

Are code blue calls being used appropriately?

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ABSTRACT

Aims: The aim of this study is to emphasize the importance of the blue code system, identify existing deficiencies in its implementation, and contribute to efforts aimed at addressing these shortcomings. Additionally, the study seeks to determine the rate of unnecessary and incorrect blue code activations and contribute to reducing such cases.

Methods: A total of 565 patients were included in the study by retrospectively reviewing the Code Blue Incident Reporting Forms at the University of Health Sciences Kayseri Training and Research Hospital between January 1, 2016, and May 5, 2018.

Results: Of the 565 patients included in the study, 49.9% (n=284) were female and 51.1% (n=285) were male. The mean age was 67.9±18.06 years; for females and 67.53±18.62 years for males 68.89±16.79 years. The average response time for the resuscitation team to reach the patient was 83.02±51.76 seconds. When the units initiating the blue code calls were analyzed, 54% (n=305) originated from intensive care units (ICU). In our hospital, 71.7% (n=405) of blue code calls were evaluated as incorrect activations. The most common reason for blue code activation was respiratory failure/desaturation, accounting for 52% (n=294) of the cases. Cardiac arrest was the second most common cause, observed in 27.7% (n=155) of the cases. The most frequently performed intervention was endotracheal intubation, conducted in 50.4% (n=285) of patients. Among patients who received cardiopulmonary resuscitation, 52.3% (n=81) resulted in death.

Conclusion: We found our code blue team to be successful in providing early intervention to patients; however, the rate of incorrect code activations in our hospital was found to be high. For the blue code system to function effectively, it is crucial for hospital administrations to provide continuous training to healthcare personnel and the implementation of appropriate regulatory measures.

Keywords: Code blue, cardiopulmonary resuscitation, cardiac arrest, early warning score

INTRODUCTION

The “code blue” system is implemented to initiate cardiopulmonary resuscitation (CPR) in individuals whose vital functions such as respiration and circulation are at risk or have ceased. To operate the code blue system, hospitals have established specialized teams typically consisting of physicians, nurses, anesthesia technicians, support staff, and security personnel.¹ The code blue protocol was first defined and introduced in the 1990s at the Bethany Medical Center in Kansas, USA.² It has since become a widely adopted emergency code worldwide, where the same color is used to indicate the same type of emergency situation. In hospitals, the blue code is typically activated by dialing the number 2222. Upon receiving the call, the code blue team

aims to reach the patient within the shortest possible time—ideally within three minutes. The team is responsible for initiating, continuing, and terminating the CPR process as appropriate. The code blue team documents patient findings and interventions using a standardized Code Blue Incident Report Form, which is archived by the hospital’s quality management unit.³ Hospital administrations are also responsible for providing training and conducting regulatory and supervisory activities related to the code blue system.

According to current reports, the incidence of in-hospital cardiac arrest (IHCA) varies across institutions and countries. Denmark’s national DANARREST registry reported a

cardiac arrest rate of 1.8 per 1.000 hospital admissions or 0.6 per 1.000 inpatient days between 2017 and 2018.⁴ The United Kingdom's National Cardiac Arrest Audit (NCAA) reported an annual incidence ranging from 1.0 to 1.6 per 1.000 hospital admissions between 2011 and 2021.^{5,6}

The aim of this study is to emphasize the importance of the code blue system, to identify deficiencies in our hospital's code blue practices by comparing them with data from the global literature, and to contribute to future improvement efforts. Additional goals include enhancing the effective utilization of a well-organized code blue team, determining the frequency of unnecessary and inappropriate code blue activations in order to help reduce them, and ultimately contributing to a reduction in in-hospital mortality from cardiopulmonary arrests through an efficiently structured and coordinated team approach.

METHODS

The study was conducted with the permission of the Kayseri City Hospital Medical Specialization Ethics Committee (Date: 08.01.2021, Decision No: 46). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study was conducted at the University of Health Sciences Kayseri Training and Research Hospital. The data were obtained by retrospectively reviewing the Code Blue Incident Reporting Forms archived by the Quality Management Unit, recorded between January 1, 2016, and May 5, 2018. The study includes adult patients who received a code blue call and had a completed reporting form. Pediatric patients, false code blue calls, and patients with incomplete data in the Code Blue Incident Reporting Forms were excluded from the study.

Within our hospital, there were a total of seven code blue teams, each consisting of a specialist physician (typically an anesthesiologist or a physician from another department acting as the team leader), an anesthesia technician, and a security officer.

