mentioned the emergency response team. NHS England (2013), stated that the fire structure must have a fire response team.

Theme 6: Training and Awareness

The hospital staff must be aware of the action they must apply. Having awareness and training. Participant 4 stated "*So we have OKK, so we have awareness, two times we do the tabletop, we do the fire drill. So, all the staff must know*." Standards and old research focused on the role of training in providing better responses when a fire occurs. Senin et al. (2022), stated that the absence of knowledge of space design arrangement, inadequate experience in training, and fire safety, and a shortage of understanding of facility fire safety all contribute to delays in responding to fires. Also, Agus Salim et al. (2023), found that one of the obstacles is insufficient training for staff. Therefore, Della-Giustina (2014), stated in his book that there should be proper Instruction and training for all personnel. Also, NHS England (2013), stated that fire safety management must guarantee a proper fire safety training. Moreover, Abhishek Shastri et al. (2018), found one of the management assessment tools for health and safety is utilizing education and training to raise knowledge of fire safety and emergencies. Ebenehi et al. (2017), stated that to prevent fire-related damage, various actions must be taken, such as teaching staff, and practicing fire drills. Ong and Suleiman (2015b), stated that one of the fire safety management activities is the fire drills. NHS England (2013), stated that all fire action plans must be routinely practiced, whether through table workouts, walkthroughs, fire drills, or other suitable methods.

Fire Action Plan Checklist

The participant responses provide 5 themes.

Theme 1: Complying With Hospital Design and Regulation Standards

This theme represents all the spaces and designs for fire safety.

Fire certificate and compliance schedule. In Malaysia, the hospitals must annually renew their fire certificate, Participant 1 stated *"In Malaysia, you need to renew your fire certificate every year."*

Escape back lift. Participant 3 stated *"They have what we call an escape backlift. Others building they don't have except in hospital building."*

HIRARC. Participant 1 stated *"HIRARC is more about risk assessment."*

Refuge area. Participant 3 stated "In hospital, they have a refuge area."

Layout plan with details. Participant 4 stated *"The layout plan. So all the walls or the surfaces make a layout plan. Where do you want to go if fire happen?"*

Mimic diagram. Participant 3 stated *"And mimic diagram. You need to have mimic diagram. Where the fire exit, where the fire protection system, the mimic diagram in hospitals, it's very important."*

Panic button with exact fire location. Participant 4 stated *"Okay, so one button to activate the committee. So we have a specific button to activate."*

Alarms with lighting for disabled people. As a requirement, Participant 3 stated *"Because the people, if they have any disability, they can't hear it. They can't hear the sound. They just see it. Yeah, you just see the lighting."*

Compartment. Related to the design of the hospital, participant 3 stated *"You confine the compartment. You close the door. You close everything to confine the fire."*

Fire reset door. Participant 4 stated *"The fire-reset door. All the fire-reset doors must close so to protect the people."*

Smoke ventilation design. Participant 3 stated *"For example in hospital ward, they need to ventilate the smoke."*

Reduce fire load. Participant 3 stated *"So our fire load in hospital building must be reduced fire load, the load must be non-combustible."*

The escape path is wide and clear. Participant 4 stated *"The corridor. All the corridors must be free. From the any blockage."* Regarding complying with design and structure, this theme has various components, Bakar (2006), found that passive fire protection is important in reducing fire risk. Also, research found compartmentation and structural integrity are the final lines of defence (Kodur et al., 2020). NHS England (2013), required that the fire safety manual have information on any compartmentation space. This is in line with Participant 3 statement that hospitals having compartmentation. Other hospital designs are related to the spaces that protect the patients during incidents as stated by participants 1 and 3, such as fire lifts, refuge areas, and reducing fire load. The University of Edinburgh (2023), stated that the fire plan must contain Temporary refuge areas and Lifts, also mentioned by Bakar (2006), the active fire protection systems consist of having a fire lift. The UBBL of 1984, mandates that all

buildings possess a minimal level of structural integrity. When it comes to compliance with regulations and standards the participant mentioned it with high importance. Hamida & Hassanain (2019), stated that being aware of the fire systems to evaluate and sustain the full compliance of the buildings to the standards. Della-Giustina (2014), stated that the fire safety management program must ensure compliance with regulations. Participants One and Two mentioned that it is recommended to share plans with the local authorities. Abhishek Shastri et al. (2018), stated that hospital administration must conceive and regularly enforce operational criteria and must never diverge from safety regulations outlined by authorities. Also, Participants One and Three mentioned that all their training and activity are documented for future reference. NHS England (2013), requires a manual that has documentation of fire action plan practice. Moreover, Ong and Suleiman (2015b), found one of the issues that hospitals face are related to documentation. Ensuring the proper functionality of the hospital fire systems. Nugroho et al. (2022), stated that all used equipment should also undergo routine maintenance. However, Agus Salim et al. (2023), found that Malaysian public hospital accidents are due to lacking maintenance plans, receiving poor maintenance, and inadequate fire safety equipment maintenance.

Theme 2: Continuity of Operation

Hospital facilities are very different from any other facility when it comes to fire safety, the continuity of the hospital operation of providing care is vital. Participant 1 stated "*If you lost your emergency department today, you need to have your backup plan. You always have a continuous plan."* In addition, participant 4 mentioned that his hospital has a continuity plan *"So we must send patients to the nearest hospital. Let's say a fire happen in level two the nearest hospital we send patients to the Hospital Putrajaya."* The standards have discussed this area as a part of the fire protocol, NHS England (2013), stated that the fire protocol must have a plan for continuity of care. Moreover, Della-Giustina (2014), states that resources both internal and external are ascertained for business continuity.

