A Study to Assess the Knowledge on Fire Safety at Work Place among the Health Care Workers at a Tertiary Care Hospital

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Abstract

Fire safety is a crucial set of precautions and practices designed to prevent the outbreak of fires, minimise their destructive potential, and ensure the safety of individuals and property. It also helps early detection, and effective response strategy in the event of a fire emergency. This study employed a descriptive cross-sectional analytical design, with 384 participants selected using a proportional quota sampling technique. A self-structured questionnaire was used to assess the knowledge of fire safety. This questionnaire covered various aspects of fire safety, including fire prevention strategies, early detection methods, and effective response strategies. The primary objective was represented by frequency and percentage, while the secondary objective was analysed using a chi-square test. This rigorous methodology ensures the reliability and validity of the study's findings. The results showed that most participants (77.1%) had good to very good knowledge, with 48.2 percent having good knowledge and 28.9 percent having average knowledge. Only 13.3 percent needed improvement. The study also found a statistically significant association between the level of understanding of fire safety and certain demographic variables. The fire safety interventions implemented at JIPMER, including periodic fire drills and comprehensive training, have been proved highly effective. Additionally, the annual fire safety training for healthcare workers, which covers fire safety regulations, evacuation procedures, and fire extinguishers, has contributed to the high level of knowledge among most healthcare workers at JIPMER, Puducherry.

"Safety should never be a priority. It should be a precondition."- Paul O'Neill.

Key words: Fire safety, Health care workers, Knowledge of fire safety

Fire is an essential need of life for every living being on earth, and it is regarded as life's driving force. Though fire plays a significant role in life on earth, minor negligence in handling of fire can cause a lot of casualties within seconds. In hospitals, the proactive involvement of healthcare workers is essential for minimising fire accidents and ensuring a safe environment for patients and staff.

The fire outbreak threatens all persons in a building with financial and psychological implications (Yeturu et al, 2016). Humans are prone to make mistakes due to negligence, poor vigilance, and lack of knowledge of fire safety, which can lead to fire outbreaks. Every healthcare worker should be taught about fire safety measures and how to handle, maintain and assess the working ability of fire extinguishers. The study observed that fire safety training programme and drills could make an effective emergency response system during a fire outbreak (Kulkarni et al, 2016).

According to the National Fire Protection Association (NFPA), the leading causes and circumstances of fires in healthcare facilities are related to cooking equipment, with 20 percent civilian injuries and 3 percent direct property damage. During the five years of 2011-2015, the United States Fire Department responded to an estimated average of 5,750 structure fires in healthcare facilities per year, of which 48 percent were in nursing homes, 22 percent in mental health facilities, 20 percent in hospital settings and 11 percent in clinics or doctor's office (NFPA, 2024).

As per the India Risk Survey (IRS), the rise in fire accidents has caused "fire" to be the fourth most significant risk in the 2021 survey, which was in 10th position in 2019. In the 2021 NCRB survey, there were 9329 reported cases of fire accidents with over 9000 casualties in India in the year 2020 (Kaur et al, 2023). Nearly 58 percent of the total fatalities were reported in residential buildings, and at least

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15 known cases of fire accidents in COVID hospitals in 2021. The Bharuch Hospital fire in Gujarat on 1 May 2021 killed at least 18 people, while the Virar Hospital fire in Mumbai's suburb in April killed at least 13 people. A fire in Kamala Nehru Hospital in Bhopal resulted in the death of four infants (Yeturu et al, 2016; NERB, 2024).

Fire safety prevention protocol is necessary for every healthcare facility and essential to building infrastructure plans. Providing fire safety systems like emergency exits, different types of fire extinguishers, safe assembly areas, and fire hydrant systems is mandatory in healthcare settings (Kaur et al, 2023)

Need of the study: The present study assessed the knowledge of fire safety at the workplace among the healthcare workers at a tertiary care hospital to help formulate fire safety measures, plan adequate fire safety drills, and improve the patient's quality of life.

