

Knowledge of Operation Rooms' Staff Toward Sources, Prevention and Control of Fires at Governmental Hospitals in Sana'a, Yemen

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Abstract—Patient safety in hospitals is an essential professional indicator that should be noticed. The threat of fires is potentially the most dangerous risk that could harm patients and personnel. The aim of the study is to assess the knowledge of operating room (OR) staff toward prevention and control sources of fires. Data collection was done between March 1 and March 30, 2022. A descriptive cross-sectional study was conducted. The sample of the study consisted of 89 OR staff from different governmental hospitals. Convenient sampling was applied to select the sample size. Official approvals were obtained from selected settings for start collection data. Data were collected using a close-ended questionnaire and tested for knowledge. This study was conducted in four governmental hospitals in Sana'a, Yemen. Most of the OR staff were male. Of these, 50.6% of them were operation technician professionals. More than two-thirds of OR staff have less than ten years of experience; 93% of OR staff had inadequate knowledge of sources of fires, and inadequate knowledge toward control and prevention of fires (73%, 79.8%), respectively; 77.5% of OR staff had inadequate knowledge of prevention and control sources of fires. The study concluded that most of OR staff had inadequate knowledge of sources, controls, and prevention of fires, while 22.5% of them had adequate knowledge of prevention and control sources of fires. We recommended the implementation of training programs toward sources, controls, and prevention of fires or related workshops in their educational planning for OR staff of hospitals.

Keywords—Staff, fire source, operation room safety.

I. INTRODUCTION

ONE of the most complicated work settings in the healthcare industry is the OR, which is evident in patient-related difficulties, treatment procedures, and employing high-tech equipment [1]. A better adaption with this improvement to keep up with these increasingly quick changes and deliver a better and safer service to both patients and workers, health care systems need good management [2].

Compliance with safety regulations in the OR is necessary to protect both the patients who are having surgery and the safety of all employees working there. Through collaboration and shared accountability, everyone in this system can provide safety in the OR. Consequently, it is undoubtedly vital for the safety regulations to be updated on a regular basis [3].

OR safety may be achieved through a variety of means,

including as infection control, fire prevention, staff and patient environment safety, and infection control [4]. Fires are the most significant possible danger in the OR situations that are susceptible to safety concerns, thus they should be taken into consideration [5].

Additionally, safety concerns related to fires are both an ethical and legal concern because any harm caused by fires to patients or staff necessitates not only legal action but also expensive costs to cover damages, blood money (restitution), staff disability costs from injuries, and the cost of replacing damaged equipment [6], [7].

Hospital administrators in the United States believe that there are around 100 fires in their hospitals ORs each year, with an average of 10 to 20 cases resulting in severe injuries and 1-2 instances resulting in fatalities [8]. To start a fire, certain circumstances and components are necessary, such as combustible substances, fire or heat, and oxygen. Normally, it would not be harmful if these three things were kept apart from one another. The likelihood of any incident is uncertain in the OR, though. It could catch fire if two of the three components get close to one another for any reason [9]. Unfortunately, the necessity of OR fire safety is still not well acknowledged [10]. That might be due to misconceptions of the authorities on the low probability of incident such as fires in a hospital OR therefore, every staff member of the OR should exercise additional caution and there must be effective collaboration and knowledge among all staff to avoid fires while doing surgery [11], [12].

OR fires are rare but may be disastrous. Almost any surgical operation can result in these fires, but airway surgery, head and neck surgery, and the use of volatile flammable chemicals increase the risk. Each team in the OR, including anesthesia, surgery, and nursing, is uniquely qualified to avoid and handle a fire. Continuous training and an interdisciplinary discussion of risks and duties before each high-risk situation can help avert fires [13].

The operation theater is one of the most important areas in hospital where all the surgeries are undertaken. The Emergency Care Research Institute (ECRI) reported in 2013 that 650 cases of surgical fire are seen every year. The same institute

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considered surgical fires to be one of the 10 leading technological dangers for patients and staff [14].

