











## Assessment of Fire Emergency Preparedness in Subdistrict Health Promoting Hospitals in Urban Areas of Ubon Ratchathani Province, Thailand



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### ABSTRACT

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Fire emergencies represent a critical threat to healthcare systems, particularly in those primary healthcare facilities that serve vulnerable populations. This study aimed to assess fire emergency preparedness among subdistrict health-promoting hospitals in urban areas of Ubon Ratchathani Province, Thailand. A cross-sectional study was conducted between October 2025 and February 2026 among 21 subdistrict health-promoting hospitals and 170 healthcare personnel. Data were collected using structured questionnaires, facility assessment checklists, and interviews with facility directors. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used for data analysis. Among healthcare personnel, 58.2% demonstrated good knowledge of fire emergency prevention and response, while 48.8% reported good fire prevention and suppression practices. Facility assessments revealed substantial deficiencies in physical infrastructure and environmental preparedness. All facilities lacked backup power systems, displayed evacuation plans, emergency lighting, and designated fire safety personnel. Although most directors reported having fire prevention and emergency response plans, on-site observations indicated that these plans were generally not visibly displayed within the facilities. Fire alarm systems and other technological support systems were absent in most facilities. All subdistrict health-promoting hospitals were classified as having a fire emergency preparedness level of Needs Improvement. The findings indicate that fire emergency preparedness in urban subdistrict health-promoting hospitals remains inadequate, particularly in infrastructure, emergency communication systems, and the practical implementation of preparedness measures. Strengthening fire safety policies, routine emergency drills, staff training, and infrastructure investments may improve preparedness and resilience in primary healthcare facilities.

## 1. INTRODUCTION

Fire disasters constitute a significant global public safety issue [1, 2], resulting in considerable human fatalities, infrastructural destruction, and economic detriment [3, 4]. Fire disasters in Southeast Asia, particularly in Thailand, are intensifying due to climate change, which are having extensive impacts on human life, infrastructure, and health systems. In the last fifty years, calamities in the region have led to over 435,000 fatalities and have impacted more than 580 million individuals. Moreover, around \$235 billion in damages have been incurred [5]. Regional guidelines emphasize the necessity of systematic monitoring of burned areas for efficient fire management, disaster mitigation, and protecting communities and vital infrastructure [6]. These incidents underscored that fire emergencies can occur in any organizational context, with their effects differing based on

environmental factors, preparedness levels, and response capabilities [7]. Meanwhile, healthcare professionals were found to lack sufficient knowledge concerning emergency preparedness [8].

Healthcare facilities are especially susceptible to fire emergencies due to the presence of patients, elderly individuals, persons with disabilities, and other medically fragile populations, who may lack the ability to evacuate autonomously [9-11]. The intricacies of hospital infrastructure—comprising electrical systems, medical apparatuses, oxygen supply lines, medications, and flammable substances—augment fire danger [12, 13]. In the event of a fire at these facilities, the repercussions may encompass not only structural damage, but also interruptions in critical medical services, patient morbidity, and fatalities [14].

Primary healthcare institutions, including sub-district health-promoting hospitals, are crucial to Thailand's

healthcare framework, providing essential frontline services, preventive care, and community-oriented health initiatives. In urban areas, these facilities frequently encounter large numbers of patients and function within structures that may possess inconsistent structural requirements, declining facilities, or inadequate emergency preparedness resources [15, 16]. Such conditions increase the likelihood that emergencies-including fires-may occur and simultaneously complicate effective responses. Despite their critical role within the healthcare system, little empirical evidence exists regarding their level of fire emergency preparedness and the factors influencing readiness.

In Thailand, regulatory frameworks require healthcare facilities to implement designated fire-safety procedures, encompassing emergency plans, equipment inspections, and training programs. Nonetheless, implementation at the local level may differ owing to variations in resources, administrative capabilities, and contextual limitations. Urban sub-district health-promoting hospitals, frequently constrained by inadequate staff members and financial resources, may encounter specific difficulties in regularly adhering to these requirements. Despite the significance of this issue, empirical research about fire preparedness in primary healthcare environments-particularly in semi-urban or urban district contexts-remains scarce. The majority of the existing research has concentrated on hospitals or large healthcare institutions [13, 17], resulting in a knowledge deficiency with regard to smaller community-based facilities that provide initial care for numerous individuals.