Review of Literature

A cross-sectional study by Kulkarni et al (2016) assessed the knowledge and practices of healthcare workers in tertiary care teaching hospitals in Maharashtra. The sample size was 202 healthcare workers, and a pre-designed, pre-tested questionnaire assessed their knowledge. Data was analysed using percentages, proportions, and z-tests. Researchers mentioned that the majority of healthcare workers knew fire safety preparedness without having prior classes.

Prajwal et al (2020) conducted a study to assess the awareness of occupational safety and health hazards among nursing staff of a teaching hospital for three months. A questionnaire on a 5-point scale was administered to nursing staff. Total scores and percentage of responses were computed, and the degree of correlation was observed to be 0.4 between the participants' age, educational qualification, and total scores. The study highlighted the areas that require knowledge enhancement on occupational safety and health hazards, which helps adopt the best workplace practices.

Parthala et al (2020) conducted a descriptive study on reported fire accidents in major hospitals in India. An extensive internet search was done for news reports and articles on fire incidents in major hospitals by mainstream media outlets. The most common cause of the fire was electrical short circuits (78%), with air conditioners being the most common source. Functional fire fighting systems were reported in 39 percent of the accidents.

Objectives

The primary objectives was to assess the level of knowledge on fire safety at the workplace among healthcare workers. The secondary objectives was to find the association of the level of knowledge on fire safety with selected demographic variables.

Materials and Methods

This quantitative cross-sectional analytical study was carried out among healthcare workers at Jawaharlal Institute of Post Graduate Medical Education Research (JIPMER), Puducherry, India. Data collection was done from July 2022 to March 2023. Subjects included were: nurses, doctors, daily labourer RL, UDS, security, dieticians, lab technicians, physiotherapists, social workers and other professionals. A proportional quota sampling technique was used to recruit the samples. Researchers felt that the study needed representation from each category of staff. The proportion was decided based on the number of employees in each category. Hearing impaired, visually challenged, and mentally unsound during data collection were excluded from the study.

The sample size was estimated to be 384 using the statistical formula of calculating the single population. The expected projection of healthcare workers with good knowledge of fire safety was 0.50 (50%), and the sample was estimated at a 5 percent level of significance and 5 percent absolute precision.

A self-structured questionnaire in Tamil and English was used for data collection. The questionnaire consisted of two parts: Demographic data and self-structured questionnaires on fire safety. Demographic data contained socio-demographic variables such as age, gender, education, designation, working experience, fire drill attended, fire safety trained, and any time involved in fire evacuation. Researchers assessed the knowledge regarding fire safety through 25 questions, and each correct answer was given a score of "1" and "0" for each wrong answer. The Assistant Divisional Fire Officer, Fire Service Department, Puducherry, validated and accepted the tool. The tool was checked for feasibility through pilot testing and found to be reliable and feasible.

After getting approval from the Scientific and Institute Ethics Committee, the participants were contacted and provided adequate information about the study. After obtaining consent, the participants were supplied with a self-administered questionnaire. Data was collected only once at their workplace and the answered questionnaires

were evaluated with validated answers. Study participants' anonymity and confidentiality was ensured throughout and afterwards.

Statistical analysis: The level of knowledge on fire safety among healthcare workers was represented as frequency. The association of the level of knowledge on fire safety with selected demographic variables was assessed using a chi-square test. All statistical analyses were carried out at a 5 percent significance level, and a p-value <0.05 was considered significant.

Results

The demographic characteristics of study participants are shown in Table 1. Out of 384 study participants, 211 (54.9%) were females, 254 (66.1%) participants had completed their under graduation, 142 (37%) participants were nursing professionals, 221 (57.6%) participants had attended the fire drill, 120 (31.3%) had more than nine years experience, 358 (93.2%) participants were not involved in fire evacuation, 256 (66.7%) participants were fire safety trained and 220 (57.3%) were trained in JIPMER.