According to related research by Thompson et al., the majority of hospital employees, particularly those working in an OR, lacks expertise of fire prevention and control [7]. In research regarding staff knowledge in Shiraz hospitals by Davoodiantalab et al., it was discovered that almost 50% of employees did not have enough understanding about fire management [9].

Justifications of the Study

Safety in the OR may be addressed by a team effort where everyone in this system takes responsibility. Fires in the OR are one of the most dangerous occurrences that can have disastrous results. Therefore, it is unquestionably important to update the safety regulations on a regular basis. Infection control, fire prevention, staff and patient environment safety, and other topics may all be investigated from the perspective of OR safety. Fires are the most significant potential threat that should be recognized among all situations involving safety difficulties in the OR. Further injuries and damage can be averted if the OR staff is sufficiently knowledgeable about fire origins, preventative strategies, and suppression techniques [15].

The safety standards must be taken in order to work in a safe environment and maintain safety of patients and staff. The staff knowledge about the prevention and control of fire is an essential since they play an important role in the safety of the OR. Some hospitals have conducted fire-combatting training for staff. The study therefore is an attempt to assess the knowledge of OR staff toward prevention, and control sources of fires at Governmental Hospitals in Sana'a, Yemen.

II. RESEARCH METHODOLOGY

A descriptive cross-sectional study was conducted among ORs in Governmental Hospitals in the city of Sana'a in 2022. The sample consisted of 89 employees (11.2% consultant anesthesiologist, 33.7% anesthesiology resident, 4.5% anesthesia technician, and 50.6% operation technician) from four hospitals (Al-Kuwait University Hospital, Al-Thawra General Hospital Authority, Republican Teaching Hospital Authority, and Palestine Maternity & Child Hospital) because these hospitals are the biggest, referral hospitals for patients and have many operation therapy rooms. In this study, all OR personnel were investigated using convenient sampling method. Fire sources, prevention, and control questionnaires were used to collect information, adopted from [16], [17]. A close-ended questionnaire with an information letter and consent form attached was handed to participants by the researchers. This questionnaire consists of two parts. The first part gathered socio-demographic characteristics including: age, sex, marital status, profession, and years of experience, while second part consisted of a knowledge questionnaire to assess the OR staff knowledge concerning prevention, and control sources of fires in the deferent department. The staff knowledge was categorized into nine items, covered by 16 questions, including the following: knowledge of OR staff toward sources of fires (seven questions), knowledge of OR staff toward

prevention of fires (six questions), and knowledge of OR staff toward controlling sources of fires (three questions). The scoring system of the OR staff knowledge questionnaire was done as follows: Each correct answer scored one point and each incorrect answer scored a zero. The total score was computed out of a total score of 45. According to the OR staff responses, their level of knowledge is categorized as the following: adequate knowledge with total score between 34-45 scores (>75%), and ($\geq 75\%$) inadequate knowledge with total score between 0-33 scores.

The validity of the English and Arabic versions of the questionnaire was reviewed by three experts of academic staff in operation and specialist in surgery field. The reliability of the questionnaire was tested by using Cronbach's alpha (Cronbach's alpha = 0.925). The questionnaire was piloted by eight OR staff working in the study setting prior to data collection. Only minor changes were made to the instrument's layout and presentation. The pre-test results were excluded from the final study sample.

The questionnaire was prepared in English and then translated into Arabic using a translation and back-translation process by two specialists. All OR staff were given the choice to receive either an Arabic or English version of the questionnaire to fill out. In case any questions were unclear to the participants, the researchers provided explanations and clarifications.

The questionnaires were completed in the presence of the researcher and participants were free to ask any questions or clarifications. Data were collected over a period of one month from March 1 and March 30, 2022. The questionnaire was completed during working hours (rest time); verbal consent forms and completed questionnaires were coded by the researcher and taken from each unit daily. All the collected data have been checked by the researcher daily for completeness. SPSS V.24.0 was used for statistical analysis of the data. Descriptive statistics was used to interpret descriptive measures including demographic data, frequency, percentage of categorical variables, and mean and standard deviation of numerical variables. The chi-square test was used to determine the association between total knowledge and demographic characteristics. A P-value ≤ 0.05 was considered significant for categorical data.