In Ubon Ratchathani Province, there are 21 sub-district health-promoting hospitals situated in urban districts, that deliver daily health services to substantial populations. These facilities serve as critical components of the regional health system, and their readiness for emergencies directly influences community resilience and disaster response capabilities. Evaluating their readiness is essential for both institutional safety and for the continuity of public health systems. Additionally, understanding the factors related to preparedness, such as staff skills, training, building safety, and management practices, can help to improve interventions and policies. Previous studies on fire emergency preparedness have primarily focused on tertiary hospitals, teaching hospitals, and large healthcare institutions, where emergency management systems, infrastructure, and specialized personnel are generally more developed. These studies have highlighted the importance of staff training, emergency drills, fire safety equipment, and organizational preparedness in reducing fire-related risks. However, evidence regarding fire preparedness in primary healthcare facilities remains limited, particularly in low-resource community-based settings. Furthermore, previous studies have rarely examined the combined effects of structural, organizational, technological, and behavioral factors in these facilities. Therefore, this study was conducted to address this knowledge gap by assessing fire emergency preparedness and its determinants among urban sub-district health-promoting hospitals in Ubon Ratchathani Province, Thailand.

The objective of this study was to assess fire emergency preparedness among subdistrict health-promoting hospitals in urban areas of Ubon Ratchathani Province. The findings provide empirical evidence on the current status of fire emergency preparedness and identify gaps requiring improvement. This information may support healthcare administrators, policymakers, and local authorities in

strengthening fire safety measures and emergency preparedness systems within primary healthcare facilities. Ultimately, improving fire emergency preparedness can reduce risks, protect healthcare personnel and service users, and enhance the resilience of the healthcare system.

## 2. METHODOLOGY

This cross-sectional survey study, which aimed at assessing emergency preparedness in 21 sub-district health-promoting hospitals located in urban regions of Ubon Ratchathani Province in Thailand, was conducted from October 2025 to February 2026. The assessment focused on five key domains, including personnel readiness, availability of fire safety equipment, physical infrastructure and environmental safety, emergency planning, and technological support for emergency management.

### 2.1 Population and sample

The study population consisted of three primary groups. Firstly, all sub-district health-promoting hospitals in urban regions of Ubon Ratchathani Province were evaluated to examine the physical infrastructure and environmental conditions pertaining to the availability and sufficiency of fire prevention and firefighting apparatus in compliance with legal standards. Secondly, the directors of the 21 sub-district health-promoting hospitals were surveyed to gather information regarding the institutional policies, emergency management plans, the frequency of emergency drills, and staff training programs. Finally, a total of 182 healthcare professionals, who were employed at the participating sub-district health-promoting hospitals, were included.

The sample size was calculated to estimate the population proportion using a standard formula for proportion estimation:

$$n = \frac{NZ_{a/2}^2[p(1-p)]}{[e^2(N-1)] + [Z_{a/2}^2p(1-p)]}$$

where,  $N$  is the total individual population (182 individuals),  $n$  indicates the necessary sample size,  $Z(a/2)$  refers to the standard normal deviate for a 95% confidence level (1.96),  $P$  represents the estimated proportion of hospital staff members possessing a sufficient knowledge of emergency plans (0.34, as per Nasir and Zaka [18]), and  $e$  denotes the permissible margin of error, which was defined as not exceeding 10% of  $P$ .

$$n = \frac{(182)(1.96^2)[0.34(1-0.34)]}{[0.034^2(182-1)] + [1.96^2(0.34)(1-0.34)]} = 147$$

The minimum requisite sample size for this investigation was 147 participants. To mitigate any potential data loss or non-response during field data collection, an additional 15% was incorporated, yielding a final sample of 170 individuals. A computer-generated randomization mechanism was utilized for simple random sampling so that the specified number of participants could be achieved. The inclusion criteria consisted of individuals, who had been employed at the urban sub-district health-promoting hospitals in Ubon Ratchathani Province for a minimum of six months and who were also able to provide voluntary agreement to participate. The exclusion

criteria encompassed individuals on study leave, maternity leave, or temporary leave throughout the data collecting period, in addition to those with physical or mental health issues or acute illnesses, which may have impaired their capacity to furnish comprehensive and reliable information.

