International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 15; Issue: 4; April 2025
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effectiveness of Training on Awareness and Knowledge about Hospital Emergency Codes among the Security Personnel in a Tertiary Care Hospital: A Cross-Sectional Study

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DOI: https://doi.org/10.52403/ijhsr.20250438

ABSTRACT

Background: Emergency codes are standardized alert systems used by healthcare institutions to communicate specific types of emergencies quickly and effectively. These codes help ensure a coordinated response from medical and non-medical staff, promoting the safety and well-being of patients, visitors, and healthcare workers.
Aim and Objectives: This study aims to assess the effectiveness of training on the awareness of hospital emergency codes among hospital security guards.
Materials and methods: A cross-sectional study was conducted on all security guards deployed in the Hospital to assess their awareness and knowledge about hospital emergency codes. A pre-tested structured questionnaire with a Cronbach's Alpha score of 0.88 was used to collect the data. The questions pertained to knowledge and awareness of emergency codes, viz. Code Blue, Code Pink, Code Violet, and Code Red. The data thus collected was analyzed in the data analysis tool in MS Excel and SPSS IBM Version 20.0.
Results: A total of 90 questionnaires were analyzed in cycle 1(Pre-training phase) and cycle 2 (Post-training phase). In Cycle 1, the average score obtained by the participants was 12.6 ± 2.6 SD, with an overall awareness of 66.7 %. In Cycle 2, the mean score was 15.5 ± 2.3 SD with an overall awareness of 80.8 %. This suggests that the interventions implemented between the two cycles effectively improved awareness levels, with a statistically significant P value = 0.00003 (< 0.05).

Keywords: Awareness, Effectiveness, Emergency codes, Knowledge, Training,

INTRODUCTION

An emergency is also defined as any incident, caused by humans or a natural event, which requires an effective, responsive action to protect life or property. Hospitals often face emergencies, and to ensure safety and quick responses, they use standardized emergency codes, which are color-coded signals used to communicate the type of emergency or critical situation. [1] As the WHO puts it in its guide to mass casualty management systems, "The invariably cited problem in disaster management is the breakdown in communications, and decision-making gets seriously affected due to delayed or lost vital information. [2] The 2022 Hospital Accreditation Standards from the Joint Commission (TJC) state that each facility must possess a communications plan that accounts "for the rapid evolution of an emergency or disaster and the need to provide consistently clear information regarding the emergency and the hospital's ability to provide services both internally and externally". [3]

Emergency codes were developed to alert relevant healthcare personnel in a hospital to a critical situation while not alarming patients and visitors. These codes are often broadcast over the hospital's public address system, alerting specific teams discretely to mobilize expert assistance to take immediate action. Based on their training, whenever a code is called, the healthcare professionals respond swiftly and efficiently to the situation. [4, 5] The use of codes is intended to convey essential information/communication quickly with a minimum of misunderstanding to the hospital staff while preventing stress or panic among visitors of the hospital. [6] Emergency codes minimize confusion, prevent panic, and ensure that the appropriate professionals handle each type of emergency. When these codes are developed independently by hospitals, there is variability between hospitals. This practice has been confusing at critical moments for healthcare personnel. [7-11]

Healthcare workers move frequently between hospitals and may work at multiple hospitals. Single color codes have diverse meanings in different hospitals. This could adversely affect hospitals' efficient and effective emergency response. [12] Standardized emergency codes are essential to identify a risk or emergency within any facility. An emergency code notifies an event that requires immediate action. Hospitals are the most common institutions that use color codes to designate emergencies because hospitals/health-care organizations house patients and are vulnerable to mishaps such as fire, earthquake, floods, violence, and epidemic outbreaks. [13]

The low code identification accuracy suggests that healthcare employees may have limited awareness of ongoing emergencies. [14] Emergency code awareness is necessary to improve the response capability of hospital employees. Hence, hospital/hospital employees must be prepared to deal efficiently and effectively with different emergencies that may arise. Hospital employees, including doctors, should undergo extensive training to respond to each of these events, allowing them to save lives. [15]

Most code systems use color-based codes (e.g., "Code Red" for a fire), predicated on the idea that colors are easier to remember and serve as a tool to increase encoding among a target audience. [16] However, due to factors such as age, education, culture, and geographic area, individuals often associate specific colors with specific images that may not be universal. [17-19] This likely explains why colors that have less culturally ingrained meanings, such as black, silver, purple, or orange, are used for a broader range of emergencies, while colors such as red and pink are nearly universally used for fire and pediatric incidents. [20] Healthcare employees consider the lack of consistency in codes a barrier to providing high-quality patient care. [21]

An effective emergency alert must accomplish four goals: (1) reach the target audience; (2) capture the attention of the target audience; (3) ensure comprehension of the risk and necessary actions; and (4) lead the audience to respond appropriately. [22] By increasing awareness and understanding of hospital emergency codes, the staff, patients, and visitors can be empowered to act swiftly and effectively in times of crisis.

