



## ASSESSMENT OF KNOWLEDGE & PRACTICES ON FIRE SAFETY AMONG HEALTH CARE PROFESSIONALS IN CLINICAL LABORATORY OF TERTIARY CARE HOSPITAL IN NORTH INDIA - A CROSS SECTIONAL STUDY

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### ABSTRACT

**Objectives** Fire safety is of paramount importance in healthcare settings, particularly in clinical laboratories where hazardous substances, flammable materials, and complex equipment are frequently present. Knowledge and practices of health care workers about fire safety prevention is essential to ensure the well-being of patients, staff, and the preservation of critical healthcare services. **Material & Methods** A cross-sectional study was carried out in clinical biochemistry laboratory of Safdarjung Hospital, New Delhi, during from April 2023 to August 2023. Study participants included the doctors, paramedical technical staff and group IV people. A questionnaire with close ended and open ended questions was used for assessment. The data was tabulated in Microsoft MS-Excel data sheet and analysis was done using SPSS 27 version of statistical software. Categorical variables were presented as number, percentage and median. Qualitative variables were compared using Chi-Square test and quantitative variables using Kruskal Wallis test. For statistical significance, p value of less than 0.05 was considered statistically significant. **Results** 63 HCWs participated in the study which gave a 100% response rate. Most of the participants were Doctors (42.86%) and Laboratory technicians (44.44%) with variable years of work experience ranging from <1 year to >9 years. The results indicate that participants have a mean knowledge score of  $7.94 \pm 1.4$  and median of 8 whereas the mean practice score was  $7.24 \pm 1.28$  with a median of 7 towards fire safety. **Conclusion:** The present hospital based study revealed that the majority of healthcare workers had significant knowledge about fire safety but still considering the important role of every employee in a fire accident, there is need to give fire safety training to all health care workers at timely intervals.

**KEYWORDS :** Knowledge, Practices, Fire Safety, Health care workers

### INTRODUCTION

Fire safety is an essential component and requirement in any building infrastructure plan. Hospitals and medical centres are among the places where a large number of fires occur annually (1). Thus, it is a critical aspect of any healthcare setting, considering the potential of fire-related incidents to pose significant risks to patients, staff and infrastructure (2).

The clinical laboratories operating within the hospitals, in addition, have various types of safety hazards. These laboratories often handle flammable substances, volatile chemicals, and electrical equipment, making them vulnerable to fire hazards. The consequences of a fire outbreak can be catastrophic, leading to injuries, loss of life, damage to equipment, and disruption of critical healthcare services (3). Apart from these unavoidable causes, human factors such as carelessness, negligence and lack of fire safety awareness account for the leading causes of fire outbreaks (4).

Healthcare workers in clinical laboratories are at the forefront of patient care, and their understanding of fire safety protocols is vital to prevent, contain, and respond effectively to fire incident (5). It is essential for these professionals to possess comprehensive knowledge of fire prevention techniques, appropriate handling of flammable substances, proper storage practices, evacuation procedures, and the use of fire extinguishers. By evaluating the current understanding and adherence to fire safety protocols, we can identify potential gaps and implement necessary measures to enhance the safety preparedness of the clinical laboratory environment.

This can serve as a foundation for developing targeted training programs, implementing robust fire safety policies, ensuring the overall safety of healthcare workers and patients in clinical laboratory settings and can contribute to the formulation of evidence-based guidelines and protocols, leading to a safer and more secure environment in healthcare facilities throughout India.

While some studies have been conducted on fire safety in healthcare settings, there is a scarcity of research specifically

focusing on clinical laboratories, especially in North India. This study aims to bridge this knowledge gap by assessing the knowledge and practices of healthcare workers in a tertiary care hospital's clinical laboratory in North India regarding fire safety. The findings will provide valuable insights into the existing level of preparedness and highlight areas that require improvement to enhance fire safety measures.

### MATERIAL AND METHODS

Cross-sectional analysis was carried out amongst the group of health care workers working in clinical biochemistry laboratory of Vardhman Mahavir Medical College (VMMC) & Safdarjung Hospital, a tertiary care teaching hospital in New Delhi, India after approval from the Institutional Ethical Committee wide ethical clearance number: **S.No. IEC/VMMC/SJH/Project/2023-07/CC-367**. The procedures adhered to the ethical guidelines of the Declaration of Helsinki.