## 2.2 Research instruments and validity

### 2.2.1 Research tools

The research tools consisted of the following:

(1) A structured questionnaire was distributed to hospital personnel and staff members, comprising three sections:

In Section 1, information was gathered on the respondents' demographic details via multiple-choice questions, encompassing gender, age, educational level, work position, fire safety training, and previous fire event experience (9 items).

In Section 2, knowledge pertaining to fire emergency prevention and response in the sub-district health-promoting hospitals, which encompassed fundamental fire-extinguisher usage, emergency planning, equipment and personnel readiness, and participation in drills, was evaluated (12 items). Responses were classified as “Yes,” “No,” or “Don’t know,” with accurate responses assigned a score of 1 and incorrect responses a score of 0. According to a criterion-referenced assessment developed from Bloom (1971), knowledge scores (maximum = 12) were categorized into three tiers high (80–100%; scores 10–12), moderate (50–79%; scores 6–9), and low (0–49%; scores 0–5).

In Section 3, fire prevention and suppression approaches were assessed with 15 items focusing on operational behaviours, including equipment utilization, preparedness planning, resource availability, and engagement in drills. The response alternatives were “Regularly,” “Sometimes,” and “Never,” which were assigned scores of 2, 1, and 0, respectively, for positively phrased topics. Conversely, reverse scoring was applied to the negatively phrased items. Total practice scores (maximum = 30) were classified based on Best’s criteria (1977) into three categories: “Good” (21–30), “Moderate” (11–20), and “Needs improvement” (0–10).

(2) A structured facility assessment checklist was employed to assess the physical infrastructure of the sub-district health-promoting hospitals, concentrating on the availability and preparedness of the legally mandated firefighting apparatuses and safety devices, including fire extinguishers, first-aid supplies, and alarm systems. The instrument consisted of 21 items with three response options as follows: “Available,” “Partially Available,” and “Unavailable,” which were accordingly assigned scores of 2, 1, and 0. Facility readiness was assessed based on the percentage of items that could be attained. Hospitals achieving  $\geq 80\%$  of the criteria were designated as having good structural and environmental readiness, while those scoring  $<80\%$  were deemed to necessitate improvement, which was in alignment with the Ministry of Public Health star-rating standards for primary care facilities [19].

(3) A standardized questionnaire was distributed to the directors of the sub-district health-promoting hospitals, with sections on respondent demographics, institutional policies, and emergency management plans, which included the frequency of emergency drills and staff training initiatives. The instrument was composed of 12 closed-ended questions and 2 open-ended questions.

(4) The fire emergency preparedness of the sub-district

health-promoting hospitals was assessed across five domains: (1) the physical infrastructure and environment, (2) the existence of emergency response plans, (3) the frequency of emergency drills, (4) the availability and functionality of the firefighting equipment, and (5) the presence of technological systems supporting emergency management. Facilities with implementation levels of  $\geq 80\%$  in these domains were deemed to possess good fire emergency readiness, while those with scores  $<80\%$  were identified as needing improvement, which is in accordance with the Ministry of Public Health’s primary care facility star-rating standards [19].

### 2.2.2 Research tools qualifications

The content validity was confirmed by presenting the questionnaire to three subject-matter experts, who assessed the items for content accuracy, linguistic clarity, and alignment with the study’s objectives. The Index of Item–Objective Congruence (IOC) varied from 0.67 to 1.00, signifying acceptable to exceptional content validity.

Reliability testing was performed via a pilot study involving 30 personnel from Ubon Ratchathani University Hospital. The internal consistency of the knowledge part was tested using the Kuder–Richardson Formula 20 (KR-20), resulting in a coefficient of 0.73. The behaviour section was assessed with Cronbach’s alpha, providing a reliability coefficient of 0.72, demonstrating satisfactory instrument reliability.

## 2.3 Data collection and analysis

### 2.3.1 Data collection

Questionnaire data collection: The study team directly gathered data from the pertinent participants, including the personnel and staff members at the sub-district health-promoting hospitals, as well as the hospital directors.

