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ORIGINAL ARTICLE

Fire Protection Systems, Life-Saving Facilities, and Fire Management in Depok City in 2020: A Case Study

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ABSTRACT

Introduction: Hospital fire can result in greater casualties, injuries to patients or staff, and loss of property and equipment compared to fires in other types of building. This is attributed to the presence of a large number of vulnerable individuals, including those who are ill, disabled, pregnant, children, elderly, immunocompromised, on life support, or incapable of moving independently. This study aims to assess the implementation of the fire protection system, life-saving facilities, and fire management in Hospital X. **Methods:** This was a quantitative study on active fire protection system facilities, passive protection system facilities, live-saving facilities, and fire management as the subjects. Data were collected through observation, interviews, and document review, as well as a checklist and then analyzed by comparing the actual conditions with applicable standards and regulations. The final result was presented as the percentage compliance level and categorization according to the criteria established by the Research and Development Agency of the Public Works Department. **Results:** The active fire protection system presented a standard fulfillment rate of 53%, categorizing it as poor. The passive fire protection systems similarly demonstrated a poor fulfillment rate at 42%, while the life-saving facilities achieved a 66.7% fulfillment rate, placing them in the quite good category. Additionally, fire management attained an 81% fulfillment level, which falls under the good category. **Conclusion:** Hospital X has a good fire prevention approach with a standard fulfillment level of 60%.

Keywords: active fire protection system, fire management, hospital, life-saving facilities, passive fire protection system

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INTRODUCTION

Fire is an event where a building is engulfed in flames, resulting in casualties and/or losses (National Agency for Disaster Management, 2013). Fire is an undesirable event as it is unpredictable in terms of when and where it will happen (Setiawan, Handawati and Ermalia, 2020). Fire can occur in many buildings such as houses or settlements, factories, markets, and hospitals.

Hospital fire can result in greater casaualties, injuries to patients or staff, and loss of property and equipment compared to fires in other types of building. This is attributed to the presence of a large number of vulnerable individuals, including those who are ill, disabled, pregnant, children, elderly, immuno-compromised, on life support, or incapable of moving independently. The loss of life during the treatment process in a hospital is a somber event that leads to various health, economic, and social consequences (Sharma, Bakshi and Banerjee, 2019).

Hospital fire has happened around the world and caused many casualties. In Taiwan, the worst fires occurred in Xinying Hospital Beimen Branch and Taipei Hospital Nursing Home in 2012 and 2018, respectively. Thirteen casualties and 61 injuries were recorded at the Xinying Hospital Beimen Branch while the Taipei Hospital Nursing Home recorded 15 deaths and 37 injuries (Wu *et al*., 2023). On December 20, 2018, a fire broke on the third and fourth floors of the ESIC Kamgar Hospital in Mumbai, causing eight deaths and 145 injuries, including the firefighters (Patharla, Pyreddy and Panthagani, 2020). In Indonesia, during 2020, there were seven cases of hospital fires in Jakarta, Surabaya, Yogya, Semarang, and Bekasi (Umar, 2020).

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Hospital fires can originate from various sources, including cooking equipment, accumulated trash or debris, electrical wiring and lighting, heating devices, clothes washers and dryers, medical and electronic equipment, and smoking materials. In the United States, cooking equipment accounts for the majority of hospital fires, contributing to 52% of such incidents (Pan American Health Organization, 2014). From 2010 to 2023, 89% fire accidents in hospitals in India were contributed by a short circuit (Juyal *et al*., 2023). Meanwhile, most hospital fires in Indonesia happen in the dry season when water to extinguish fires is very limited (Umar, 2020).

