

Knowledge of Emergency Colour Codes among Healthcare Workers in a Tertiary Care Hospital of Wardha, Maharashtra, India: A Cross-sectional Study

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ABSTRACT

Introduction: An emergency refers to any crisis caused by humans or natural disasters that requires prompt and effective action to protect life and property. Consequently, a well-coordinated and carefully planned emergency response is crucial. Medical emergency codes are utilised globally to alert hospital staff about various emergencies.

Aim: To assess the knowledge of healthcare workers regarding emergency colour codes in a tertiary care hospital. Additionally, it aims to develop standardised operating procedures and policies based on these codes and provide guidance on their implementation in hospitals for different emergency situations.

Materials and Methods: This cross-sectional study was conducted at Jawaharlal Nehru Medical College, Wardha, Maharashtra, India, from December 2021 to May 2022. A total of 100 healthcare workers aged >18 years, employed at a tertiary care hospital, were included in the study. A survey was conducted using a structured questionnaire to assess the knowledge of the participants. The questionnaire consisted of two sections: the first section collected demographic information such as age, gender, qualifications, and profession, while the second section consisted of nine items to evaluate knowledge related to the role of emergency response codes

in managing hospital emergencies. Descriptive statistics, including percentages and frequencies, were used to present the results.

Results: In the present study, out of 100 study subjects, 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. Among the participants, 25% were male and 75% were female. A significant proportion (92.7%) of the population demonstrated knowledge of the codes for handling hospital emergencies. Specifically, 98% of participants were familiar with the use of code red for fire emergencies, and 88% understood the process of activating code red. All participants had a basic understanding that code blue is used for cardiac arrest, and 85% had knowledge of paediatric emergency codes. Additionally, 96% were aware of the indications for Cardiopulmonary Resuscitation (CPR), and 100% knew the abbreviation for CPR.

Conclusion: The present study revealed that 96% of the population had good knowledge, while 4% had average knowledge regarding the codes for handling hospital emergencies. Implementing standardised operating procedures and ensuring staff awareness of all emergency response codes used in the hospital are recommended.

Keywords: Colour coding, Emergency crisis, Public health, Safety protocol

INTRODUCTION

An emergency is a situation that requires immediate and effective action to protect life or property, whether caused by humans or natural disasters. Therefore, it is crucial to have a well-coordinated and well-planned emergency response. Medical emergency codes are used globally to alert hospital staff about different crises. The purpose of using codes is to quickly convey essential information to staff members with minimal ambiguity and to reduce fear and panic among hospital visitors [1].

Clear communication is vital for providing high-quality patient care and maintaining a safe environment for patients, visitors, and hospital personnel. In emergencies where time is critical, prompt and appropriate communication followed by coordinated actions are crucial [2]. Hospital emergency codes often utilise colours to improve response time and avoid confusion. By standardising and implementing colour codes, healthcare organisations can quickly notify staff members about specific medical emergency situations, enabling them to respond accordingly in a planned manner. Additionally, colour coding has been shown to reduce common errors in diagnosis or treatment and enhance institutional awareness of various health-related aspects [3].

To address safety and security issues in healthcare facilities, the Hospital Association of Southern California (HASC) established a

Safety and Security Committee in December 1999 [4]. Comprising experts in safety, security, licensing, and accreditation from member hospitals, the committee aimed to promote healthcare facility safety. One of the primary issues addressed by the committee was the lack of standardisation in emergency code systems used by different healthcare facilities. Implementing a universal code enables personnel working across multiple locations to respond appropriately to specific emergencies, enhancing their safety and protecting patients and visitors. To aid in code conformity, the organisation developed standardised universal codes and guidelines that all healthcare facilities can utilise [4].

There is limited data available regarding the knowledge of emergency colour codes among healthcare workers in India. Therefore, the present study was conducted to evaluate the knowledge of healthcare workers regarding emergency colour codes in a tertiary care hospital in Wardha, Maharashtra, India. The study also aims to establish codes-based standard operating procedures and policies and provide guidance on their implementation in hospitals for various emergency situations.

MATERIALS AND METHODS

A cross-sectional study was conducted at Jawaharlal Nehru Medical College, Wardha, Maharashtra, India, over a period of

six months from December 2021 to May 2022. The study protocol was evaluated and approved by the Datta Meghe Institute of Medical Science, a Deemed to be University, (DMIMS DU) with the Institutional Ethics Committee (IEC) number IEC/JAN-2022/1295. Written informed consent was obtained from each participant after explaining the purpose and objectives of the study. Participants were assured of confidentiality and privacy.

Inclusion criteria: Healthcare workers aged >18 years working in tertiary care hospitals were included in the study.