This study aimed to assess the hospital's efficacy of color-code emergency alert systems. The main objective was to determine the ability of security employees to identify their facility's emergency codes correctly. Secondary objectives included assessing the effectiveness of training in improving awareness of these codes.

MATERIALS AND METHODS

Study Design: An observational, cross-sectional study.

Study setting and location: The study was conducted among security personnel at a Tertiary Care Teaching Hospital in North India.

Study duration: Three months.

Sample size: All the security guards posted to the Main Hospital and Cancer Research Institute/wing (CRI) were included in this study.

Sample procedure: Out of a total of 100 security guards, 10 were involved in the pilot study and 90 were included in the first and the second cycle of the study.

Ethical clearance: As the study involved only the administrative staff of the hospital, approval for the study was accorded by the Chief Medical Superintendent vide letter No. HH/MS/421/2023/08.

Inclusion criteria: All security guards employed in the main hospital and CRI were included.

Exclusion criteria: Those who participated in the pilot study (n=10) and individuals who became part of the hospital one week before the study commencement and had not been part of any awareness program were excluded from the research (n=14).

Data collection: The primary data collection tool for this study was a structured, closed-ended questionnaire. The questionnaire was developed based on NABH policies for emergency codes and was validated by experts to ensure content validity. The questionnaire consisted of two sections: (a) Socio-demographic profile, education status, and awareness of Hospital Emergency Numbers, and (b) a Section related to questions addressing specific aspects of knowledge and awareness regarding Hospital Emergency codes. This questionnaire consisted of 20 questions. Each correct answer was given one mark, and the wrong answer was marked zero. A score of less than eight marks (40%) was considered 'poor', a score between 9-12 (41-60%) was considered 'average', a score between 13-15(61-75%) was considered 'Good' and a score of more than 15 (>75%) was considered as 'Excellent'.

The most commonly used Emergency response color codes that were analysed during this study included:

- Code Blue: Common reasons for activating code blue include cardiac arrest, like a heart attack or dangerous arrhythmia, and respiratory arrest.
- Code Red: Code Red indicates a fire occurring in the hospital. Any staff member who sees or smells smoke may activate Code Red.
- Code Pink: Code Pink indicates a missing infant/child in the hospital.
- Code Violet: Code violet is used to denote a violent patient/attendant. The code provides an appropriate response to situations involving an aggressive, hostile, or combative person toward hospital employees

To further ensure the reliability and validity of the questionnaires, a pilot study was conducted with a small group of security guards (n=10). The results of the pilot study were used to reframe the wording and clarity of the questions for better

understanding. Cronbach's Alpha was calculated to be 0.88, indicating good internal consistency. In the first cycle, the pre-intervention questionnaire was administered, and data was collected to assess the awareness levels among the study participants. Subsequently, the training phase was implemented, focusing on imparting training on hospital security codes. Post-training surveys were then conducted to evaluate the effectiveness of the training and assess any changes in awareness levels among the study participants.

STATISTICAL ANALYSIS:

The collected data was entered into Microsoft Excel 2013, and IBM SPSS version 20.0 was used for further analysis. The confidentiality of participant data was ensured. For analysis, a paired t-test was used to assess the study means for the pre- and post-intervention periods. We went ahead with the null hypothesis that there is no difference in the awareness of hospital emergency codes among security guards between the first and second cycles. Before conducting the test, we ensured that the data met the assumptions of normality and homogeneity of variances. Descriptive statistics was calculated to summarize the variables in each period, followed by the paired t-test to determine if there is a statistically significant difference in means between the pre- and post-intervention periods, using a statistical significance level of $p < 0.05$ for hypothesis testing.