Hospital fire prevention can be achieved through the implementation of active protection systems, passive protection systems, life-saving facilities, and fire management strategies. Active protection systems directly address fires and include components such as detectors, fire alarms, sprinklers, standpipe systems, hydrants, fire extinguishers, and fire pumps. Passive protection systems involve regulatory measures related to building structures, compartmentalization, and the separation of buildings to mitigate fire risks (Hanan and Talarosha, 2020). Life-saving facilities include exit way, emergency door, emergency exit, directional sign, and assembly point. Fire management consists of fire protection organization, operational management, and human resources (Pontan and Maxsi, 2021).

One of the hospitals in Depok City is Hospital X. According to the initial survey, this hospital did not have comprehensive fire protection systems in every area, e.g., sprinklers. Additionally, one of the buildings in Hospital X has not been audited because it only started operating in 2019. This hospital can also be considered as a crowded place because it has many visitors and 650 employees. As a result, there is a significant risk of numerous victims in the event of a fire. Therefore, this research sought to assess the implementation of the fire protection system, life-saving facilities, and fire management in Hospital X according to the standards from National Fire Protection Association (NFPA, 2019) and the Technical Guidelines for Hospital Buildings and Facilities (Ministry of Health of the Republic of Indonesia, 2012).

METHODS

This study was a quantitative observational descriptive study performed from June to July 2020. To assess the implementation of fire protection systems, life-saving systems, and fire management in Hospital X, data were collected through field observations, interviews, and document review. The assessment of the active fire protection system included components such as fire detectors, fire alarms, sprinklers, standpipe systems, hydrants, fire extinguishers, and fire pumps. For the passive fire protection system, the evaluation focused on building construction and compartmentation. Additionally, the life-saving facilities evaluated included exit way facilities, emergency doors, emergency exits, emergency lighting, directional signs, and assembly points. The fire management elements reviewed were fire protection organization, operational management, and human resources.

The total of elements in each variable was calculated and every element was assessed in term of appropriateness with the applicable standards. The standards used were the NFPA (2019) and Technical Guidelines for Hospital Buildings and Facilities from Ministry of Health of the Republic of Indonesia (2012). The fulfillment level of each variable was calculated using the following:

$$Fulfillment\ Level = \frac{A}{A + IA} x100\%$$

where:

A = the total of appropriate elements

IA = the total of inappropriate elements

After the percentage score of the fulfillment level was obtained, all elements were categorized according to the criteria of the Research and Development Agency of the Department of Public Works as good (80-100%), quite good (60-80%), and poor (<60%). The instruments for this study included a checklist, a camera for documentation, a tape measure for measurement, and a cell phone to record the results of the interview.

The study was conducted in accordance with the ethical guidelines and regulations applicable and approved by the Ethical Commission for Research and Public Health Service, Faculty of Public Health, Universitas Indonesia with the issuance of the ethical clearance number Ket-345/UN2.F10.D11/PPM.00.02/2020 on June 24, 2020.

RESULTS

Hospital X consists of two buildings, Building A and Building B. Building A, constructed in 1991, consists of six floors, with the sixth floor under renovation at the time of the study. Building B was completed in 2007, but it only became operational in December 2019. This building has seven floors, with the third and fourth floors still unoccupied at the time of the study.

Overall Fire Protection System

Based on the results in Table 1, Hospital X achieved a score of 60%, or quite good, for the overall fire prevention. Fire management had the highest fulfillment level of 81% and was categorized as good. Meanwhile, the variable with the lowest fulfillment level was the passive fire protection system at 42%, which was considered as poor.

Table 1. Overall Fire Protection System in Hospital X in 2020

Variable	Element (n)			Fulfillment Level (%)	Category
	Total	A*	IA**		
Active fire protection system	56	30	26	53.0	Poor
Passive fire protection system	7	3	4	42.0	Poor
Life-saving facilities	27	18	9	66.7	Quite good
Fire management	11	9	2	81.0	Good
Overall	101	60	41	60.0	Quite good