Ethical Considerations

Approval for the research was obtained before carrying out this study from the ethical committee of the Al-Razi University, as well as the managers of hospitals where the research was conducted. Informed oral consent was obtained from the participants, and confidentiality and privacy were ensured for all information provided. Anonymity was also guaranteed for each participant. The purpose and objectives of the study were explained to all study participants, and they were informed of their right to withdraw at any time.

III. RESULTS

Table I shows the distribution of demographic characteristics of OR staff. The majority were male (66%), belonged to the age group of 20-30 years (65.2%) with a mean age of 30.07 ± 7.612

years. In terms of years of experience, over two-thirds of OR staff had less than 10 years of experience (74.2%).

TABLE I
DISTRIBUTION OF OPERATION ROOM STAFF ACCORDING TO DEMOGRAPHICAL CHARACTERISTICS (N = 89)

Items	No.	%
Age group:		
20-30 years	58	65.2%
31-40 years	21	23.6%
41-50 years	9	10.1%
> 50 years	1	1.1%
Sex:		
Male	59	66.3%
Female	30	33.7%
Years' experience:		
Less than 10 years	66	74.2%
10-20 years	19	21.3%
More than 20 years	4	4.5%

TABLE II
LEVEL AND MEAN SCORE OF KNOWLEDGE OR STAFF TOWARD SOURCES, PREVENTION, AND CONTROL OF FIRES (N = 89)

Variable	Adequate knowledge F/(%)	Inadequate knowledge F/(%)	Mean \pm S.D
Sources of fires	6 (6.7)	83 (93.3)	5.15 \pm 2.50
Prevents of fires	18 (20.2)	71 (79.8)	8.57 \pm 4.93
Controls of fires	24 (27.0)	65 (73.0)	7.17 \pm 4.25

Table II indicates that the majority of OR staff had inadequate knowledge towards sources of fires (93.3%) and prevention of fires (80%), while over two-thirds of OR staff (73%) had inadequate knowledge towards controls of fires.

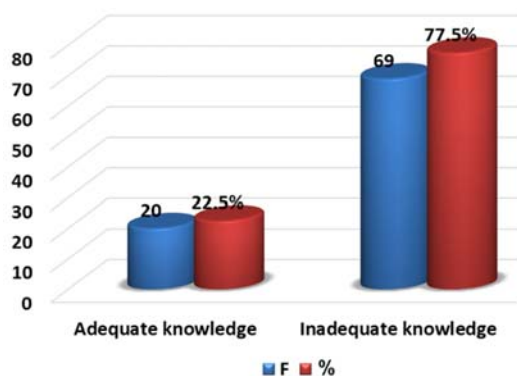


Fig. 1 Total knowledge level of OR staff toward sources, prevention, and control of fires (n = 89)

Fig. 1 shows that the majority of OR staff (77.5%) had inadequate knowledge toward prevention, and control sources of fires, while 22.5% had adequate knowledge toward prevention, and control sources of fires, with mean score 7.17 ± 4.25 .

There was no statistically significant difference between total knowledge level toward prevention, and control sources of fires with demographic characteristics of OR staff with regard to age, sex, and profession (p -value > 0.05). But there is a statistically significant difference between knowledge level of OR staff and

years' experience (p -value = 0.014).

IV. DISCUSSION

Fire is one of the most dreaded and devastating accidents that can happen to any member of the OR team, as well as a potentially catastrophic event for surgery patients, during a surgical procedure. The aim of the present study was to assess the knowledge of OR staff toward sources, prevention, and control of fires. In regard to the demographical data, most of the participants were male and aged between 20-30 years (65.2% with mean a 30.07). The scrub nurse profession was half distribution among OR staff 50.6%. More than two third of OR staff less than 10 years of work experience (74.2%).