In this study, patient age, sex, the unit initiating the code blue call, time of the call, response time of the resuscitation team, reason for the blue code blue activation, interventions for patients, decisions made by the resuscitation team regarding their subsequent follow-up were analyzed. CPR intervention performed on patients experiencing cardiac arrest, which includes both chest compressions and airway management techniques. Therefore the interventions were not classified separately as chest compressions or airway techniques such as endotracheal intubation within the CPR group. Endotracheal intubation intervention was also performed in patients who did not develop cardiac arrest but required emergency airway management due to desaturation or respiratory failure. Other interventions were performed simple intervention such as oxygen therapy, intravenous line placement, and intravenous fluid administration), as well as medications administered other than adrenaline (including steroids, antihistamines, and anticonvulsants). Additionally, data from patients who

experienced cardiac arrest were analyzed to determine whether they achieved return of spontaneous circulation (ROSC) or if the event resulted in death.

Statistical Analysis

The data obtained in the study were analyzed using the SPSS 22.0 software package (IBM SPSS Statistics for Windows, Version 22.0; IBM Corp., Armonk, New York, USA). Frequencies, percentages, means, and standard deviations were used for the statistical analysis.

RESULTS

Data from 663 patients for whom a blue code was activated were initially evaluated. However, 34 pediatric patients and 7 cases identified as false blue code activations were excluded from the study. Additionally, 57 patients were excluded from the study due to missing data in the Code Blue Incident Reporting Forms. In total, the study included data from 565 patients. In the study, 49.9% (n=284) were female and 51.1% (n=285) were male. The mean age was 67.9±18.06 years; for females and 67.53±18.62 years for males 68.89±16.79 years. The average response time for the resuscitation team to reach the patient was 83.02±51.76 seconds. Among the code blue calls, 28.3% (n=165) occurred during working hours (weekdays between 08:00 and 16:00), while 71.7% (n=404) occurred outside working hours (weekdays between 16:00 and 08:00, and weekends between 08:00 and 08:00) (**Table 1**).

Table 1. Demographic data

Variable	
Female, n (%)	284 (49.9%)
Male, n (%)	285 (51.1%)
Age (total), mean±SD	67.94±18.06 years
Age (female), mean±SD	67.53±18.62 years
Age (male), mean±SD	68.89±16.79 years
The data are presented as mean and number (%), SD: Standard deviation.	

When the units initiating the blue code calls were examined, 54% (n=305) originated from intensive care units, 26.9% (n=152) from inpatient wards, 7.6% (n=43) from imaging centers, 4.6% (n=26) from outpatient clinics, another 4.6% (n=26) from interventional procedure areas (e.g., blood collection units, hemodialysis units, interventional radiology rooms), and 2.3% (n=13) from the emergency department (**Table 2**).

Table 2. Units triggering code blue calls

Unit	Number (n)	Percentage (%)
Intensive care units	305	54.0%
Inpatient wards	152	26.9%
Imaging centers	43	7.6%
Outpatient clinics	26	4.6%
Interventional procedure areas	26	4.6%
Emergency department	13	2.3%
The data are presented as number and percentage.		

In our hospital, 71.7% (n=405) of the code blue activations were evaluated as inappropriate, while 28.3% (n=160) were considered appropriate activations (Figure).



Figure. Appropriateness rates of code blue calls

When analyzing the reasons for code blue calls, respiratory failure/desaturation accounted for 52% (n=294), cardiac arrest for 27.7% (n=155), clinical deterioration for 8.7% (n=49), hypotension for 4.4% (n=25), epileptic seizures for 3% (n=17), syncope/presyncope for 1.4% (n=8), conversion disorder for 1.1% (n=6), suspected drug allergy or anaphylaxis for 0.9% (n=5), respiratory arrest for 0.9% (n=5), and altered level of consciousness for 0.2% (n=1) (Table 3).

Table 3. Reasons for blue code activation

Reason for call	Number (n)	Percentage (%)
Respiratory failure/low oxygen saturation	294	52.0%
Cardiac arrest	155	27.7%
Patient deterioration	49	8.7%
Hypotension	25	4.4%
Epileptic seizure	17	3.0%
Syncope/presyncope	8	1.4%
Conversion disorder	6	1.1%
Drug allergy or anaphylaxis concern	5	0.9%
Respiratory arrest	5	0.9%
Altered consciousness	1	0.2%

The data are presented as number and percentage.