RESULTS

Socio-demographic characteristics:

A total of 90 security guards participated in this study. Out of which 76 were from the main hospital building and 14 were from the CRI building. Of the 90 participants, 24 (26.7%) were in the age group of 25-35 years, 32 (35.6%) were 36-45 years, and 34 (37.7%) were more than 45 years old. The proportion of males, 72 (80%), was higher than females, 18(20%). Among the total study participants 46(51%) were 10^{th} pass, 32(36%) were 12^{th} pass and 12(13%) were graduates. The details are shown in Table 1.

Table 1: Socio-demographic Profile (n=90)

Variables		Study participants		
		Main Hospital (n=76)	CRI (n=14)	Total (n=90)
Age (Years)	25-35	19 (25%)	5 (36%)	24(26.7%)
	36-45	29 (38%)	3 (21%)	32(35.6%)
	>45	28 (37%)	6 (43%)	34(37.7%)
Gender	Male	59 (78%)	13 (93%)	72(80%)
	Female	17 (22%)	1 (7%)	18(20%)
Education	10^{th} Pass	38 (50%)	8 (57%)	46(51.1%)
	12^{th} Pass	28 (37%)	4 (29%)	32(35.6%)
	Graduate	10 (13%)	2 (14%)	12(13.3%)

Awareness of emergency codes by age group

In Cycle 1(Before imparting training), the average score obtained by the participants was 12.6 ± 2.6 SD, with an overall awareness of 66.7 %. The awareness levels were 54% in the 25-35 age group, 61% in the 35-45 age group, and 60% in the 45 or older age group. In Cycle 2 (After training), the mean score was 15.5 ± 2.3 SD with an overall awareness of 80.8 %. The awareness levels improved to 74%, 78%, and 77 % in 25-35, 36-45, and > 45, respectively. This suggests that the interventions implemented between the two cycles effectively improved awareness levels, with the largest improvement in the age group of 25-35. It had a positive correlation with Pearson r = 0.15 and a statistically significant P value = 0.00003 (< 0.05). The same is depicted graphically in Figure 1.

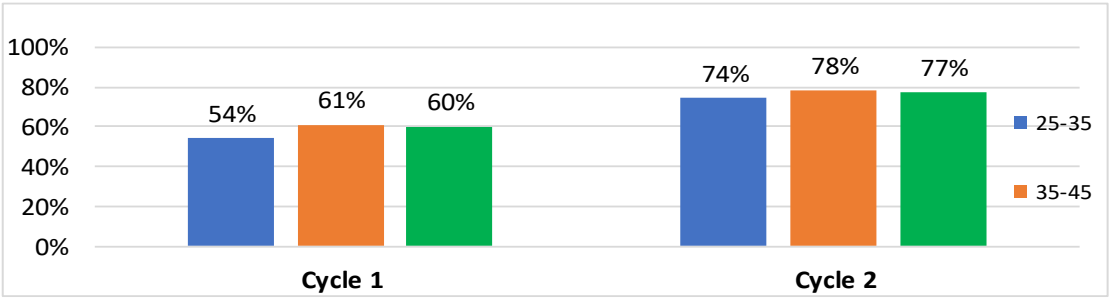

Figure 1: Awareness level in age groups

Awareness of emergency codes as per Gender

In Cycle 1, the awareness level of emergency codes among females was 61%, while in Cycle 2, this increased to 80% with a statistically significant p-value = 0.002(< 0.05). Similarly, for males, the awareness level was 67% and 77 % in Cycles 1 and 2, respectively. It is important to note that females had a larger increase in awareness compared to males between the two cycles. It revealed a positive correlation r = 0.27 and a statistically significant p-value = 0.000001(< 0.05). The same is illustrated graphically in Figure 2.