Our results agree with Jalali et al., who found that, the job tenure was less than 10 years [17]. On other hand, the present results disagree with Hannani et al., who reported that the mean age of participants was 28.90 years [19]. Moreover, Gong et al. mentioned that the median age of most respondents was 30 years, and 30.71% of staff had been working in the OR center for over 10 years [20]. Jalali et al. found that, 63% were female and belonged to the age group 31-40 years. The highest employment rate at 36.6% was for OR technicians [17]. As for the level of knowledge of OR staff towards sources and prevention of fires, the study results showed that the majority of OR staff had inadequate knowledge in this area. This finding is consistent with the study conducted by Jalali et al., who found that two-thirds (66%) of participants had an inadequate level of knowledge about fires and its sources and prevention [17]. The present study results show that, 73% of OR staff had inadequate knowledge toward controls of fires; a similar study by Yeturu et al. reported that very few participants knew the way to use fire control measures in case of fire accident [21]. Furthermore, Jalali et al. found that, most (70%) of participants had an inadequate level of knowledge about methods of fire control [17]. The present study is in contrast with Davoodiantalab et al., who found that 76% of the participants had full knowledge of fire control methods [9].

As for the total level of knowledge of staff towards prevention and control of sources of fires, the present study results showed that 77.5% of OR staff had inadequate knowledge towards controlling fires. It is possible that lack of continuous training and education in the field of fire prevention contributed to the inadequate knowledge level among the OR staff. Additionally, the fact that most of the participants had a technical education level may have also played a role in their limited knowledge of fire prevention and control. It is important for hospitals and healthcare facilities to provide regular training and education on fire safety to all staff members, especially those working in high-risk areas such as ORs. Our results are consistent with those of Davudian et al., who reported that more than half of OR personnel had a low level of knowledge in pre-intervention training regarding fire prevention [22]. On the same note, Abdul Rahim et al. reported that the respondents had low levels of awareness, which reflected in their poor actions when facing emergency situations, such as fires [23]. Davoodiantalab et al. reported that more than half (59.03%) of the participants had knowledge on fire prevention methods

before the intervention, while 40.97% had no knowledge [9]. Talab et al. indicate that knowledge about fire prevention methods between OR personnel is low and that their safety is not satisfied [24]. Hossein et al. concluded that the majority of OR staff is not aware of the sources of fire and its prevention methods in the OR [18].

Our results are in agreement with Aygin et al., who determined that the OR staff have a moderate level of knowledge of surgical fires [25]. Cho et al. demonstrate that training nurses is imperative to increase the safety of patients and to prevent fire accidents. In addition, information related to continuing professional education and exploring values training is suggested to improve patient safety awareness [26].

As regard to association between demographic characteristics of OR staff and knowledge level toward prevention, and control sources of fires, there was a statistically significant difference between knowledge level of OR staff and years of experience (p -value = 0.014). The study is similar to Jalali et al., who indicated that factors such as job tenure can have an impact on the level of knowledge ($P < 0.05$) [17]. Furthermore, Davoodiantalab et al., suggested that there was a significant relationship between the awareness of OR personnel to fire control methods and work experience [9]. The present study demonstrated that there was no statistically significant difference between total knowledge level toward prevention, and control sources of fires and demographic characteristics of OR staff with regard to age, sex, and profession (p -value > 0.05).

V. CONCLUSION AND RECOMMENDATION

We conclude that, the majority of OR staff have inadequate knowledge toward sources of fires, and 79.8% of them have inadequate knowledge toward prevention of fires. More than two thirds of OR staff have inadequate knowledge toward controls of fires. Finally, the majority of OR staff (77.5%) have inadequate knowledge, while 22.5% have adequate knowledge toward prevention, and control sources of fires. There was a statistically significant difference between knowledge level of OR staff and years' experience. We recommended that the authorities include:

1. All hospital staff should be aware of their responsibility toward their profession, patients, equipment, and environment.
2. Training programs for operating room staff on the risks and precautions toward fire, these training programs need to be repeated at regular intervals and evaluated

Conflicts of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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