The frequency and percentage-wise distribution of questions regarding fire safety that the participants responded to are shown in Table 2. Out of 384 participants, 340 (88.5%) knew the components of the fire triangle, 338 (88.0%) were aware that multiple electrical extension boxes could not be used in patient service areas, 330 (85.9%) participants knew about PASS acronym and 120 (31.3%) participants learned about the manual evacuation method for pregnant ladies.

Frequency and percentage distribution of level of knowledge among health care workers shows (Figure 1) that out of 384 subjects, 185 (48.2%) had a good level of knowledge, 111 (28.9%) had excellent level of knowledge, 37 (9.6%) had average level of knowledge and 51 (13.3%) needed improvement in level of knowledge.

The association of the level of knowledge with their selected demographic variables (Table 3) shows that there is a statistically significant association between the level of knowledge on fire safety and the demographic variables like gender ($p<0.001$), designation ($p<0.001$), fire drill attended ($p<0.001$), working experience ($p<0.001$), fire safety trained ($p<0.001$), JIPMER or outside ($p<0.001$). In contrast, some demographic variables like education ($p=0.034$) and any time involved in fire evacuation ($p=0.977$) are not associated with the level of knowledge.

Table 1: Frequency and percent distribution of the socio-demographic variables among the healthcare workers (N=384)

Sl. No.	Socio-demographic variables	Frequency (n)	Percentage (%)
1	*Gender*		
	Male	173	45.1
	Female	211	54.9
2	*Education*		
	High school	19	4.9
	Higher Secondary	16	4.2
	Diploma	20	5.2
	UG	254	66.1
	Others	75	19.5
3	*Designation*		
	Nursing professionals	142	37.0
	Medical professionals	26	6.8
	AMS professionals	17	4.4
	Nursing students	80	20.8
	AMS students	28	7.3
	Security	31	8.1
	DRL	2	0.5
	Admin and other hospital services	58	15.1
4	*Fire drill attended*		
	Yes	221	57.6
	No	163	42.4
5	*Working experience*		
	None	112	29.2
	<1 year	15	3.9
	1-4 years	80	20.8
	5-8 years	57	14.8
	>9 years	120	31.3
6	*Any time involved in fire evacuation*		
	Yes	26	6.8
	No	358	93.2
7	*Fire safety trained*		
	Yes	257	67.0
	No	127	33.1
8	*JIPMER or outside*		
	None	126	32.8
	JIPMER	220	57.3
	Outside	30	7.8
	Both	8	2.1

Table 2: Frequency and percentage-wise distribution of questions answered correctly by the participants regarding fire safety (N=384)