Facility assessment: Researchers conducted on-site assessments of the sub-district health-promoting hospital structures utilizing a standardized assessment checklist created for this project.

### 2.3.2 Data analysis

Data were analyzed using descriptive statistics, including frequencies, percentages, means, and standard deviations, to summarize personnel characteristics, knowledge, practices, facility characteristics, and fire emergency preparedness levels.

### 2.3.3 Ethical statement

The protection of the rights of the volunteers, who were participating in the project, was taken into consideration. On September 17, 2025, the Human Research Ethics Committee of Ubon Ratchathani University gave its approval to this study, which was given the project number: UBU-REC-171/2568.

## 3. RESULTS

### 3.1 The general characteristics

Of the 170 participants, 85.9% were female, with a mean age of 44.16 years (S.D. = 9.53). The majority of the respondents were married (68.8%) and possessed a bachelor’s degree (69.4%). Almost half were public health technical officers or had comparable technical roles (49.4%), followed by registered nurses (32.4%). Regarding their training experiences, 57.6% had undergone basic fire safety training.

However, 65.9% had not received any instruction on the utilization of fire hose cabinets. The majority indicated that they had not experienced previous occurrences of fire on their jobs (88.2%), and 96.5% had never participated in firefighting actions (Table 1).

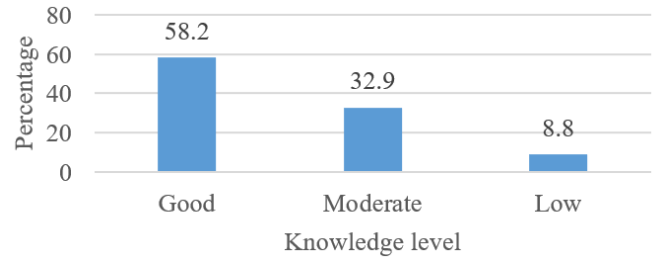
**Table 1.** The general characteristics of the personnel in the sub-district health-promoting hospitals (n = 170)

General Characteristics	Numbers	Percentages
Gender		
Female	146	85.9
Male	24	14.1
Age		
Mean = 44.16 S.D. = 9.53 Minimum = 20 Maximum = 61		
Marital status		
Single	35	20.6
Married	117	68.8
Widowed	4	2.4
Divorced	13	7.6
Separated	1	0.6
Educational levels		
Below bachelor's degree	42	24.7
Bachelor's degree	118	69.4
Master's degree	9	5.3
Doctoral degree	1	0.6
Current positions		
Public health academic officer	31	18.2
Registered nurse	55	32.4
Public health technical officer or other technical staff	84	49.4
Having received basic firefighting training		
Received	98	57.6
Not received	72	42.4
Fire hose training (fire hose cabinet use)		
Received	58	34.1
Not received	112	65.9
History of fire incidents in the workplace		
Reported	20	11.8
Not reported	150	88.2
Having experience in fire suppression		
Had participated	6	3.5
Had not participated	164	96.5

### 3.2 Knowledge regarding fire emergency prevention and response among the personnel in the sub-district health-promoting hospitals

The personnel revealed an adequate understanding of fire emergency prevention and response, with 58.2% categorized as having excellent knowledge, 32.9% at a moderate level, and 8.8% at a low level (Figure 1). The majority of the respondents had accurately comprehended the essential fire safety principles, such as the correct firefighting technique of positioning upwind and targeting extinguishing agents at the base of the flames (90.0%), as well as the necessity of possessing sufficient fire protection equipment to mitigate fire-related damage (88.8%). Nonetheless, lowered rates of accurate responses were noted for specific items. Only 62.9% had accurately identified that water extinguishers are inappropriate for electrical fires, while 64.1% had correctly acknowledged that expired fire extinguishers should be avoided, even in emergencies. Furthermore, 71.8% had accurately recognized