*= Appropriate

**=Inappropriate

Table 2. Active Fire Protection System in Hospital X in 2020

Variable	Element (n)			Fulfillment Level (%)
	Total	A*	IA**	
Detector	8	6	2	75.0
Fire alarm	9	4	5	44.4
Sprinkler	8	4	4	50.0
Standpipe system	6	4	2	66.7
Hydrant	9	5	4	55.0
Fire extinguisher	12	5	7	41.6
Fire pump	4	2	2	50.0
Overall	56	30	26	53.0

*= Appropriate

**=Inappropriate

Active Fire Protection System

Active fire protection systems of Hospital X comprised of fire detectors, fire alarms, sprinklers, standpipe systems, hydrants, fire extinguishers, and fire pumps. The detectors used consisted of heat detectors and smoke detectors, both of which functioned fully and automatically. In Building A, an alarm was not available on each floor; however, manual call points (MCPs) were available in every floor. Building B was equipped with alarms, light indicators, and MCP. The sound of the alarm in Hospital X was turned off because it could disrupt the serenity. In Building A, sprinklers were only installed on the second, fourth and sixth floor. Hospital X had both yard hydrants and building hydrants, with hydrants present on every floor of the building. Moreover, Hospital X also had fire extinguishers. However, while fire extinguishers were available, some were obstructed by other objects and spaced too far apart (18-24 meters). Each building was also equipped with a fire pump.

Overall, the active fire protection system scored 53%, placing it in the poor category. The primary issue identified within the active fire protection system was the fire extinguishers, which had a compliance rate of 41.6%.

Figure 1. Fire Extinguisher Blocked by Objects

Table 3. Passive Fire Protection System in Hospital X in 2020

Variable	Element (n)			Fulfillment Level (%)
	Total	A*	IA**	
Building construction	2	1	1	50.0
Compartmentation	5	2	3	40.0
Overall	7	3	4	42.0

*= Appropriate

**=Inappropriate

Passive Fire Protection System

The building structure of Hospital X was made up of solid brick, thus had fire resistance for up to two hours. The walls were made of brick and the office was made of gypsum. Floors in Hospital X were made of ceramic, marble, and epoxy. The emergency door in Building B was made of iron, while other doors were made of wood and glass. Hospital windows were made of aluminum. Stairs were made of wood and concrete, while handrails were made of wood and iron. In general, the compartments of the hospital already had room dividers made of solid brick except for the office rooms. Several rooms were also equipped with fireproof iron doors, but some doors were found to have gaps. Additionally, Hospital X had a connecting bridge between buildings with a glass door as the separator. However, the glass in Hospital X was not fireproof.

Figure 2. Gate of Bridge between Building A and B

Table 4. Life-Saving Facilities in Hospital X in 2020

Variable	Element (n)			Fulfillment Level (%)
	Total	A*	IA**	
Exit way facility	4	1	3	25.0
Emergency door	6	2	4	33.0
Emergency exit	5	5	0	100.0
Emergency lighting	4	3	1	75.0
Directional sign	5	4	1	80.0
Assembly point	3	3	0	100.0
Overall	27	18	9	66.7

*= Appropriate

**=Inappropriate

Overall, the passive fire protection system had a score of 42%, which was in the poor category. Based on the results of the percentage calculation above, it could be seen that the main problem with the passive fire protection system was the compartment, with a score of 40%.

Life-Saving Facilities

Life-saving facilities in Hospital X included public corridors used for evacuation routes, emergency exits, emergency stairs, emergency lighting, directional signs, and assembly points. However, emergency doors and emergency stairs were only found in Building B. Hospital X was built in sloping land, so the first and fourth floors of Building A had a separate exit way to the outside of the building. Building A was only equipped with two public stairs and one connecting bridge to Building B. The hospital emergency doors were made of a fire-resistant material that can hold fire for two hours. This door could only be opened on one side, the side with the panic bars. The emergency doors were also equipped with a self-closing door. The emergency stairs in Building B had fire-resistant construction. Hospital X was equipped with emergency lighting