The participant population included doctors, lab technicians, lab attendants and BVG workers in the department.

**Sample size** of the study was calculated as per the reference study (6).

**Sample size formula:**  $n = (Z_{\alpha})^2 \cdot P \cdot Q / L^2$

Where n is the sample size,

P = 96.4

$\alpha = 0.05\%$ , CI = 95%

L = 5% Absolute error

Final sample size after adding 10% non-response rate, rounded off to 60.

However, our study population included 63 health care workers, who participated in the study.

### Data Collection Tools

All health care professionals from the department of Biochemistry that included Clinical Laboratory, Emergency Laboratory (24X7) and Postgraduate Laboratory, were included in the study. Permission was obtained from the Head of the Department before the initiation of the study. Informed written consent from the participants was also obtained. The

questionnaire was developed in English (for doctors and residents) and Hindi (for technicians and Group D workers), using basic questions and statements for better clarity. The answer categories were mutually exclusive and special instructions were provided where necessary, for easy understanding. A predesigned and pretested questionnaire was used to collect data and questions on knowledge and practising behaviours. Each completed questionnaire was also checked to ascertain all questions whether properly filled or not.

**Data collection and Statistical analysis**

A validated questionnaire in Hindi and English language were tools for data collection. The questionnaire consisted of two sections:

The first section included respondents' demographic information, including age, gender, education and years of service of the respondents

The second section determined their knowledge and practices about fire safety that was assessed through 10 and 9 questions each with 'Yes' and 'No' options.

All participants were given a briefing about the objective of the study and were assured confidentiality in the collection of personal data.

The data was collected using Google forms. It was tabulated and a master chart was prepared. Data collected in the questionnaire was coded and entered in Microsoft Excel Sheets and results were displayed in the form of tables and graphs. Categorical variables were presented as numbers and percentage (%), while the quantitative data with non-normal distribution were presented as median with 25th and 75th percentiles (interquartile range). The data normality was checked by using the Shapiro-Wilk test. The cases in which the data was not normal, non-parametric tests were used. The following statistical tests were applied for the results:

1. The comparison of the variables which were quantitative and not normally distributed in nature were analysed using Kruskal Wallis test followed by Dunn's multiple pairwise comparison test.
2. The comparison of the variables which were qualitative in nature were analysed using the Chi-Square test. If any cell had an expected value of less than 5 then Fisher's exact test was used.
3. The data entry was done in the Microsoft EXCEL spread sheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 27.

For statistical significance, p value of less than 0.05 was considered statistically significant.

**RESULTS**

The demographic characteristics of the study population is shown in **Table 1**. Out of 63 participants, 35 (56.6%) of them were females and 28 (44.4%) were males, while majority 34 (52.8%) were in the age of 28-37 years, followed by 16 (25%) in the age of 38-47.

**Table1: Socio-demographic characteristics of the study participants**

Characteristics	Number (n=63)	Percentage (%)
Gender		
Female	35	56.6
Male	28	44.4
Age (in years)		
18-27	5	8.3
28-37	34	52.8
38-47	16	25

48-57	8	13.9
Experience (years)		
<1	2	2.8
1-4	21	33.4
5-8	14	22.8
>9	26	41.7
Designation		
Faculty	11	17.4
Senior Resident	8	12.7
Junior Resident	8	12.8
Laboratory Technician	28	44.4
Laboratory Attendant	4	6.3
Group D workers	4	6.3

Frequency and percentage about the Knowledge questions and Practise questions shared with the health care workers regarding fire safety distribution is shown in **Table 2**. Descriptive statistics of the Knowledge score and Practice score in the form of mean ± SD is 7.94 ± 1.4 for Knowledge score and 7.24 ± 1.28 for Practice score and median of 8 and 7 respectively, calculated for 25th-75th percentile and is depicted in **Table 3 and Figure 1**.