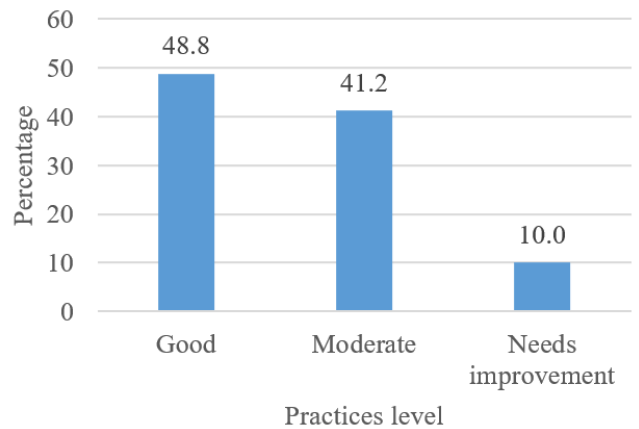
that emergency response plans necessitate regular updates, and that fire suppression can be accomplished by removing at least one component of the fire triangle, namely fuel, heat, or oxygen.



**Figure 1.** The levels of knowledge regarding fire emergency prevention and response among the sub-district health-promoting hospital personnel

### 3.3 Fire prevention and suppression practices among the personnel in the sub-district health-promoting hospitals

Personnel exhibited effective fire prevention and suppression behaviours at a rate of 48.8%, with moderate practices at 41.2% and those requiring improvement at 10.0% (Figure 2). Commonly reported appropriate practices included the regular inspection of the electrical plugs and wiring to mitigate short-circuit hazards, as well as the assurance that emergency equipment, such as flashlights and first-aid kits, remained operational and accessible, with compliance reported by 64.1% and 62.4% of respondents, respectively. Nonetheless, some inferior techniques were also recognized. A significant percentage of the personnel indicated the following: 1) they occasionally or never inspect fire alarm systems, 2) they refrain from engaging in fire extinguisher training despite available opportunities and 3) they fail to report damaged electrical equipment or fire extinguishers for repair or replacement, comprising 77.1%, 75.3%, and 70.0%, respectively.



**Figure 2.** Levels of fire prevention and suppression practices among the sub-district health-promoting hospital personnel

### 3.4 The general characteristics of the directors of the sub-district health-promoting hospitals

The directors possessed a mean age of 50.67 years (S.D. = 6.50) and an average managing experience of 11.74 years (S.D. = 13.59). Each facility employed, on average, nine staff people. Ninety percent of the facilities reported no previous fire accidents, while 9.5% had seen such occurrences,

predominantly due to electrical overloads or short circuits (4.8%). No injuries or fatalities were reported. Nevertheless, the highest recorded property damage totaled 23,000 Thai Baht (Table 2).

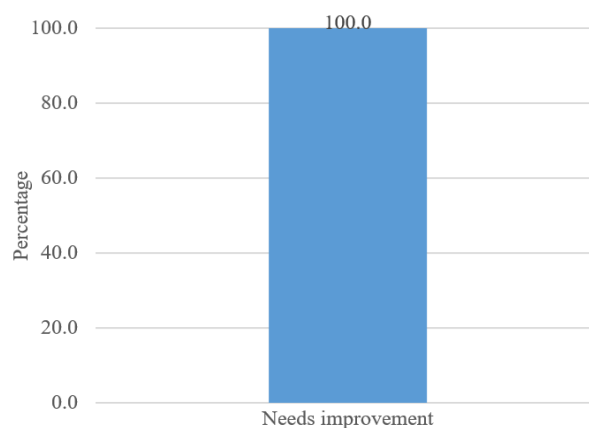
**Table 2.** The characteristics of the directors of the sub-district health-promoting hospitals (n = 21)

The Characteristics of the Directors	Numbers	Percentages
Position		
Director	21	100.0
Age		
Mean = 50.67 S.D. = 6.50 Minimum = 38 Maximum = 60		
Experience at a sub-district health-promoting hospital		
Mean = 11.74 S.D. = 13.59 Minimum = 0 Maximum = 36		
Total number of staff members at the sub-district health-promoting hospitals		
Mean = 8.71 S.D. = 2.72 Minimum = 4 Maximum = 14		
History of fire incidents at the sub-district health-promoting hospitals		
Yes	2	9.5
No	19	90.5
Causes of incidents of fire		
Electrical overload	1	4.8
Electrical short circuits	1	4.8
Injuries or fatalities during fire incidents		
No injuries or fatalities were reported.	2	100
Estimated property damage during fire incidents		
Maximum = 23,000 Minimum = 0		