When the interventions administered to patients were examined, 50.4% (n=285) underwent endotracheal intubation due to respiratory failure/desaturation without receiving CPR (endotracheal intubations performed on patients who experienced cardiac arrest were not included in this rate.), 27.7% (n=155) received CPR, and in 12% (n=68) of the cases, no intervention was performed. Simple interventions such as nasal oxygen administration, intravenous line placement or intravenous fluid administration were carried out in 8% (n=45) of patients. In 3% (n=17) of the patients, medications such as steroids, antihistamines, and anticonvulsants were administered (Table 4).

When the outcomes of the patients for whom a code blue was activated and the decisions made by the resuscitation team regarding their subsequent follow-up were analyzed, it was found that 63.4% (n=358) of the patients continued to be monitored in their current location, 14.3% (n=81) resulted in death, 11.7% (n=66) were transferred to the intensive

Table 4. Interventions performed

Intervention	Number (n)	Percentage (%)
Endotracheal intubation ¹	285	50.4%
Cardiopulmonary resuscitation (CPR)	155	27.7%
No intervention	68	12.0%
Simple intervention	45	8.0%
Medication	17	3.0%

The data are presented as number and percentage.
¹Emergency endotracheal intubation performed in patients with respiratory failure/desaturation without cardiac arrest. Endotracheal intubations performed on patients who experienced cardiac arrest were not included in this rate.
 Simple intervention: Administration of nasal oxygen, IV line placement, fluid administration.
 Medication: Steroids, antihistamines, anticonvulsants

care unit, 8.8% (n=50) were transferred to the emergency department for observation, 1.4% (n=8) were referred to an external facility, 0.2% (n=1) were admitted to an inpatient ward, and 0.2% (n=1) underwent emergency surgery (Table 5).

Table 5. Code blue follow-up decisions

Decision	Number (n)	Percentage (%)
On-site follow-up	358	63.4%
Death (exitus)	81	14.3%
Transfer to intensive care	66	11.7%
Transfer to emergency service	50	8.8%
External referral	8	1.4%
Transfer to ward	1	0.2%
Emergency surgery	1	0.2%

The data are presented as number and percentage.

Among the patients who underwent CPR, 52.3% (n=81) resulted in death, 29.7% (n=46) achieved return of ROSC, and 18.1% (n=28) were handed over to the on-site medical team for further intervention and decision-making before the CPR outcome could be determined (Table 6).

Table 6. Cardiopulmonary arrest outcomes

Outcome	Number (n)	Percentage (%)
Death (exitus)	81	52.3%
Return of spontaneous circulation (ROSC)	46	29.7%
Outcome unknown/pending	28	18.1%

The data are presented as number and percentage.

DISCUSSION

The blue code is a rapid response system developed for the emergency resuscitation and stabilization of patients within a hospital who have experienced, or are at risk of, cardiac or respiratory arrest.⁷ In Türkiye, among the objectives of “Code Blue Management,” which is included in the Ministry of Health’s hospital quality standards, is to reduce in-hospital mortality and morbidity by ensuring that a well-trained emergency response team reaches patients in the shortest possible time.

Studies have shown that survival rates after cardiac arrest decline with increasing age, particularly after the age of 70.⁸ In studies conducted in Türkiye, similar to our findings, Özbilgin et al.⁹ reported a mean patient age of 63.76±19.77, and Kayır et al.¹⁰ reported a mean age of 73.8. Although IHCA is more

common among male patients, clinical outcomes are reported to be similar between men and women.¹¹ In line with the literature, our study also found that 49.9% were female and 51.1% were male.

One of the most critical factors influencing the success of a code blue intervention is early response. It has been demonstrated that CPR administered within the first 3-4 minutes yields significantly better outcomes.^{12,13} In our study, the average response time to reach the patient was 83.02 seconds (1.38 minutes), indicating that the code blue system in our hospital is implemented within the target timeframe and in accordance with quality standards, allowing for timely intervention. Studies conducted in Türkiye show variability in response times. Esen et al.¹⁴ reported a longer response time of 3.45 minutes compared to our study. On the other hand, Özütürk et al.¹⁵ reported a shorter response time than ours, reaching patients in 1.1 minutes.

Other factors influencing the success of CPR include whether the patient was being monitored at the time of arrest, whether the initial rhythm was ventricular tachycardia or fibrillation, the absence of the need for tracheal intubation, normal cerebral performance, and the absence of comorbidities such as chronic obstructive pulmonary disease (COPD), acute kidney failure, and sepsis.¹⁶ In our study, the majority of code blue calls (54%) originated from intensive care units. Patients in these units tend to have more comorbid conditions compared to those in inpatient wards or receiving outpatient care. This higher burden of comorbidity negatively impacts post-cardiac arrest survival rates.