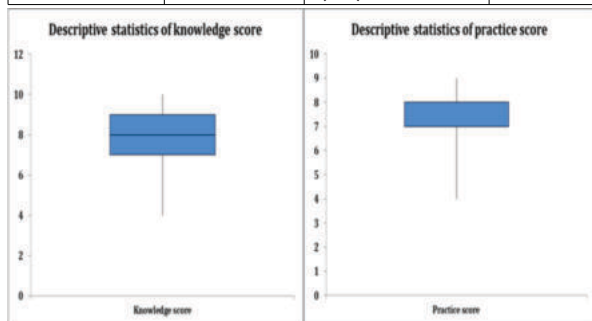
**Table 2: Knowledge & Practices amongst health care workers regarding fire safety distribution**

Knowledge amongst health care workers regarding fire safety	Frequency	Percentage
Staircase is the best means to escape in case of fire instead of elevator		
No	8	12.70%
Yes	55	87.30%
There are five types of fire as per National Fire Protection Association		
No	18	28.57%
Yes	45	71.43%
DCP fire extinguishers can be used for A, B, C class of fire		
No	28	44.44%
Yes	35	55.56%
Foam containing fire extinguishers can be used for electric fire		
No	24	38.10%
Yes	39	61.90%
Awareness of exit routes in workplace is important for every employee		
Yes	63	100.00%
Knowledge about how to evacuate patients safely during a fire emergency in your department		
No	13	20.63%
Yes	50	79.37%
Knowledge about emergency contact number in case of fire emergency		
No	13	20.63%
Yes	50	79.37%
Ever felt need for more fire safety training and drills in the workplace		
Yes	63	100.00%
Awareness of different types of fire extinguishers		
No	9	14.29%
Yes	54	85.71%
Know about important cause of death in fire accident- smoke and suffocation		
No	2	3.17%
Yes	61	96.83%
Practices amongst health care workers regarding fire safety		
Have fire alarm at workplace		
Don't know	1	1.59%
Yes	62	98.41%

Received fire safety training at your workplace		
No	24	38.10%
Yes	39	61.90%
Awareness of fire emergency procedure of institution		
No	42	66.67%
Yes	21	33.33%
Received practical training on the use of portal fire extinguishers		
No	24	38.10%
Yes	39	61.90%
Awareness of using a fire extinguisher in case of fire outbreak		
No	12	19.05%
Yes	51	80.95%
Have fire hose at workplace		
Don't know	4	6.35%
No	1	1.59%
Yes	58	92.06%
Have fire/smoke detectors at workplace		
Don't know	1	1.59%
No	2	3.17%
Yes	60	95.24%
The very first thing to do on discovering fire at workplace is to activate the fire alarm		
Yes	63	100.00%
Ever felt need of more fire safety training and drills in workplace		
Yes	63	100.00%

**Table 3: Descriptive statistics of knowledge score and practice score**

Variable	Mean ± SD	Median (25th-75th percentile)	Range
Knowledge score	7.94 ± 1.4	8(7-9)	4-10
Practice score	7.24 ± 1.28	7(7-8)	4-9



**Figure 1: Descriptive statistics of knowledge score and Practice score**

Analysis of responses about the questions in the knowledge domain and Practices amongst health care workers is shown in **Table 4**.

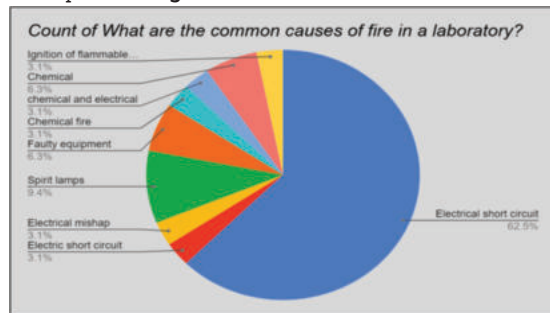
**Table 4: Analysis of responses in the Knowledge domain and Practices amongst health care workers**

VARIABLES	CORRECT RESPONSE (%)	INCORRECT RESPONSE (%)
Instead of an elevator (Lift) staircase is the best means of escape while there is a fire in a high rise building.(Yes)*	57 (90.5)	6 (9.5)
According to the National Fire Protection Association, there are five types of fire.(Yes)*	45 (71.4)	18 (28.6)
DCP fire extinguishers can be used for A, B, C class of fire.(Yes)*	35 (55.6)	28 (44.4)