### 3.5 Physical infrastructure and environmental conditions of the sub-district health-promoting hospitals

The field observation assessment focused on the visible availability and display of fire safety and emergency

preparedness elements within the facilities. The findings therefore reflect on-site observations rather than the existence of administrative documents or policies maintained by the facilities. The evaluation indicated that the comprehensive standard of physical infrastructure and environmental management at all sites had been deemed to require improvement (100.0%) (Figure 3). All hospitals had exhibited sufficient lighting systems, suitable access and exit locations, prominently visible main doors clear of obstructions, and clean, well-maintained flooring (100.0%). Yet significant shortcomings were detected in the fire safety systems. Specifically, qualified personnel had neither inspected nor maintained the emergency support systems in 95.2% of the hospitals. Furthermore, all facilities (100.0%) were devoid of backup power systems, electrical system schematics, fire prevention and suppression plans, evacuation plans, designated safety officers, and emergency stairways that were fitted with illuminated exit signs (Table 3).



**Figure 3.** The levels of physical infrastructure and environmental management of the sub-district health-promoting hospitals

**Table 3.** The physical infrastructure and environmental characteristics of the sub-district health-promoting hospitals (n = 21)

Characteristics	Results (Percentages)		
	Yes	Some	No
<b>Domain 1: Physical Structure and Environmental Conditions</b>			
1. The external building structure and facilities were appropriate.	95.2	4.8	-
2. Adequate night-time lighting had been provided at the hospital's entrance.	100.0	-	-
3. The width of the main entrance was adequate for traffic flow.	100.0	-	-
4. The main entrance was clearly visible and unobstructed.	100.0	-	-
5. The main entrance was adequately illuminated.	100.0	-	-
6. The flooring at the main entrance was clean and even.	100.0	-	-
7. The electrical wiring was orderly and properly arranged.	95.2	4.8	-
8. Electrical fault warning systems had been installed.	4.8	-	95.2
9. Emergency support systems had been inspected and maintained by qualified personnel.	4.8	-	95.2
10. Backup power systems had been installed and were regularly tested and maintained.	-	-	100.0
11. An electrical backup system layout had been installed for emergency reference.	-	-	100.0
12. A clearly defined emergency response plan was displayed and directed by senior management.	-	-	100.0
13. The fire prevention and suppression plan had been updated annually.	-	-	100.0
14. An evacuation plan with clear procedures was visibly displayed throughout the facility.	-	-	100.0
15. Personnel, who were to be responsible for fire and disaster prevention, had been officially designated.	-	-	100.0
16. Emergency stairways were clean and well maintained.	4.8	-	95.2
17. Emergency stairways had been equipped with emergency lighting.	-	-	100.0
<b>Domain 2: Fire Prevention and Safety Management</b>			
18. Fire hose cabinets and hoses with nozzles had been installed in clearly visible locations.	-	-	100.0
19. Portable chemical fire extinguishers had been installed in visible and easily accessible locations.	100.0	-	-
20. At least one fire extinguisher had been provided per 1,000 m <sup>2</sup> of building area, with a minimum of one per floor.	100.0	-	-
21. Fire hose connection points had been installed in clearly visible and easily accessible locations throughout key areas of the facility.	100.0	-	-

### 3.6 Fire emergency management preparedness among the directors of the sub-district health-promoting hospitals

The information presented in this section was based on self-reports provided by facility directors and reflects the existence of administrative policies and emergency preparedness documents. The directors reported that the majority of the institutions had exhibited robust preparedness in fire safety planning and maintenance. All the hospitals (100.0%) confirmed the testing of fire extinguishers at designated intervals. Furthermore, 95.2% indicated that the regular maintenance and readiness assessments of the fire safety apparatuses, including fire extinguishers, had accompanied the implementation of protocols or strategies for the inspection and maintenance of emergency preventive equipment. Ninety percent of the establishments reported possessing fire prevention and suppression strategies, as well as establishing coordination systems with local firefighting or municipal emergency response units. Nonetheless, some significant deficiencies in preparedness were recognized. A significant percentage of facilities were lacking in critical warning and suppression systems, such as fire alarms, smoke detection devices, and automated fire suppression systems (95.2%). Moreover, 76.2% had neither posted evacuation route maps nor designated assembly sites, while 71.4% had failed to perform regular fire emergency drills. Although most facility directors reported the existence of fire prevention and emergency response plans, on-site assessments revealed that these plans were generally not visibly displayed within the facilities.

