EURASIAN JOURNAL OF EMERGENCY MEDICINE

"Code Blue" in Theory Versus Daily Practice: Data from a Secondary Care Hospital Short title: "Code Blue" in a State Hospital

Eylem Kuday Kaykısız, Ali Tongün, Mihriban Sönmezsoy, Ramazan Güven
Clinic of Emergency Medicine, Bitlis State Hospital, Bitlis, Turkey

Cite this article as: Kuday Kaykısız E, Tongün A, Sönmezsoy M, Güven R. "Code Blue" in Theory Versus Daily Practice: Data from a Secondary Care Hospital. Eurasian J Emerg Med 2017; 16: 157-61

Abstract

Aim: Education regarding the code blue team has been provided in all hospitals, but the true code blue activation is rare. This study aimed to evaluate the true code blue rates and to investigate if there is a need for education regarding code blue or an additional team for reducing team efforts in hospitals.

Materials and Methods: In this cross-sectional study, the code blue reports of a secondary care hospital were retrospectively searched from the forms recorded, and a self-administered structured survey with health staff was developed to determine the knowledge level regarding code blue.

Results: In total, code blue was activated at 123 instances. Code blue had been mostly activated from the services (n=43). Twenty-two patients had been hospitalized; 34 of patients had been admitted to ICU; 19 patients had died; and the remaining 20 patients had been externed. The overall response times were <3 minutes in all code blue cases. In total, 120 staff members participated in the self-administered structured survey. Overall, 38 participants were identified in the moderate group and 82 in the adequate awareness group. There was no significant association between demographic characteristics and the status of awareness regarding the code blue system (p>0.05).

Conclusion: The most significant problem is the number of inappropriate calls. To achieve a lower number of inappropriate calls, we must continue the periodic in-service basic life support training.

Keywords: Code blue, emergency code systems, health staff

Introduction

Hospital emergency codes are used worldwide to alert the staff for various emergency situations to reduce in-hospital deaths. Code blue systems are communication systems that ensure the most rapid and effective resuscitation of a patient in respiratory or cardiac arrest; however, personnel training and code procedures are important for those in charge of the code blue systems in the hospital. Each hospital, as part of the disaster plan, establishes a policy to determine which units will provide personnel for code coverage.

In Turkey, hospitals have code blue teams to reduce preventable in-hospital deaths. Although education regarding the code blue team program has been provided in all hospitals, true code blue activations are rare. This study aimed to evaluate the true code blue rates and reasons for wrong code blue activations and to additionally investigate if there is a need for education regarding code blue or constitute another team to reduce code blue team efforts in hospital.

Materials and Methods

Study design

This study analyzed the code blue forms used between January 1 and December 31 in 2016, and a self-administered structured

Correspondence to: Eylem Kuday Kaykısız e-mail: eylemkuday@hotmail.com
Received: 28.04.2017 • **Accepted:** 29.05.2017 • **Available Online Date:** 09.10.2017

DOI: 10.5152/eajem.2017.79664

survey including 10 questions about the code blue system was conducted in our hospital. Our hospital deals with approximately 60000 patients per month and has a code blue team composed of 2 experienced nurses and an intensive care unit (ICU) doctor for responding to all calls in all hospital areas except ICU and emergency rooms. A code blue is defined as any patient with an unexpected cardiac or respiratory arrest requiring resuscitation and activation of a hospital-wide alert. A wrong code is defined as a code activated for training or incorrectly dialing the number 2222.

In our hospital, any health staff (doctor, nurse, or paramedics) can raise an order for code blue by dialing 2222. Subsequently, the code blue team that is responsible for that region arrives at the scene. After arriving to the scene, the order for code blue is terminated by the team leader by dialing the same number. All the information is recorded in code blue forms, for example, which parts of hospital activated the code blue; how many were incorrect or true codes; the results of patient's last status (classified as exitus, transferred to another hospital, hospitalization, admission to ICU, and discharge); and the maximum number of arrivals evaluated from the code blue forms. In addition, a survey including 10 questions were obtained from the health staff to evaluate their level of knowledge regarding code blue system. The survey obtained from the health staff is shown in Figure 1. Questions were prepared by the investigators based on the American Heart Association (AHA) 2015 guidelines (prevailing at the time of study), with a maximum score of 10. Each answer was allotted one point, giving a total of 10 points for the survey. Participants with 0–5 points were classified into the weak awareness group; those with 6–8 points into moderate; and those with 9–10 points into the adequate awareness group. The results of the survey and evaluation of code blue forms were compared and the association between the level of theoretical knowledge and daily practice of health staff were evaluated.