False code blue activations can negatively affect the motivation of code blue teams and lead to unnecessary workforce burden. In our study, the rate of inappropriate code blue calls was recorded as 71.7%. A code was considered appropriate if it was initiated for a patient experiencing cardiac and/or respiratory arrest. In the directive published in 2017 regarding code blue practices, it is stated that "code blue calls are not issued in units such as emergency departments, intensive care units, and operating rooms".¹⁷ Intensive care units are expected to have the medical equipment, tools, knowledge, and skills necessary to intervene in deteriorating patients. Therefore, code blue calls made for patients in the ICU who require urgent intervention due to desaturation or respiratory failure without experiencing cardiac arrest have been considered inappropriate. In our hospital, the primary source of false code blue activations was intensive care units. Additionally, the most frequent reason for initiating a code was consultation for elective endotracheal intubation due to respiratory failure or desaturation. Among all interventions performed, endotracheal intubation was the most common procedure, conducted in 50.4% of cases. Endotracheal intubations performed in patients who developed cardiac arrest were not included in the total count of intubations presented in this study; therefore, the actual intubation rate is likely to be higher. These findings suggest that healthcare staff working in intensive care units may lack sufficient experience and confidence in performing intubation independently. Moreover, in some ICUs within our hospital, specialist physicians are assigned to multiple areas, which may delay the response to deteriorating patients. We believe that, in our hospital practice, healthcare professionals working in the intensive care units have developed the incorrect habit of initiating code blue calls for patients whose condition is

deteriorating. As a result, staff may prefer to activate the code blue system, perceiving the experienced and well-equipped code blue team as a safer, easier, and more reliable option for urgent interventions.

Some studies have excluded code blue calls from intensive care units from their analyses due to methodological concerns. In a study by Çiçekci et al.¹⁸ 42% of the code blue calls originated from ICUs, with the cardiology ICU being the most frequent source. In another study by Eroğlu et al.¹⁹ the rate of false code blue calls was reported as 91%, higher than in our study. They attributed the high rate of inappropriate activations to staff anxiety and pressure from patients' relatives. In the study by Baytar et al.²⁰ the rate of inappropriate code blue calls was 42.9%, with the most common reason for activation being syncope.

Mortality rates reported in the literature vary between 0% and 42%. In large-scale studies, the overall survival and hospital discharge rates following CPR are approximately 20%, and this rate has been increasing over the past two decades.²¹

In our study, 52.3% of the patients who received CPR resulted in exitus. Considering patients whose CPR outcome could not be evaluated due to early handover to the on-site team, it is estimated that the actual mortality rate in our hospital may be even higher. Çakırca et al.²² reported a higher mortality rate than ours, with 88.9% of patients who experienced cardiac arrest not surviving.

The 2021 guidelines of the European Resuscitation Council recommend that hospitals implement and monitor early warning score systems to identify patients whose condition is deteriorating or who are critically ill. This is because both in-hospital and out-of-hospital cardiac arrests are often preceded by warning signs, some of which may be preventable.²³ In a study by Lee et al.²⁴ the implementation of medical emergency teams (rapid response teams) led to a decrease in code blue activations in medical units, from 3.55 to 0.96 per 1,000 admissions during periods when these teams were actively operating. Furthermore, hospitals with well-organized team, where team roles are clearly defined, communication is effective, leadership is strong, training is continuous, and unannounced drills are regularly conducted have been shown to experience lower in-hospital mortality rates.²⁵

Limitations

There are certain limitations in our study. Due to incomplete documentation in the code blue notification forms, data regarding the initial rhythms, medications administered, and the duration of CPR in patients who experienced cardiac arrest could not be analyzed. Additionally, in some patients, the outcome of CPR was not observed, which may have led to an overestimation of the mortality rate. Furthermore, among patients who achieved return of ROSC, outcomes such as neurological deficits or discharge to home were not evaluated.

CONCLUSION

As a result, the code blue system is an essential component of hospital quality standards. For this system to function effectively, hospital administrations should provide continuous training to their staff, enhance the knowledge, skills, and confidence of other physicians in managing patients

experiencing cardiac arrest, establish an adequate staffing level of code blue teams to ensure to rapid response to patients, and implement early warning score systems. We believe that these measures can contribute to reducing the incidence of IHCA and associated mortality.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was conducted with the permission of the Kayseri City Hospital Medical Specialization Ethics Committee (Date: 08.01.2021, Decision No: 46).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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