### 3.7 Fire prevention equipment and technological systems in the sub-district health-promoting hospitals

A small percentage of the facilities possessed fire protection

technologies. In total, 33.2% of the sub-district health-promoting hospitals indicated the presence of any type of fire safety equipment or technical system. Only 9.5% of facilities had been outfitted with sprinkler or automatic fire suppression systems, while closed-circuit television (CCTV) surveillance systems had been implemented in merely 4.8% of facilities, highlighting significant deficiencies in technological readiness for fire risk mitigation.

### 3.8 Fire emergency preparedness in subdistrict health promoting hospitals in urban areas of Ubon Ratchathani Province

The assessment of fire emergency preparedness among subdistrict health-promoting hospitals in urban areas of Ubon Ratchathani Province revealed that the strongest domains of preparedness were the availability of emergency plans and firefighting equipment. All facilities were equipped with fire extinguishers, emergency exit signs, and clearly documented emergency plans. However, improvements were needed in the domains of physical infrastructure and environment as well as technology to support emergency management, particularly fire alarm systems, which were absent in several facilities.

Emergency preparedness was assessed based on compliance with at least 80% of the established criteria according to the Ministry of Public Health's Primary Care Unit Star Rating Program (2021). As this study evaluated five domains, facilities were required to meet the criteria in at least four domains to be classified as prepared. Based on these criteria, all subdistrict health-promoting hospitals were classified as having a "Needs Improvement" level of fire emergency preparedness (Table 4).

**Table 4.** Fire emergency preparedness in subdistrict health promoting hospitals (n = 21)

Sub-District Health Promoting Hospitals	Physical Infrastructure and Environmental Characteristics	Having an Emergency Plan	Having Had a Rehearsal	Having Emergency Equipment Readily Available	Having the Technology to Support Emergency Management	Fire Emergency Preparedness Needs Improvement
NO.1	×	√	√	√	×	√
NO.2	×	√	×	√	√	√
NO.3	×	√	×	√	×	√
NO.4	×	√	√	√	×	√
NO.5	×	×	×	√	×	√
NO.6	×	×	×	√	×	√
NO.7	×	√	√	√	×	√
NO.8	×	√	×	√	√	√
NO.9	×	√	√	√	×	√
NO.10	×	√	×	√	×	√
NO.11	×	√	×	√	×	√
NO.12	×	√	√	√	×	√
NO.13	×	√	×	√	×	√
NO.14	×	√	×	√	×	√
NO.15	×	√	√	√	×	√
NO.16	×	√	×	√	×	√
NO.17	×	√	×	√	×	√
NO.18	×	√	×	√	×	√
NO.19	×	√	×	√	×	√
NO.20	×	√	×	×	×	√
NO.21	×	√	×	√	×	√

Note: √ indicates compliance with the criterion; × indicates non-compliance with the criterion.

#### 4. DISCUSSION

The deficiencies identified in this study have important implications for emergency management in primary healthcare facilities. The absence of essential fire safety components, including fire alarm systems, emergency lighting, backup power supplies, and displayed evacuation plans, may significantly hinder emergency response and evacuation procedures during fire incidents. Such limitations could increase risks to healthcare personnel, patients, and visitors, particularly among vulnerable populations requiring assistance during evacuation. Recent research has demonstrated that when the healthcare personnel actively participate in these exercises, the accuracy of their reactions significantly improves during emergencies, as well as their confidence [20-22]. The limited practical experience noted in this study may consequently restrict effective real-time response capabilities, particularly in institutions that cater to vulnerable populations, such as the elderly and chronically ill patients [23, 24]. Most personnel demonstrated adequate knowledge of fire emergency prevention and response, while a substantial number showed only moderate knowledge. Having a contribute to understanding of effective extinguisher techniques and of the importance of having adequate fire prevention equipment was also observed. Gaps in knowledge persisted in critical technical areas, particularly the improper use of water extinguishers for electrical fires and the functionality of expired extinguishers. These gaps corresponded with research findings, which demonstrated that healthcare personnel show a positive attitude toward fire safety. However, they need to enhance their theoretical knowledge and practical preparedness in order to foster an effective fire safety culture [8, 25].