Foam containing fire extinguishers can be used for electric fire.(No)*	39 (61.9)	24 (38.1)
The important cause of death in fire accidents is smoke and suffocation. (Yes)*	63 (100)	0 (0)
Awareness of exit routes in the workplace is important for every employee.(Yes)*	63 (100)	0 (0)
Do you know how to evacuate patients safely during a fire emergency in your department?	55 (87.3)	8 (12.6)
It is important to know the emergency contact number to call in case of a fire emergency in your hospital.	52 (82.5)	11 (17.4)
There is a need for more fire safety training and drills in your workplace.	63 (100)	0 (0)
You have a fire alarm at your workplace	63 (100)	0 (0)
You have received fire safety training at your workplace.	39 (61.9)	24 (38.1)
You are aware of the fire emergency procedure of your institution.	28 (44.4)	35 (55.6)
You have received practical training on the use of portal fire extinguishers.	39 (61.9)	24 (38.1)
You know how to use a fire extinguisher in case of a fire outbreak.	45 (71.4)	18 (28.6)
You have a fire hose at your workplace	63 (100)	0 (0)
You have a fire/smoke detector(s) at your workplace.	63 (100)	0 (0)
The very first thing you will do when you discover fire at your workplace is to activate the Fire Alarm.	63 (100)	0 (0)

\*Correct Response

Responses to the open-ended question in the knowledge domain about the "Common causes of fire in a laboratory" has been depicted in **Figure 2**. Responses to the open-ended question, depicting the responses of the participants about "How often should fire drills be conducted in a hospital?" has been depicted in **Figure 3**.



**Figure 2: Responses of HCWs about "Common causes of fire in a laboratory"**

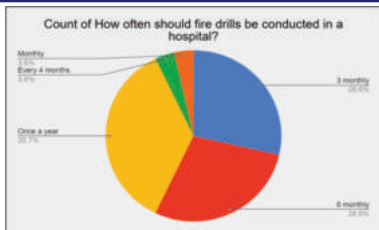


Figure 3: Responses of HCWs about “How often should fire drills be conducted in a hospital?”

All the participants felt that there is a need for more fire safety training and drills at the workplace and were aware of the location of the fire hose and fire/smoke detector’s location at the workplace. Most of them had received fire safety training at the institute and were aware of the fire emergency procedure of your institution. Majority of HCWs had also done practical training on the use of portal fire extinguishers and were aware of the fire extinguisher to be used in case of a fire outbreak. However, most of the HCWs (37.7%) were of the opinion that fire drills should be conducted in hospitals yearly, whereas 28.6% wanted that these drills should be conducted every 6 months and another 28.6% voted for them to be conducted on quarterly basis. Only a few of the HCWs (3.6%) wanted the fire safety drills to be conducted in a monthly manner and the rest 3.6% wanted them to be conducted every four months.

Comparison of Knowledge score and Practice score between Doctors, technicians and attendant/Class 4 employee is done in Table 5.

Table 5: Comparison of knowledge score between doctors, technicians and attendant/Class 4 employee.

Knowledge score	Doctors (n=27)	Technicians (n=28)	Attendants/Class 4 employee (n=8)	P value
Median (25th-75th percentile)	9(8-9)	8(7.75-9)	6(5-7)	0.0001§ Doctors vs Technicians:0.147 Doctors vs Attendants/Class 4 employee:<.0001 Technicians vs Attendants/Class 4 employee:0.001
Practice score	Doctors (n=27)	Technicians (n=28)	Attendants/Class 4 employee (n=8)	P value
Median (25th-75th percentile)	8(7-8)	7(7-8)	5(5-7.25)	0.016‡ Doctors vs Technicians:0.146 Doctors vs Attendants/Class 4 employee:0.005 Technicians vs Attendants/Class 4 employee:0.063

\*Kruskal Wallis test

Figure 4 & 5 show the comparison of knowledge score and practice score between doctors, technicians and attendant/Class 4 employee respectively.

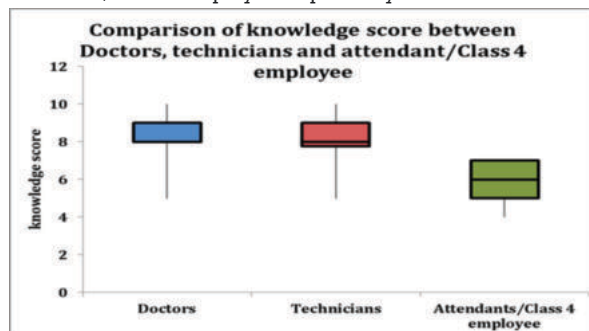


Figure 4: Comparison of Knowledge score between Doctors, technicians and attendant/Class 4 employee.