Study duration

Between January 1 and December 31, 2016, the hospital's code blue reports (Figure 2) were searched retrospectively, and data were collected from the recorded forms. Incomplete forms or the code blue alarms, which had been cancelled, were excluded from the study.

Statistical analysis

The data were recorded in a Microsoft excel file, and the data analysis was performed using the Statistical Package for the Social Sciences for Windows, version 22.0 (IBM SPSS Statistics, Armonk, NY, USA). The differences between groups were compared by using Mann–Whitney U test and Kruskall–Wallis H test where appropriate. Data were shown as mean ± standard deviation or median (min-max), where applicable. A p value <0.05 was considered statistically significant.

Ethics

This study has been approved by the ethics committee of Bitlis Eren University. The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all the participants.

Results

Code blue was activated at 123 instances throughout the study period. Of these, 28 were excluded because of a wrong call. The evaluation of the characteristics of the remaining 95 code blue calls according to location showed that code blue was activated mostly from the services (n=43) and followed by polyclinics (n=23), phlebotomy units (n=13), and radiology department (n=11; Table 1).

The evaluation of the distribution of the final status of patients showed that 22 patients had been hospitalized (23%); 34 had been admitted to the ICU by a successful intervention (35%); 19 were exitus (20%); and the remaining 20 (22%) were externed from the emergency department with an appropriate treatment or a confirmation regarding the rejection of treatment (Table 2).

The overall response times after the code blue activation were <3 minutes in all code blue cases. In total, 120 health staff participated in the self-administered structured survey; 32 of these (27%) were males and 88 (63%) were females.

According to the code blue activation status, 40% of participants (n=48) have activated and 60% (n=72) have never activated the code blue previously. Additionally, 38 participants (32%) have resuscitated a patient with cardiac or respiratory arrest; however, 82 of these (68%) have never resuscitated previously. The evaluation of the education status of participants showed that 26% (n=32) were high school graduates; 15 (n=18) had an associate's degree; 52% (n=62) were undergraduates; and 7% (n=8) were postgraduates.

According to the running period as a health staff; the percentage of health staff for 1 year was 13% (n=16); for 2–5 years was 55% (n=66); for 6–10 years was 20% (n=24); and for >10 years was 12 % (n=14; Table 3).

Overall, 38 participants (32%) were located in the moderate group and 82 (68%) in the adequate awareness group. There was no statistically significant association between sex, code blue activation status, resuscitation status to a patient with cardiac or respiratory arrest status, running period as a health staff of participants, and the status of awareness regarding the code blue system (p>0.05).

Discussion

Code blue is generally used to indicate a patient requiring resuscitation or otherwise in need of immediate medical attention, most often due to respiratory or cardiac arrest that is common in hospital areas; delayed treatment is associated with a lower survival rate (1). There are various studies regarding this issue in literature (2-4). In total, 231 of 311 patients' code blue calls were inappropriate in a study performed by Kaernested et al. (5). Conversely, in a study performed by Herrera et al. (6) this rate was 11%. Canural et al. (7) reported that 61% of code blue calls had not been in a life-threatening situation. However, in our study, the rate of wrong calls was 22%; the rate of patients not in a life-threatening situation was 45%. Our data are compatible with some of the data because of various rates reported previously in literature. Despite organizing

PROPOSALS	TRUE	FALSE	DON'T KNOW
Code blue only activates in cardiac or respiratory arrest.			
Respiration and circulation control must control to activate code blue in patients in syncope,			
Code blue team is waited for CPR in patients with cardiopulmonary arrest.			
Code blue mist be activated in patiens with epileptic seizures.			
Code blue team must arrived to scene in max 3-5 minutes.			
Code blue must activates in patients with hypotension in hospital.			
Punishment are applied to individual activated code blue unnecessaryly.			
Security personnel must take precautions to interfered by code blue team.			
Any health staff can give an order for code blue by phone by dialling 2222 and after arriving to the scene, order for code blue is terminated by team leader by phone dialling same number.			
Code blue activation must be terminated as soon as possible if it is unnecessary code.			