Exclusion criteria: Interns, allied health science students, and class four workers were excluded from the study.

Sample size: The sample for this study comprised 100 healthcare workers employed in tertiary care hospitals in central India. The sample size was calculated using the formula for comparing two proportions (paired - before and after).

$$\phi = \frac{\pi_A(1-\pi_B)}{\pi_B(1-\pi_A)}$$

$$\pi_{Discordant} = \pi_A(1-\pi_B) + \pi_B(1-\pi_A)$$

$$N_{pair} \geq \frac{Z_{1-\frac{\alpha}{2}}(1-\phi) + Z_{1-\beta}\sqrt{(\phi+1)^2 + (\phi-1)^2\pi_{Discordant}}}{(\phi-1)^2\pi_{Discordant}}$$

π_A = Expected proportion of outcome before the study = 0.10% [5]

π_B = Expected proportion of outcome after the study = 0.35% after

Z (table value at $\alpha=0.05$) = 1.96 (one tail)

Z (table value at $1-\beta=0.90$) = 1.64

Total sample size = 100

Hundred healthcare workers were enrolled in the study using convenient sampling.

Data collection: The investigator obtained permission from the respective authority to conduct the study and obtained written informed consent from all study participants. A structured questionnaire was used to collect data through a survey.

The structured questionnaire consisted of two sections. The first section gathered demographic information such as age, gender, qualification, and profession. The second section comprised nine items to assess knowledge related to the role of emergency response codes in handling hospital emergencies. The questionnaire was developed by the researchers and was reviewed by 10 subject experts to ensure its reliability and validity. The tool's validity was assessed using the Cronbach's alpha method, and a satisfactory value of 0.784 was obtained. Scoring criteria were established by the researchers for this study, where one point was assigned for each correct answer and zero points for incorrect answers. The minimum possible score was 0, and the maximum possible score was 9. The interpretation of the scores is presented in [Table/Fig-1].

Scoring	Range
Poor	0-3
Average	4-6
Good	7-9

[Table/Fig-1]: Scoring criteria.

STATISTICAL ANALYSIS

All data were analysed using MS Excel and Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics, such as frequency and percentages, were used to describe and summarise the data. The Chi-square test was employed to test for associations between the variables.

RESULTS

In the present study, the majority of study subjects (40%) belonged to the age group of 36-55 years, followed by 22% in the 26-30 years

age group, and the lowest percentage (18%) was in the 18-25 years age group. Among the participants, 25% were male and 75% were female. In terms of qualification, 25% were Bachelor of Medicine, Bachelor of Surgery (MBBS), 35% were General Nursing and Midwifery (GNM), 30% were Bachelor of Science (BSc), and 10% were Masters of Science (MSc) [Table/Fig-2].

Demographic variable	n (%)
Age (years)	
18-25	18 (18)
26-30	22 (22)
31-35	20 (20)
36-55	40 (40)
Gender	
Male	25 (25)
Female	75 (75)
Qualification	
Bachelor of Medicine, Bachelor of Surgery (MBBS)	25 (25)
General Nursing and Midwifery (GNM)	35 (35)
Bachelor of Science (BSc)	30 (30)
Masters of Science (MSc)	10 (10)
Profession	
Doctors	25 (25)
Nurses	75 (75)

[Table/Fig-2]: Distribution of healthcare workers according to their demographic characteristics n=100.

Overall, 92.7% of the population in the study had knowledge of the codes for handling hospital emergencies. Specifically, 98% of participants were aware of using code red for fire emergencies. Among the healthcare workers, 88% had an understanding of the process of activating code red, while 12% did not. All participants had a basic understanding that code blue is used for cardiac arrest. Additionally, 85% had knowledge of paediatric emergency codes, and 80% had knowledge related to the indications of code red. A high percentage (96%) knew the indications for CPR, and 100% had excellent knowledge of the CPR abbreviation [Table/Fig-3].

S. No.	Questions	%
1.	Code red is used for?	
	a. Fire	98
	b. Bomb threat	02
	c. Cardiac arrest	0
2.	What is the process of code red activation? (Remove patient (R), Contain the fire and smoke by closing all doors (C), Activate the fire alarm (A), Extinguish the fire (E))	
	a. R.A.C.E.	88
	b. A.R.C.E.	05
	c. E.R.A.C.	0
3.	Which code is activating for Cardiac Arrest?	
	a. Code red	0
	b. Code blue	100
	c. Code pink	0
4.	The acronym R.A.C.E. correlated with which colour code?	
	a. Blue	0
	b. Orange	07
	c. Red	90
	d. Green	03