Figure 3. Emergency Door

Table 5. Fire Management in Hospital X in 2020

Variable	Element (n)			Fulfillment Level (%)
	Total	A*	IA**	
Fire protection organization	2	2	0	100.0
Operational management	7	5	2	71.4
Human resource	2	2	0	100.0
Overall	11	9	2	81.0

*= Appropriate

**=Inappropriate

Figure 4. Disaster Alert Schedule Board

in all areas including the emergency stairs. There were two types of direction signs at Hospital X, the "EXIT" sign on the ceiling and the "EVACUATION PATH" sign 45 cm above the floor. Hospital X had five assembly points or gathering areas spread across the parking area and could accommodate all hospital residents.

Overall, life-saving facilities had a score of 66.7% which was in the quite good category. Based on the results of the percentage calculation above, it could be seen that the main problem with the life-saving facilities was the exit way facility with a score of 25%.

Fire Management

Fire management at Hospital X was handled by the fire management division of the Occupational Health and Safety (OHS) committee. The work programs comprised of an audit from Depok Fire Department, training for all employees in Hospital X, and maintenance of fire protection equipment. In addition, Hospital X had a disaster preparedness organization. In the event of a disaster, including a fire, the organization would operate according to their designated workflows and roles. Hospital X already had a fire safety plan and a fire emergency plan, but several documents had not been updated since 2017. Audit and training at Hospital X were carried out once a year by Depok Fire Department for all hospital employees, including the canteen employees. Furthermore, the hospital had a disaster alert board for nurses in each unit, elaborating their roles and responsibilities during disaster.

Overall, the fire management scored 81%, which was in the good category. Based on the results of the percentage calculation above, it could be seen that the main problem in fire management was operational management with a score of 71.4%.

DISCUSSION

Active Fire Protection System

A fire detector is a tool made to track a fire then start taking action, such as turning on the alarm (Ruslan, Al-Amin and Emidiana, 2021). There were two detectors that did not comply with the standards and six that complied with standards in Hospital X. The distance between detectors at Hospital X was found to be 19.2 meters, which is too far based on the applicable standard of 15 meters. According to the Guidelines for Active Fire Protection Systems in Hospital Buildings, detectors have a detection range of 7.5 meters, and, when aligned, they should be spaced a maximum of 15 meters apart. Additionally, some detectors were installed less than 1.5 meters from air flows, which does not comply with the standards (NFPA, 2019). This will hinder the detectors to function optimally as they were too close to the air flow.

Fire alarm is a component of a system that provides a signal or sign after detecting a fire. Fire alarm systems are used to notify workers and occupants when a fire breaks out (Ruslan, Al-Amin and Emidiana, 2021). Hospital X has nine alarm systems, but while four have met the standards five of them have not. In Building A, not every floor has an alarm, only MCP. Alarms in Building A are only found on the fourth and fifth floors. In Building B, an alarm system is available on every floor, consisting of the alarms, MCP, and light indicators. The alarm sound at Hospital X was turned off at the time of the study. According to the team of the Hospital X, the sound alarm could reach 70-80 dB, so it should be turned off because it can disrupt the serenity. This is contrary to the requirement that all residents must be warned by the sound of an alarm to start evacuation in a shorter time. On the first floor of Building A, there is only a manual call point near the elevator, and none near the exit. Additionally, this MCP did not meet the standards, as it is grey—the same color as the walls—and installed at a height of 1.8 meters. Ideally, an MCP should have a contrasting color from the walls to be easily visible and be positioned at a maximum height of 1.5 meters for accessibility.