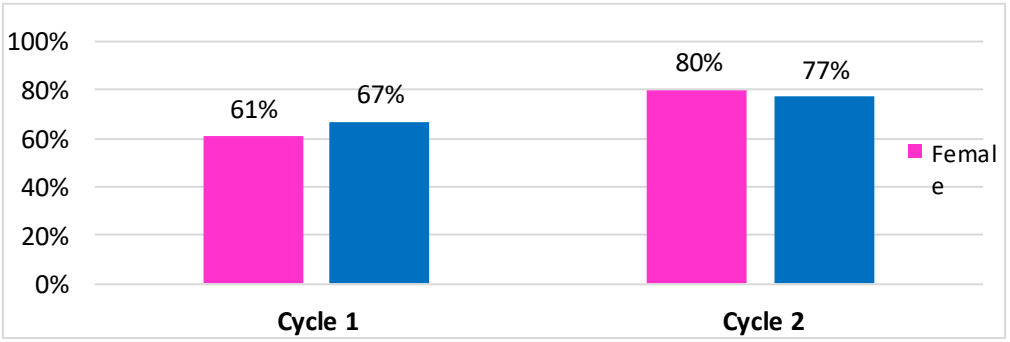

Figure 2: Awareness between Females and Males

Awareness among individuals with different education levels

Figure 3 indicates awareness among individuals with different education levels in both cycles. In Cycle 1, the awareness score was 56% for 10th Pass individuals, 62% for 12th Pass individuals, and 59% for Graduates. In Cycle 2, this awareness score improved to 74%, 82%, and 77%, respectively. The correlation analysis between Cycles 1 and 2 by education levels revealed a positive correlation with r = 0.15 and a statistically significant p-value = 0.00001 (< 0.05), thereby suggesting that education level significantly improved awareness in this study.

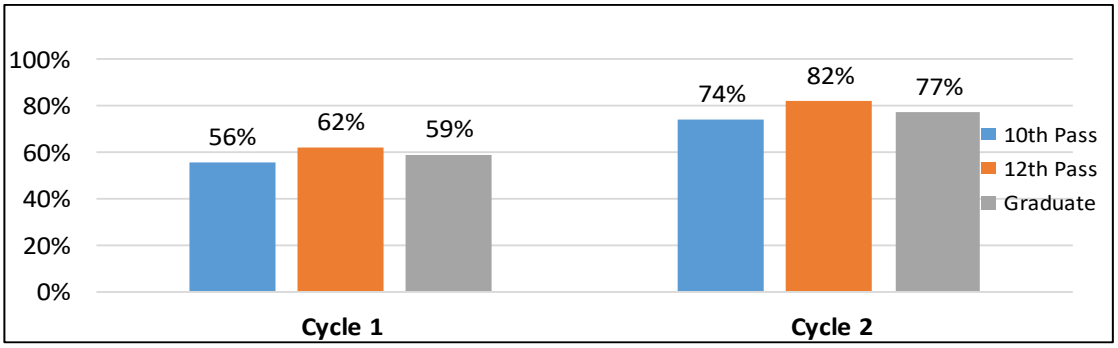

Figure 3: Awareness by education levels

Awareness of hospital emergency desk numbers among security staff

Security staff should be aware of the hospital emergency desk telephone number (No. 111 for this hospital) for intimating emergencies of any nature. In Cycle 1, 83% of individuals were aware of the hospital emergency number, while 17% were unaware of the same. However, in Cycle 2, the awareness level increased to 100%.

Awareness of hospital emergency codes among Security Guards Pre and post-intervention

In Cycle 1, the overall awareness was 66.7%. However, this increased to 80.8% in Cycle 2. This suggests that the interventions implemented between the two cycles were effective in improving awareness levels for emergency codes.

The correlation analysis of awareness between Cycle 1 and Cycle 2 revealed a positive correlation and a statistically significant p-value ($r = 0.28$, $P < 0.00001$), thus suggesting that imparting training significantly enhanced the awareness of emergency codes in the security staff. A comparative tabular representation of the number of participants with correct responses to the questionnaire concerning hospital emergency codes pre and post-intervention is depicted in Table 2.

Table 2- Participants with correct responses pre and post-intervention (n=90)

Hospital Emergency codes	**Pre-Training (Participants with Correct responses)**	**Post-Training (Participants with Correct responses)**
Code Blue	49(54%)	71(79%)
Code violet	68(76%)	76(84%)
Code Pink	56(62%)	67(74%)
Code Red	65(72%)	77(85%)
Average	60 (66.7%)	73 (80.8%)

The mean score of the participants before the conduct of training sessions was 12.6 ± 2.6 SD. After imparting training on the hospital security codes, the mean score obtained by the participants improved to 15.5 ± 2.3 SD. The variables of mean, median, mode, minimum score, and maximum score obtained by the participants in cycles 1 and 2 were calculated, and the results are summarised in Table 3.