S. No.	Questions	N	Percent
1	The components of the fire triangle are Oxygen, Heat and Fuel	340	88.5
2	Fire can be extinguished by cooling, smothering & starving methods	277	72.1
3	The commonest cause of a fire accident in the hospital is an electricity fire	322	83.9
4	To operate the fire extinguisher, follow the PASS sequence	270	70.3
5	You should maintain a safe distance of (minimum) 5ft during extinguishing a fire	144	37.5
6	To extinguish a fire, you should aim the fire extinguisher at the base of the fire and sweep it back	246	64.1
7	Which extinguisher can be used for all types of fire? ABC extinguisher	209	54.4
8	RACE expands to rescue, alarm, contain, and evacuate	229	59.6
9	PASS expands as Pass, Aim, Squeeze, Sweep	330	85.9
10	During fire incidents, all activity should be carried forward at the fire site except shouting for fire and using the elevator for safety evacuation	288	75
11	In an electrical fire accident, the first step to prevent the spread of fire is to switch off the power supply to the burning material	313	81.5
12	In case of fire, those in imminent danger to the fire spot must first be attended to in the rescue operation procedure	221	57.6
13	If the fire is spreading beyond control and might block your way out, you should evacuate the building immediately	183	47.7
14	Storage of flammable lab chemicals is permitted near window panels. False statement	254	66.1
15	Multiple electrical extension boxes can be used permanently in the patient service area. False statement	338	88
16	Single split A/C can be used continuously 24/7 to meet ambient room temperature. False statement	297	77.3
17	As per safety codes, the building basement shall not be used to store flammable chemicals. True statement	282	73.4
18	The primary purpose of the evacuation route map provided in the building corridors is for the public to know the nearest exit during emergencies	314	81.8
19	All of the below-mentioned areas are restricted to vehicle parking except the building basement	294	76.6
20	All of the following are true except for improving the clinical services with space constraints; electrical equipment can be placed near each other	304	79.2
21	All of the below-mentioned items are true except for housekeeping, and combustible items can be stored below the staircase	257	66.9
22	While operating the fire extinguisher in the open place, which of the following procedures should be followed? Stand in the same wind direction to prevent the fire from approaching	210	54.7
23	Which of the below-mentioned manual evacuation methods will be used to evacuate pregnant ladies? It the cradle method?	120	31.3
24	Ambulant patients should be mobilised before non-ambulant patients during uncontrolled fire accidents, which is a true statement	233	60.7
25	Which of the following should you NOT do during a fire emergency is to reenter the building without the permission of authorities	287	74.8

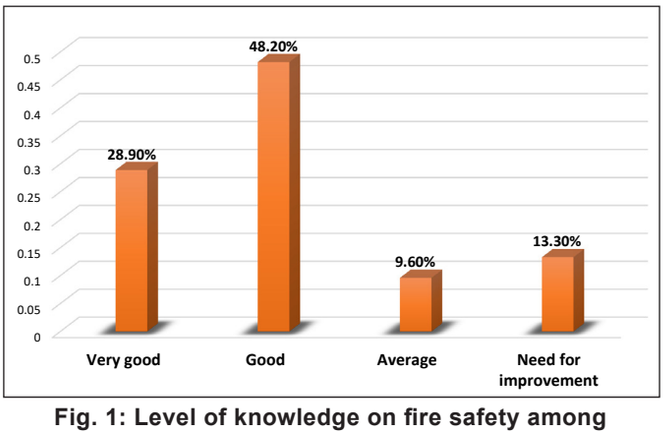

Fig. 1: Level of knowledge on fire safety among health care workers

Discussion

The current study was carried out among 384 healthcare workers to assess their knowledge of fire safety at the workplace. The majority of the participants were nursing professionals, followed by nursing students. In this study, most healthcare workers had a good level of knowledge, and only a few needed improvement as periodic fire drills were conducted and most of the participants were fire safety trained.

A South Indian cross-sectional study conducted in Maharashtra revealed that most healthcare workers (96.4%) had correct knowledge regarding fire safety preparedness (NCRB, 2024). A quantitative descriptive study conducted by Bose et al (2019) in Andhra Pradesh revealed that among 100 nurses, 36 (36%) had good knowledge of the questionnaire, scoring a percentage of 75 and above, and 64 (64%) had adequate knowledge regarding fire accidents.

The present study showed a significant association between the level of knowledge and selected demographic variables such as gender, designation, working experience, fire safety training, and fire drill attended. However, a cross-sectional study conducted by Yeturu et al (2016) found no significant association between the knowledge of fire safety and the educational level of the participants. Similarly, a descriptive cross-sectional study conducted by Coletto et al

Table 3. Association of level of knowledge with their selected demographic variables (N=384)