Theme 3: Defined Roles and Responsibilities

Participant 4 mentioned that the roles safety are not limited to the fire safety staff *"So maybe we can add on the security guard. The security guard must work."* Participant 1 stated *"We do have a... so called procedure for every people inside the ERT team, they know what to do, and they train for it."* According to 2021 IFC. (2020), stated that the plan must provide the exact processes for evacuating patients. NHS England (2013), stated that the staff must know the required actions, such as sounding the alarm. The Centers for Disease Control and Prevention (2023), developed a fire emergency plan where each floor has a monitor whose tasks are to verify that every individual has left. The traffic

controller mentioned by Kodur et al. (2020), states that there must be control for those who may be subjected and their possessions to fire.

Theme 4: Fire Training

Participant 1 stated *"Meaning that in a year you need to have a fire training how many times a fire training we also have a schedule to do the fire evacuation so it's a thing that we schedule early of the year throughout the year."* This topic must be checked and confirmed that the hospital staff undergo training. Ebenehi et al. (2017), stated that to prevent firerelated damage, various actions must be taken, such as teaching staff, and practicing fire drills. Ong and Suleiman (2015b), stated that one of the fire safety management activities is the fire drills.

Theme 5: Inspection and Maintenance of the Hospital System

This theme focuses on the maintenance and inspection of these spaces also other materials. This theme has 5 codes. Firstly, kitchen engineering system inspection. Participant 2 stated *"kitchen engineering system must be inspected."* Secondly, electric system inspection. Various reports mentioned the most common cause of fire is the faulty electric system, participant 2 stated it as one of the most important checked elements *"electrical system inspection."* Thirdly, hazardous materials and special equipment inspection. Due to the nature of the operation, hospitals become more prone to fire incidents, participant 2 stated *"hazardous materials inspection."* Fourthly, inspections of fire systems and maintenance. Participant 2 stated *"Yes, based on fire safety checklist in term of checking on fire active and passive system."* Fifthly, medical gases inspection. Participant 2 stated that through his inspections of the hospitals, the medical gases are always on the inspection checklist *"The medical gas inspection."* According to DellaGiustina (2014), stated that every kitchen must have a Class K fire extinguisher. Regarding the electrical systems, NFPA 99 (2020), discussed in depth one of the main topics in fire protection is the electrical systems and equipment. Also, DellaGiustina (2014), stated that there must be a Class C fire extinguisher for electrical systems and equipment. Moving to hazardous materials, the literature has rated hospital buildings as high-risk buildings due to containing hazardous materials, various researchers have stated that one of the most common issues creating fire is related to hazardous materials, Abhishek Shastri et al. (2018), Agus Salim et al. (2023), and Ong and Suleiman (2015a) stated that one of the causes of fire occurrences is related to materials. Finally, regarding medical gas inspection, several standards have considered this topic, Sahebi et al. (2021), stated that hospitals are facilities under fire risk due to medical gases and combustible chemicals, therefore, NHS England (2013), stated the hospital's fire protocol must address various issues, such as medical gases.

CONCLUSION

This research aims to find a method to minimize the fire incident outcome, by studying the fire safety of hospitals, and by coming up with a checklist for the components that could help in this matter. The research has contributed to the topic of hospital fire safety using a qualitative research method by using open-ended interview questions. This study helped in developing a fire action plan checklist, also providing data on the components of fire action plan for hospitals. The findings of this study can provide the concerned parties with this topic of having comprehensive data on fire action plan.

The objective to investigate the fire action plan components, two methods have been used, collecting data from previous research and standards and conducting interviews with fire safety specialists. The outcome of the data collected from the interviews and the analysis chapter of the data taken from the interviews provided us with six themes for the fire action plan such as (1) communication (2) firefighting systems and design (3) immediate actions and activation (4) monitoring and control (5) planning and roles (6) training and awareness.

The other objective is to develop a checklist that can be implemented in hospitals, which ensures the fire action plan is efficient in case of fire events. The checklist has been developed from the respondents' answers in addition to data from the literature. The main themes in the checklist are (1) complying with hospital design and regulation standards (2) continuity of operation (3) defined roles and responsibilities (4) fire training (5) inspection and maintenance of the hospital. See Figure 1 for the developed checklist.

Criteria		Response		
		Yes	No	Comment
Complying With Hospital Design And Regulation Standards	Fire certificate and compliance schedule			
	Escape back lift.			
	Having HIRARC			
	Refuge area			
	Layout plan with details			
	Mimic diagram			
	Panic button with exact fire location			
	Alarms with lighting for disabled people			
	Compartment			
	Fire reset door			
	Smoke ventilation design			
	Reduce fire load			
	The escape path is wide and clear			
Continuity Of Operation	The continuity plan effective			
Defined Roles And Responsibilities	Firefighting team and search and rescue team.			
	Emergency manager			
	Evacuation officer.			
	Maintenance team			
	Sweeper			
	Traffic controller			
	Historian			
	Safety officer			
Fire Training	Fire drill			
	Monitoring of training			
	Staff educated on fire			
Inspection And Maintenance Of The Hospital System	Kitchen engineering system inspection			
	Electric system inspection			
	Hazardous materials and special equipment inspection			
	Inspections of fire systems and maintenance.			
	Medical gases inspection			
	Fire suppression gear is accessible			

Figure 1: Fire Action Plan Checklist
Source: Author Findings

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