Table 3: Descriptive Statistics (n=90)

Statistical analysis	***Cycle 1(Pre-Trg)***	**Cycle 2 (Post Trg)**
Mean score	12.6	15.5
Standard deviation	2.6	2.3
Median	13	16.0
Mode	13	17.0
Minimum	0	7.0
Maximum	18	19.0
Sum	1138	1391.0
Total participants	90	90.0

The marks obtained by the participants on the questionnaire before and after the training were also analysed. It was observed that during Pre-training, the majority of the participants, 40 (44%), had an 'average' score, and only 11(12%) obtained an 'Excellent' score. However, after the training, only 8(9%) remained in the 'Average' category and 46 (51%) upgraded to 'Excellent'. The details are summarized in Table 4.

Table 4- Grades obtained by Participants (n=90)

	Cycle 1 (Pre Trg)		Cycle 2 (Post Trg)	
Grades	**Participants**	**%**	**Participants**	**%**
Poor	2	2%	1	1%
Average	40	44%	8	9%
Good	37	41%	35	39%
Excellent	11	12%	46	51%
TOTAL	90	100%	90	100%

DISCUSSION

In our study, out of the 90 participants, the highest number of 34 (37.7%) were in the age group of > 45 years. The minimum percentage of 26.7% was in the age group of 25-35 years. The proportion of males, 72 (80%), was higher than females, 18(20%). The age group of the participants of our study corresponds with the study findings conducted by Bhushan V W et al. which revealed that the maximum percentage (40%) belonged to the age group of 36- 55 years, while the minimum percentage (18%) belonged to the age group of 18-25 years. However, our study findings are in variance with the gender findings of the study, where among the participants, 25% were male and 75% were female. [23]

The mean score of the participants before imparting the training was 12.8 ± 2.6 SD. It was observed that 40 (44%) participants had average, 37 (41%) had good, and 11 (12%) had excellent knowledge regarding emergency codes. This differs from the study findings of Saxena D et al., which revealed that the mean score of all participants was 11.71 ± 2.72 SD. Their study findings brought out that 75.2% (91) had average and 14.9% (18) had good knowledge and awareness regarding emergency codes. [24]

Our study revealed that 83 % of the participants were aware of the process of activating a hospital emergency code, while 17% were unaware or had no knowledge. These findings align with the study findings of Ghanaatpisheh E et al., which showed that 80% of participants had good knowledge, while 20% had a moderate level of expertise. [25]

Our study findings showed that post-training, 46 (51%) participants had excellent, 35 (39%) had good, 8 (9%) had average, and 1 (1%) had poor knowledge of emergency codes. This differs from the study conducted by Mapp A. et al. in Washington, which found that 92% of participants had an excellent level of knowledge, while 8% had moderate knowledge. [21]

Based on the findings and observations of the study, the following recommendations were made to the hospital administration authorities:

1. Organize training programs in continuity to enable the training of hospital employees working in all three shifts.
2. Analysis of Corrective Action Preventive Action (CAPA) must be done, and actions must be modified accordingly.
3. Organize surprise mock drills at frequent intervals.

Limitation(s)

As the study was conducted only on the security personnel, it was not feasible to impart training on all hospital security codes like code brown, code orange, code yellow, etc.

CONCLUSION(S)

Emergency codes in hospitals play a vital role in ensuring that hospitals are well-prepared to handle a wide range of emergencies, thus saving lives and maintaining order. These codes ensure staff preparedness, patient safety, and compliance with National healthcare standards. In the present study, the overall awareness, which was 66.7 % in cycle 1, increased to 80.8% in cycle 2. The mean score of the participants before the conduct of training sessions was 12.6 ± 2.6 SD. After imparting

training on the hospital security codes, the mean score obtained by the participants improved to 15.5 ± 2.3 SD. Proper training and knowledge provided to healthcare workers will prove to be immensely beneficial in tackling the hospital emergency codes efficiently. As healthcare increasingly relies on technology, focusing on robust security measures is essential for providing the highest standards of patient care.

Declaration by Authors

Human Subjects: Human consent was obtained.
Animal Subjects: Nil.
Acknowledgement: None
Source of Funding: Nil
Conflict of Interest: Nil

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How to cite this article: Himadri Mamgain, Dinesh Chandra Joshi, Vaibhav Badoni, Ravinder Singh Saini. Effectiveness of training on awareness and knowledge about hospital emergency codes among the security personnel in a tertiary care hospital: a cross-sectional study. *Int J Health Sci Res.* 2025; 15(4):263-271. DOI: *10.52403/ijhsr.20250438*

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