5.	Hospital emergency codes are coded message often announced over a public address system of a hospital to alert staff to various classes of a site emergency.	
	a. True	98
	b. False	02
6.	Which code is activated for paediatric emergency?	
	a. Code white	85
	b. Code yellow	10
	c. Code red	0
	d. Code violet	05
7.	What are the indications for code red?	
	a. Seeing smoke, sparks or a fire.	05
	b. Smelling smoke or other burning material.	10
	c. Feeling unusual heat on a wall, door or other surface.	05
	d. All of the above	80
8.	In which condition give CPR to the patient?	
	a. Cardiac arrest	02
	b. Arrhythmia	0
	c. Respiratory arrest	02
	d. All the above	96
9.	What does the abbreviation CPR stand for?	
	a. Cardio pancreatic resuscitation	0
	b. Cardio pulmonary resuscitation	100
	c. Carpet pulmonary resuscitation	0
	d. All of the above	0

[Table/Fig-3]: Knowledge of the study participants regarding the emergency colour codes.

In the present study, the majority (96%) had good knowledge with a mean score of 8.35 ± 0.725 , while only 4% had average knowledge with a mean score of 5.75 ± 0.5 . None of the subjects had poor knowledge [Table/Fig-4]. There was no significant difference found in the mean scores of subjects based on their qualifications [Table/Fig-5].

Knowledge	%	M \pm SD (score)
Poor knowledge	0	0
Average knowledge	4	5.75 ± 0.5
Good knowledge	96	8.35 ± 0.725

[Table/Fig-4]: Mean scores for knowledge of participants.

Qualification	Mean score \pm Std. Dev.	p-value
MBBS	8.28 ± 0.791	0.912
GNM	8.342 ± 0.8023	
BSC	8.133 ± 1.008	
MSC	8.2 ± 1.032	

[Table/Fig-5]: Comparison of mean scores among subjects based on qualification. MBBS: Bachelor of medicine, bachelor of surgery; GNM: General nursing and midwifery; BSC: Bachelor of science; MSc: Masters of science

DISCUSSION

In this study, a majority of participants, i.e., 98 (98%) demonstrated good knowledge of using code red for fire emergencies, while only 2% had poor knowledge. These findings were consistent with similar studies where most participants had good knowledge of code red [6]. Regarding paediatric emergency codes, 85% of participants had good knowledge, while 15% had a poor understanding. A similar study conducted in California showed that 90% of participants had good knowledge, while 10% had poor knowledge [7].

In terms of the indication of code red, 80% of participants had good knowledge, while 20% had poor knowledge. These findings align with previous studies [8,9]. Another study conducted in King Faisal Hospital found that 88% of participants had good knowledge

of the indication of code red, while 12% had a moderate level of expertise [8].

Regarding the process of activating code red, 88% of participants had good knowledge, while 12% had poor knowledge. A study showed that 80% of participants had good knowledge, while 20% had a moderate level of expertise [10].

All participants in this study were aware that code blue is used for cardiac arrest. Similar findings were reported in a study conducted in Korea, where 100% of participants had good knowledge of code blue [5]. Furthermore, 90% of participants in this study had good knowledge overall, while 10% had a poor understanding. A study conducted in Washington found that 92% of participants had an excellent level of knowledge, while 8% had moderate knowledge [11].

Regarding CPR, 96% of participants knew the indications for performing CPR, while 4% had poor knowledge. Similar findings were reported in a study conducted in Riyadh, where all participants had knowledge of CPR indications [8]. Additionally, all participants in this study had excellent knowledge of the CPR abbreviation, which aligns with the findings of the Riyadh study [8].

Limitation(s)

It is important to note that different hospitals may use different emergency response codes and activation procedures. The techniques for notifying these codes may also vary depending on the resources available at each hospital. Code designations and team makeup can differ between institutions based on the extent and scope of services provided.

RECOMMENDATION

1. Regular classes or mock drills should be planned for hospital workers as part of a continuous training program.
2. Protocols should be reviewed and updated on a regular basis as needed.
3. Continuous monitoring of various problems and staff management skills should be conducted to gather useful data for improving the program and reducing hospital risks.
4. Training exercises and conferences should be conducted to enhance preparedness and ensure that everyone understands their responsibilities during emergencies.
5. Surprise simulated exercises can be conducted to assess adherence to implemented protocols, evaluate actual training, and assess the competence of hospital staff in applying emergency response codes.

CONCLUSION(S)

In the present study, 96% of the population demonstrated good knowledge of the codes for handling hospital emergencies. Only 4% of the population had average knowledge. It is recommended to implement standard operating procedures and ensure that all staff members are aware of the emergency response codes used in the hospital. Proper training and knowledge should be provided by administrative officers to effectively handle emergencies. Planning and response activities should be seamlessly incorporated with regional and international programs.

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