Sex?

What's the code blue number?

Have you ever dialled code blue number?

Have you ever ressuciated a patient with cardiac or respiratory arrest?

What is your education status?

How long have you served as a health staff?

Figure 1. Questionnaire form obtained from the health staff

periodic training and education for the code blue system, the rate of wrong code blue calls rate was high. The reason of this may be that the staff may have initiated the code blue process under any dangerous and at-risk situations. Moreover, the reason for this was observed as pressure on the hospital staff by the patients' relatives who are highly sensitive of seeking emergency medical care for the patient.

The overall response times after the completion of announcement were reported as 105 seconds in a study by Eroglu et al. (8); 6 minutes in a study by Canural et al. (7); 2.17 minutes in a study by Bal et al. (9); 4,31 minutes in a study of Bayramoglu et al. (10); and <1 minute in study of Ezquerra Garcia et al. (11). Here, the time was <3 minutes. Because of the retrospective nature of the study, the mean response time was not determined. However, according to the data from the forms, this time was <3 minutes in all code blue calls. Ideally, the code blue team should arrive at the scene in approximately 3–5 minutes. In some studies, this time surpasses 5 minutes. This situation may originate due to the wide space of the hospital or inadequate number of members of code blue team. For this reason, constitute further code blue team and assign to different location of hospital may be a solution.

Most of the calls (43%) were made from the services according to the locations of the calls and followed by polyclinics, phlebotomy units, and radiology department. Similarly, Bayramoglu et al. (10) reported that most of calls had been made from services. Phlebotomy units were in the first line according to Eroglu et al. (8). The code blue system does not work in ICU s and emergency department with critically ill patients. The most critically ill patients in the remaining population are found in services. This may be a reason for most calls being made from services.

According to the final status of the patients, Aune et al. (12) reported a discharge rate of 29% in hospital cases and this rate was reported as 29,5% by Bayramoglu et al. (10). Bal et al. (9) reported that 137 cases were coded, 90 of these survived, but the number of ICU deaths were unknown. In our study, we found that 23% of patients had been hospitalized; 35% of patients had been admitted to ICU; 20% of patients had been exitus, and the remaining 22% of patients had been externed from the emergency department with an appropriate treatment or a confirmation regarding the rejection of treatment. However, the total death rate was 20% and the survival was 80%. Unfortunately, because of the retrospective nature of the study, the number of ICU deaths is unknown.

We aimed to determine the level of awareness regarding the code blue system of the health staff with a self-administered structured survey and investigated whether the factors influencing the level of knowledge have been present in this study. The results indicated that all participants scored ≥6 points. Here, we concluded that the level of awareness of health staff is adequate. Despite the improved results, the rate of patients experiencing a life-threatening condition among those evaluated with a code blue call is only 45% in the same hospital for the last year, and this rate is quite low when compared with the theoretical level of knowledge. The reason for inadequate application

CODE BLUE INTERVENTION FORM				
Name-surname T.C. identification number Sex Date of birth		Location: Date:		
Calling time **İntervention time** **Total response time**				
İnitial evaluation	Consciously Breathing Circulation	Yes Yes Yes	No No No	
CODE BLUE TEAM INTERVENTIONS				
Respiratory support with balloon mask monitorization Opening intravenous access Administration of intravenous drug Entubation Defibrillation		Others		
The time of termination of CPR	Spontaneous circulation	Yes No		
The time of awakening				
Other results	Exitus	Transferred to ICU	Hospitalization	Externed	Denied of treatment
Taem Leader		**Other staff**		
1..... signature		1..... signature 2..... signature 3..... signature		

Figure 2. Code blue forms of the hospital

Table 1. Call distribution according to location

	n	%
Polyclinics	23	24
Service	43	45
Phlebotomy rooms	13	14
Radiology department	11	12
Others	5	5
Total	95	100

Table 2. Distribution of the final status of patients

	n	%
Hospitalization	22	23
Admission to ICU	34	35
Exitus	19	20
Denial to treatment	10	11
Externed	10	11
Total	95	100

ICU: intensive care unit

in daily practice of health staff may originate from the pressure of the patients' relatives as stated above or the lack of awareness regarding stress management of the health staff not accustomed working in the emergency department.