A sprinkler system is a system that operates automatically to release pressurized water in all directions to extinguish a fire to prevent it from spreading (Ruslan, Al-Amin and Emidiana, 2021). Eight sprinklers were installed in Hospital X, but only four of them met the standards. Building A only had sprinklers in inpatient rooms, which had been renovated, specifically on the second, fifth and sixth floors. According to the team of Hospital X, this was because Building A was built in 1991 and there were not yet regulations regarding sprinklers. Adding sprinklers required renovations that would stop the health service provision activities in that building. However, Hospital X already has a plan to install sprinklers in all areas of Building A through gradual renovations. The distance between sprinklers ranges from 3.4 to 9.6 meters, while the distance between sprinklers and walls at Hospital ranges from 0.5 to 4.5 meters. Typically, only one sprinkler is installed per room, failing to meet the standard coverage area of 12 square meters per sprinkler (Ministry of Health of the Republic of Indonesia, 2012),

There were two standpipes that do not meet the standards and four that do. The standpipe should be located on the exit stairs, where the construction of these stairs is made from fire-resistant materials to protect the standpipe system during a fire (Ministry of Health of the Republic of Indonesia, 2012). However, in this hospital, the standpipe system is located in a room near the elevator where the room includes elements of wood. The Siamese in the yard of Hospital X was blocked by parked vehicles. This could make it difficult for firefighters to access the Siamese if a fire occurs at Hospital X.

Hospital X also had four hydrants that do not meet the standards and five that do. A hydrant must include a nozzle, a fire hose and a hose rack (Ministry of Health of the Republic of Indonesia, 2012); however, several hydrants at Hospital X does not have a hose rack and the hoses are not installed on the rack. Hydrants should have a contrasting color from the walls, but in Building B, the hydrants are white in color, which does not provide contrast with the walls. The hydrant in Building B is also not equipped with instructions for use. Hydrants must be strategically placed to ensure they are unobstructed and easily accessible (Annistyaningrum, Ekawati and Kurniawan, 2015); however, in Hospital X, there are hydrants in Building A which are located in cupboards or cabinets and blocked by patient waiting chairs. This would make hydrants difficult to find and access.

Fire extinguisher is an important safety instrument in healthcare facilities because it is used in an initial response in fire incidents, preventing the spread of fire and the potential for wider damages (Wahyudi *et al*., 2023). There are 12 fire extinguishers in Hospital but only five elements of the standards are met. Fire extinguishers must be marked with color labels to indicate their type (Ministry of Health of the Republic of Indonesia, 2012); however, the fire extinguishers in Hospital X do not have labels. The fire extinguishers are not ready for use as some have not undergone monthly inspections, and their pressure levels fail to meet the required standards. Sari and Lestari (2024) stated that fire extinguishers must be checked routinely and refilled periodically even if they are not in use. Furthermore, several fire extinguishers in Hospital X were found to not have placement markings and usage instructions, and there were fire extinguishers that were not attached to hangers. Placing the fire extinguishers on a hanger is necessary to protect them and prevent them from being easily damaged, as well as for visibility reasons. Some fire extinguishers were found to be blocked by furniture, which could make them difficult to be found and accessed. The distance between fire extinguishers should be 15 meters, but in Hospital X, fire extinguishers were found with a distance of 24 meters. The condition of fire extinguishers that do not comply with standards will affect the ability, convenience, and readiness of the fire extinguishers in preventing fires to become larger and thus causing major fires (Yuniati and Wahyuningsih, 2022).

A fire pump is a device to flow the fluid from one place to another through closed channel (Ruslan, Al-Amin and Emidiana, 2021). Four fire pumps were observed in Hospital X; however, only two met the standards. Each building had its own fire pump. If a pump is placed in a separate building, it must be situated at least 15 meters away from the main building (Ministry of Health of the Republic of Indonesia, 2012). This is to prevent separate buildings from being exposed to fire if a fire occurs in the main building. However, the distance between the buildings is only approximately 10 meters. Based on the technical guide (Ministry of Health of the Republic of Indonesia, 2012; NFPA, 2019), a backup fire pump with a diesel engine is needed because if a fire occurs and the power goes out, the pumps can still run using a backup engine. In actual conditions at the hospital, the Building B pump does not have a backup engine.