Personnel generally exhibited adequate fire prevention and suppression practices, particularly with regard to routine inspections of electrical wiring and the maintenance of emergency equipment. These practices may contribute to reducing fire-related risks and enhancing workplace safety. However, notable gaps in fire safety behaviours remained evident. These included inconsistent inspection of fire alarm systems, limited participation in fire extinguisher training despite available opportunities, and inadequate reporting of damaged safety equipment for maintenance or replacement. Behavioural preparedness is a crucial element of effective emergency management. International health emergency frameworks have indicated that in order to build a safety culture within institutions, regular drills and established reporting protocols are vital [7, 13].

This study's key findings highlighted infrastructural deficiencies across all the sub-district health-promoting institutions. Every facility was identified as needing improvements in both physical infrastructure and environmental management. Notably, critical deficiencies were identified in fire safety infrastructure, particularly the absence of backup power systems, clearly displayed evacuation plans, and emergency lighting. Fire alarm systems and automatic fire suppression systems were also largely unavailable across the facilities. The observed deficiencies in fire safety infrastructure may reflect the operational realities of primary healthcare facilities in Thailand. Unlike tertiary hospitals, sub-district health-promoting hospitals generally operate with limited budgets, smaller workforces, and aging infrastructure. Consequently, investments in advanced fire protection systems such as automatic suppression systems,

emergency lighting, and backup power supplies may not be prioritized despite their importance for emergency preparedness.

From a policy perspective, these findings highlight the need for stronger fire safety oversight and the establishment of minimum preparedness standards for sub-district health-promoting hospitals. Given the resource constraints commonly experienced by primary healthcare facilities, improvements may require dedicated budget allocation, phased infrastructure upgrades, and technical support from provincial health authorities. Regular fire safety audits, emergency drills, and staff training programs should also be integrated into routine healthcare quality and safety management systems to enhance preparedness and resilience. The resilience of infrastructure is recognized as a vital component of healthcare disaster preparedness and ensures system continuity [5, 6]. The absence of early-warning systems-like smoke detectors and sprinkler systems-impairs detection and containment, thereby increasing risks to the vulnerable residents. Recent case studies on hospital evacuations in Southeast Asia have illustrated that efficient alert systems and clearly defined evacuation routes can significantly reduce evacuation times and injury rates [11].

Administrative findings indicated that although many institutions reported having fire safety plans and coordination mechanisms with local authorities, regular fire emergency drills were not consistently conducted. Additionally, evacuation maps were largely absent in most facilities. This discrepancy highlighted the difference between recorded preparedness and functional preparedness as discussed in the disaster preparedness literature [13]. An important finding was the discrepancy between administrative reports and field observations. While most facility directors reported the existence of fire prevention and emergency response plans, on-site assessments found that these plans were generally not visibly displayed within the facilities. This suggests that preparedness documents may exist at the administrative level but may not be adequately communicated, displayed, or integrated into routine operational practice. Such gaps between documented preparedness and practical implementation may reduce the effectiveness of emergency response during actual fire incidents.

#### 5. CONCLUSIONS

This study revealed that fire emergency preparedness among subdistrict health-promoting hospitals in urban areas of Ubon Ratchathani Province was classified as Needs Improvement according to the Ministry of Public Health preparedness criteria. While most healthcare personnel demonstrated satisfactory knowledge and practices regarding fire prevention and response, important gaps were identified in physical infrastructure, emergency communication systems, and technological support for emergency management. In addition, discrepancies between administrative reports and on-site observations suggest that the existence of emergency preparedness plans does not necessarily ensure their visibility or implementation in practice. Strengthening fire safety infrastructure, improving emergency communication systems, conducting regular drills, and enhancing staff training are essential to improve fire emergency preparedness and ensure the safety of healthcare personnel, patients, and visitors in primary healthcare facilities.

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