According to the results of our study, it is clearly seen that simulated practice should enhance along with theoretical education to achieve a lower number of inappropriate calls.

Study limitations

The low number of participants and code blue activation instances are the limitations of the study. In addition, because of the retrospective nature of the study, the forms included incomplete information and long-term mortality could not be determined. Another limitation is that the number of health staff with a post graduate

Table 3. The characteristics of health staff participated in the questionnaire

		Adequate awareness group (68%) n=82		Moderate awareness group (32%) n=38	
		n	%	n	%
Sex	Male	20	24	12	32
	Female	62	76	26	68
Code blue activation status	Yes	32	40	16	42
	No	50	60	22	58
Status of intervention to arrest	Yes	28	34	10	26
	No	54	66	28	74
Education status	High school	20	24	12	32
	Associate degree	12	15	6	16
	Under graduate	42	51	20	52
	Post graduate	8	10	-	-
Running time for a health staff (years)	0-1	8	10	8	21
	2-5	46	56	20	53
	6-8	16	19	8	21
	>10	12	15	2	5

degree was limited. Thus, the association between the education status and code blue theoretical knowledge could not evaluated correctly. Prospective and multicenter studies with larger groups are needed.

Conclusion

The most significant problem of the current system is the number of inappropriate calls. To achieve a lower number of inappropriate calls, we must ensure periodic, in-service, basic life support training.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Bitlis Eren University.

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. Jones DA, Mitra B, Barbetti J, Choate K, Leong T, Bellomo R. Increasing the use of an existing medical emergency team in a teaching hospital. Anaesth Intensive Care 2006; 34; 731-5.
2. Chan PS, Jain R, Nallmothu BK, Berg RA, Sasson C. Rapid response teams: a systematic review and Meta-analysis. Arch Intern Med 2010; 170: 18-26. [CrossRef]
3. Pantazopoulos I, Tsoni A, Kouskouni E, Papadimitriou L, Johnson EO, Xanthos T. Factors infl uencing nurses' decisions to activate medical emergency teams. J Clin Nurs 2012; 21: 2668-78. [CrossRef]
4. Price JW, Applegarth O, Vu M, Price JR. Code blue emergencies: a team task analysis and educational initiative. CMEJ 2012; 3: 4-20.
5. Kaernested B, Indridason OS, Baldursson J, Arnar DO. In-hospital cardiopulmonary resuscitation at Landspitali University Hospital in Reykjavik, Laeknabladid 2009; 18: 84-90, 126.
6. Herrera M, López F, González H, Domínguez P, García C, Bocanegra C. Results of the first year of experience of the cardiopulmonary resuscitation program "Juan Ramón Jiménez" Hospital (Huelva). Arch Intern Med 2010; 170: 18-26.
7. Canural R, Gökalp N, Yıldırım K, Şahin HM, Korkmaz A. Patient safety in health care: the blue code application. International Congress of performance and quality in health. 2009; 2: 105-10.
8. Eroglu SE, Onur Ö, Urgan O, Denizbasi A, Akoglu H. Blue code: Is it a real emergency? World J Emerg Med 2014; 5: 20-3. [CrossRef]
9. Bal A, Memiş R, Kılıç H, Çalış A, Yıldız A, Yılmaz H, et al. Code blue evaluation reports. II. International Congress of performance and quality in health. 2010; 2: 608-13.
10. Bayramoglu A, Cakir ZG, Akoz A, Ozogul B, Aslan Ş, Saritemur M. Patient-Staff Safety Applications: The Evaluation of Blue Code Reports. Eurasian J Med 2013; 45: 163-6. [CrossRef]
11. Ezquerra García AM, Suberviola Fernández I, Pavía Pesquera MC. Evaluation of the effectiveness of an in-hospital cardiac alarm system. Laeknabladid 2009; 95: 509-14.
12. Aune S, Eldh M, Engdahl J, Holmberg S, Lindqvist J, Svensson L, et al. Improvement in the hospital organisation of CPR training and outcome after cardiac arrest in Sweden during a 10-year period. Resuscitation 2011; 82: 431-5. [CrossRef]