Passive Fire Protection System

Passive protection systems can protect property and occupants from physical damage during fire by controlling building components from an architectural and structural perspectives (Fakhriyanto, Azizi and Abdusshomad, 2024). In Hospital X, there is one element of building construction that does not meet the standards and one element that does. Building construction is one of the paramount indicators for occupant safety. It should support and not endanger the occupants during evacuation. If a building can resist fire for a long duration, the success rate of evacuation for all occupants in building will be higher (Aminulwahyu, Wiguna and Adi, 2021). In general, the building structure of Hospital X consists of solid brick which can withstand fire for two hours. Hospital walls are also made of solid brick, except for office rooms which have room dividers made of non-fireproof gypsum.

Hospital X has three elements of the compartment that do not meet the standards and two elements that do. To prevent the spread of smoke and fire, there should be no gap between compartments. The larger the gap between compartments is, the swifter the smoke and fire to spread (Xin *et al.*, 2021). In addition, the compartments should be made of fire-resistant materials. Hospital X has compartments made of fire-resistant walls and doors, but several compartments have a gap that could cause fire to spread to the inside or outside. The compartment doors lack automatic closing mechanisms, meaning they do not close on their own when not in use. The doors on the bridge connecting Building A and Building B uses non-fireproof glass. This means that if a fire occurs in one of the buildings, the fire can spread to other buildings. In general, room doors in Hospital X are made of wood which cannot withstand fire.

Life-Saving Facilities

There was an exit way facility that is appropriate and three that do not comply with the standard. Hospital X has more than two exits in each building. However, the access to the exit way in Building B is difficult to reach which can hinder evacuation, especially on the second and seventh floors. The exit way on the second floor is located in the pantry and blocked by furniture, while the exit way on the seventh floor is located in a linen corridor covered by curtains without any directional sign. The linen corridor is 1.3 meters wide, which does not meet the standards. According to Rahman and Sinaga (2019), an exit way is an unobstructed path that visitors must follow from a specific point in a building to a safer location during an emergency. It is crucial for the direct and rapid evacuation of individuals, helping them avoid threats such as heat and smoke. Additionally, exit ways should be easily recognizable to enhance escape efficiency in emergencies (Chen *et al.*, 2021).

Hospital X has six emergency doors but four of them do not meet the standards. Hospital X only has emergency doors in building B. On the fifth floor, the emergency door was found to be locked. According to the team of Hospital X, the emergency door is damaged and thus locked for security reasons. Additionally, the emergency door on the first floor is improperly installed, preventing it from being opened from the emergency stairs. In the event of a fire, this could trap residents in the emergency stairs, delaying evacuation. Furthermore, the emergency door does not lead directly to the outside but to a technical corridor. Ideally, an emergency door should connect directly to the outside area of the building to provide a clear escape route if other exits are blocked by fire or smoke. Additionally, emergency doors should open outward but not from the outside to prevent unauthorized entry (Irmawati, Suryani and Rakhmatsyah, 2020).

Stairs, as one of the vertical traffic facilities, are important for the evacuation during emergency situations, including fire. Visitors can use the stairs to move away from dangerous zones (Lu *et al.*, 2021). All elements of emergency stairs are in accordance with the standard. However, emergency stairs are only located in Building B where they are equipped with fireproof walls and doors that can withstand fire for up to two hours. The size of the stairs complies with NFPA (2019) and is equipped with handrails of the appropriate size as well. The emergency stairs in Hospital X are not spiral stairs, making it easier for residents to go down the stairs

Hospital X has one element of emergency light that does not meet the standard and three elements of emergency light that meet the requirements. The emergency lights at Hospital X are powered by a battery, providing illumination for up to one hour during a power outage. However, no illumination measurements have been conducted to determine whether the emergency lighting is sufficient for evacuation. Ideally, emergency lights should operate automatically and provide adequate illumination for evacuation, with a minimum of 10 Lux measured at floor level. Furthermore, the energy source for emergency lighting should be shielded by fire-resistant construction to prevent damage (Rahman and Sinaga, 2019).