Sl. No.	Socio-Demographic Variables	Level of Knowledge				Total	"p" value
		Very good	Good	Average	Need for improvement		
		n	n	n	n	percent	
1	*Gender*						
	Male	38	85	27	23	45.1	0.001**
	Female	73	100	10	28	54.9	
2	*Education*						
	High school	4	12	3	0.0	4.9	0.034
	Higher Secondary	5	4	3	4	4.2	
	Diploma	11	7	1	1	5.2	
	UG	65	129	25	35	66.1	
	Others	26	33	5	11	19.5	
3	*Designation*						
	Nursing professionals	61	68	4	9	37	<0.001**
	Medical professionals	6	13	3	4	6.8	
	AMS professionals	6	7	2	2	4.4	
	Nursing students	15	44	7	14	20.8	
	AMS students	0.	17	4	7	7.3	
	Security	9	10	9	3	8.1	
	DRL	0	2	0	0	0.5	
	Admin and other hospital services	14	24	8	12	15.1	
4	*Fire drill attended*						
	Yes	84	108	16	13	57.6	<0.001**
	No	27	77	21	38	42.4	
5	*Working experience*						
	None	12	62	13	25	29.2	<0.001**
	<1 year	3	8	3	1	3.9	
	1-4 years	26	32	10	12	20.8	
	5-8 years	28	19	8	2	14.8	
	>9 years	42	64	3	11	31.3	
6	*Any time involved in fire evacuation*						
	Yes	7	13	2	4	6.8	0.977
	No	104	172	35	47	93.2	
7	*Fire safety trained*						
	Yes	89	124	21	23	67.0	<0.001**
	No	22	61	16	28	33.0	
8	*Jipmer or outside*						
	None	21	61	16	28	32.8	<0.001**
	Jipmer	76	107	18	19	57.3	
	Outside	8	16	2	4	7.8	
	Both	6	1	1	0	2.1	

*p<0.001 ** Highly significant and p<0.05 significant, Test Chi-Square test*

(2018) contradicted the current study findings. It revealed that age, gender, years in practice, and highest education had no statistically significant correlation with knowledge and attitudes regarding fire risk assessment.

An interventional study conducted in Ahmedabad by Singh et al (2015) showed that before imparting knowledge regarding fire safety, the overall knowledge was 33.66 percent. After the impartation of knowledge, there was an overall increase of 51.50 percent in knowledge level on first-aid and fire safety. Girls had more awareness regarding fire safety and first-aid than boys. This study supports gender as an associating factor as in present study.

Similar to the present study findings, a cross-sectional study conducted by Abu-Simiyeh et al (2021). revealed that female students are more familiar with laboratory signage than male students, and there was a significant association between participants with training and those without training concerning safety rules and procedures.

The most exciting finding was that 26 participants were involved in fire evacuation in real life. That shows the strength of the training as well as the prevented accidents. Many studies have emphasised the practical aspects of fire evacuation at critical times, especially in operation theatres, crowded areas, and hospital emergencies. Training and critical analysis save more time and lives (Hanet al, 2021; Sharma et al, 2020).

Limitations of the study: It was conducted among healthcare workers working in JIPMER, and the sample was limited to 384. Practice was not assessed since it was a knowledge-based questionnaire.

Recommendations:

- Multi-centre studies can be done in different settings and replicated with larger samples for better generalisation.
- A similar study can use different assessment methods, such as practice-by-skill assessment.
- Further studies can be conducted to develop a specific tool to assess the level of knowledge on fire safety.

Nursing Implications

- Novice nurses and nursing students must be trained more on fire safety measures. This study showed that nurses' safety awareness needs to be proactively increased through education and training.
- Nursing education should be given importance regarding fire safety measures.
- Nursing administrators can arrange classes through Fire Safety and Preparedness Committee personnel during induction training.
- The nurses and nursing students should carry out extensive and vigorous research studies regarding knowledge of fire safety. The study results should be appropriately discussed for its implementation in clinical settings to improve the understanding of fire safety.

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Conclusion

The study suggests that most subjects have good knowledge of fire safety. Demographic variables such as gender, designation, fire drill attendance, working experience, and fire safety training were statistically associated with the level of knowledge. Healthcare workers must receive appropriate training on responding during a fire outbreak. Adequate fire safety training and regular emergency drills can enhance the effectiveness of emergency responses.

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