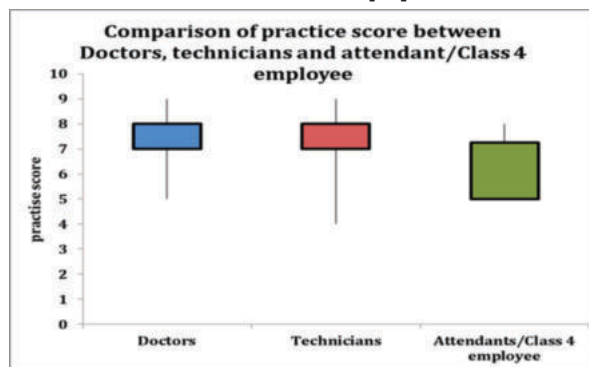


Figure 5: Comparison of Practice score between Doctors, technicians and attendant/Class 4 employee.

DISCUSSION

The present study was conducted to assess the knowledge and practices regarding fire safety among healthcare workers, in the department of biochemistry in Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi. The study participants included doctors, laboratory technicians, laboratory attendants and group IV people. A total of 63 health care workers participated in the study.

The present study revealed that the majority of healthcare workers had correct knowledge about what should be done in case of a fire outbreak in the department. Awareness about using staircase as means to escape fire was 87.30% while 79.37% knew the emergency contact number in case of fire outbreak that was in contrast to the study done by Ronoh RK et al where a large number (72%) of the respondents did not know the emergency telephone numbers to dial in order to report a fire outbreak (7). 61.9% of the total health care workers that participated in the study, had received fire safety training in the department of biochemistry and know how to use portable fire extinguishers, however 80.95% were aware of using fire extinguishers in case of a fire outbreak. This may be due to their experience apart from the institutional training. 71.43% had knowledge about the types of fire as per National Fire Protection Association and however only 55.56% knew the use of DCP fire extinguishers. Similar findings were observed in the study conducted by Ogbonna Chiom I et al that showed that workers had good knowledge about fire safety except on the types of extinguishers (8). All the participants were aware of the exit routes in the department, in case of fire and felt that there is a need for more fire safety training and drills regarding fire safety. This is similar to the study conducted by Emma M. Muindi, that showed that majority (86.5%) of their respondents expressed the need for a basic training on fire



safety preparedness but contrasted with their finding that 84% of the respondents had never been trained on fire safety preparedness, knowledge of staff on fire safety preparedness was low (7). Overall, a knowledge score of the study participants was  $7.94 \pm 1.4$  and the median of 8 while on comparing the knowledge score within the different groups, the doctors had a median of 9, technicians with the median of 8 and attendants and class 4 employees had a median of 6. There was a significant difference ( $p < 0.0001$ ) between the knowledge of doctors vs technicians. between doctors and attendants/class 4 employees and between technicians and attendants /class 4 workers. The descriptive statistics of the practice score in the present study was  $7.24 \pm 1.28$  with the median of 7 in which 92.06% of the participants were aware about the location of the fire hose in the department and 95.24% were aware about the fire/smoke detectors and 61.90% had received the practical training on the use of fire extinguishers but still 19.05% were unaware of using fire extinguishers in case of fire outbreak. This is in contrast with the study done by Ronoh RK et al in Turkana district in Kenya, in which most teachers did not know how to use fire extinguisher effectively (9). The present study revealed that 96.83% respondents knew that important cause of death in fire accident was smoke and suffocation, and 71.43% had correctly mentioned that there are five types of fire as per National Fire Protection Association.

## CONCLUSION

This assessment of knowledge and practices regarding fire safety among health care workers in the clinical laboratory of a tertiary care hospital in North India seeks to shed light on the KP of participants involved in the study. Most of the participants had significant knowledge and preparedness regarding fire safety. By identifying strengths and weaknesses, this study aims to facilitate improvements in fire safety protocols, ultimately ensuring the safety of patients, staff, and infrastructure within the clinical laboratory environment. Even though most of the participants had correct knowledge, still there is a need to conduct regular classes for fire safety preparedness. Institutions should make arrangements of fire safety equipment like smoke detectors, fire alarms and create awareness after availability of those equipment.

The outcomes of this research can contribute to the formulation of guidelines and protocols, leading to a safer and more secure environment in healthcare facilities throughout India.

## Limitations

1. The extent of KAP may be imprecise due to the limited number of questions in the questionnaire.
2. The study findings are based on data collected from a single health care facility, which might limit the generalisations of the study.
3. This study could not be assessed outside the government sector

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