There is one element of directional sign that does not meet the standards and four that comply. Directional signs in Building A are installed in every area, but this is not true for Building B. In Building B, the directional signs installed do not direct visitors to the emergency stairs, only to the public stairs. This results in the suboptimal use of the emergency stairs. Additionally, Building B lacked sufficient "EXIT" signs, necessitating the addition of more visible signs for the residents of Hospital X. According to Zhu *et al* (2020), directional signs cannot be overlooked because they have imperative roles during the indoor evacuation process. A good direction sign could reduce the wayfinding time, whereas a bad direction sign may cause people to choose the wrong route resulting in evacuation delay. Wardani *et al*. (2024) stated that the evacuation process in the building without directional signs will be more difficult, especially if the disaster occurs at night.

All elements of assembly point are proper to the standard. The assembly points are located in the Hospital X parking area and are easy to be found from each exit. The five assembly points allow accommodating the hospital residents. According to Dauda, Billa and Sobie (2022), emergency assembly point should be able to accommodate all residents and patients who must receive basic care and wait to be returned to the hospital. The location of the emergency assembly point should be easily accessible and free of obstacles. Additionally, it must be sufficiently distant from the building to shield individuals from heat and smoke during a fire. However, it should not be too far away, as this might discourage people from using it.

Fire Management

There are two elements of the fire protection organization that comply with the standard. Hospital X has a disaster preparedness organization where the director is the disaster emergency leader who holds the command for disaster management. The organizational structure includes hospital employees with their respective roles and responsibilities. The development of fire emergency response plans, such as training and audits, are coordinated by the fire management division of the OHS committee in Hospital X. Li, Tseng and Huang (2022) stated that providing training with advanced fire safety materials significantly enhances awareness and self-efficacy in emergency response compared to basic fire safety training. Additionally, a fire audit serves multiple functions, including identifying potential fire risks, verifying the functionality and completeness of the fire protection system, and devising fire prevention strategies based on identified risks (Sharafutdinov and Krasnov, 2021).

Hospital X was found to have seven elements of organizational management, but two of them did not meet the requirement. Hospital X already has a hazard identification and fire risk assessment, but it has not been updated since 2017. Hazard identification is the process of recognizing hazards and determining the actions needed to mitigate them. Risk assessment evaluates the likelihood and impacts of potential operational risk events on health, safety, and the environment (Iqbal *et al*., 2020). The prevention strategy document has also not been updated from 2017 to 2018.

Two elements of human resource in Hospital X are implemented properly according to the standards. Hospital X involves all employees, including third parties or canteen workers, as human resources for fire management. Training for human resources is conducted annually by the Depok Fire Department, comprising both instructional materials and practical simulations. According to Ab Aziz, Akashah and Aziz (2019), an emergency response team member is an individual who is the first responder to any disaster incidents such as hospital fire. Members of the response team can fulfill their responsibilities effectively when they possess adequate knowledge about risks. The disaster preparedness organization at Hospital X comprises five divisions, including doctors and nurses, technicians, paramedics, as well as general logistics and transportation officers.

CONCLUSION

Hospital X has demonstrated quite good efforts in fire prevention, achieving a 60% compliance rate with the established standards. Nevertheless, several facilities do not fully meet these standards. The active fire protection system is rated poor, with a compliance rate of 53%, while the passive fire protection systems is also rated poor at 42%. The life-saving facilities have a compliance rate of 66.7%, which falls into the quite good category. Additionally, fire management is rated good with an 81% compliance rate. Thus, the recommendations for Hospital X are, among others, replacing room doors with gap-free, fire-resistant doors, installing an automatic door closing system on each door, and replacing the gypsum walls with walls from fire-resistant materials.

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