Scoping Review

Barriers to Implementing the Code Blue System in Hospitals

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A B S T R A C T

Introduction: The Blue Code system is one of the emergency procedure codes that should be activated immediately if a person is found and the condition of cardiac respiratory arrest. Success in the treatment of cardiac arrest depends on SDM, means and facilities that are supported by the code blue system.
Purpose: The research is aimed at identifying barriers to the implementation of the Code Blue system in hospitals. The research
Method: used is scoping review in documented using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), as well as PRISMA flow diagrams for detailed quantity of literature identified.
Result: The research finds that there are still limitations in the implementation of the code blue system, which is an obstacle to the handling of code blue in hospitals.
Conclusion: Based on the scopeing review research carried out, found obstacles to the implementation of the code blue system, including SDM both lack of SDM and which also contains team improvement in performing resuscitation starting from identification of patients with pulmonary heart failure, activation of code blue systems, response code blue team, implementation by the team, evaluation and documentation, means and insufficient prasarana, which in the end correlates in response team code blue in dealing with cardiac arrest.

INTRODUCTION

Patient safety is related to quality health services where the health service meets patients' needs and expectations so that patients feel satisfied with the services provided by the local health team. Moreover, the hospital is a type of public health service facility that has a very complex character and organization with the aim of providing comprehensive health services (Bumulo et al., 2017). Health services are provided by the hospital to the maximum in order to increase the patient safety rate. One patient safety that must be considered is the risk of patient death. The death of a patient in a hospital is something that often happens in a hospital. The most common type of death is the death of cardiac and respiratory arrest patients who do not always show symptoms. This incident occurs not only in the emergency room but also in the inpatient room (Pivac et al., 2020). Nurcholis et al. (2021) also concluded that if not handled quickly and appropriately by health workers, cardiac arrest will cause death with evidence of an in-hospital cardiac arrest (IHCA) mortality rate of 80%. Handling cardiac arrest and respiratory arrest to detect and react quickly and appropriately to prevent brain death and permanent death requires the ability of nurses who have skills in carrying out a chain of survival when a cardiac arrest occurs (Lyu et al., 2021).

This requires an organizational system in the hospital and a good team in its implementation by holding responses by health service providers to patients who experience cardiac arrest and respiratory arrest. Therefore, the hospital must have an

emergency code or a code to handle cases requiring emergency medical intervention. One Code that is often used to mark an emergency is Code blue (Emergency et al., 2011). Code blue in the hospital is an emergency code that indicates an event of respiratory arrest and cardiac arrest. This procedure must be activated immediately if the patient is in this condition. Indonesia's Code Blue implementation has been regulated in the Decree of the Minister of Health of the Republic of Indonesia No.129/MENKES/SK/II/2008 concerning Minimum Hospital Service Standards. In emergency services, hospitals must provide a team of emergency service providers who are BLS/PPGD/GELS/ALS certified with an emergency response time of ≤5 minutes after the patient arrives (Ministry of Health, 2009).

The code blue team, or the rapid response team, was formed to handle emergencies in the hospital environment, which are expected to be able to carry out effective and optimal assistance and are supported by cardiopulmonary resuscitation (CPR) infrastructure such as AEDs and specific drugs that must be in the box. Emergency with the team and resuscitation facilities must be available in the inpatient room and certain places in the hospital area (Sagun et al., 2021). According to Clarke et al. (2016), it was concluded that the management of the code blue is running well and optimally seen from the results of the evaluation of the higher rate of ROSC (return of spontaneous circulation) events carried out by the ACLS (Advanced Cardiac Life Support) protocol.

The patient safety goals set by the Joint Commission International for hospitals state that hospitals must increase their awareness and response to changes in patient conditions. The instrument developed to determine which patients need to be monitored more intensively to determine resuscitation measures and to activate the code blue that needs to be done is the early warning score (EWS). Which is the proper EWS assessment significantly affects the team's response time (Subhan et al., 2019). In implementing Code Blue in hospitals in Indonesia, implementing a Code Blue activation system using a telephone network connected to a central operator to a predetermined and agreed number in each hospital, then informing all the Code Blue teams on duty. After receiving the notification, the team immediately went to the incident scene. The duration of time between receiving the message "code blue" (Code blue activation) and the arrival of the Code blue team at the scene of the incident was 5 to 10 minutes (Monangi et al., 2018). Success in handling cardiac arrest depends on human resources, supporting facilities and infrastructure for preventive, promotive, curative and rehabilitative activities in primary healthcare settings (Ministry of Health, 2019).

METHOD

This research is a scoping review used to identify the literature in depth and comprehensively, obtained through various sources with various research methods and is related to the research topic, namely "Obstacles to the implementation of the Code Blue system in hospitals". This research was documented using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and PRISMA flow diagrams to detail the amount of literature identified.

1. **Identify the research statement**

    At this stage, the researcher identified the research questions that would be used as a reference in searching for articles using the PCC (Population-Concept-Context) method. The main question in this research is, "What are the obstacles to implementing the Code Blue system in hospitals?"
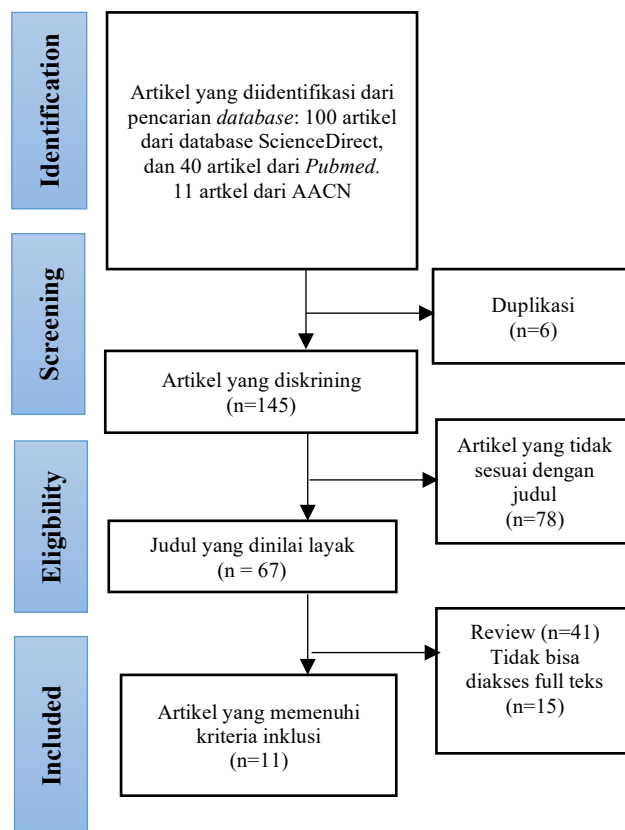
2. **Identification of relevant literature sources.**

    Literature was searched using several search engines, including PubMed, Science Direct, AACN, and cinahl. Based on the keywords used, 100 articles related to the research topic were found. The keywords used in this research are "code blue" AND "cardiopulmonary resuscitation" OR "cardiac arrest".

3. **Literature selection**

At this stage, the selection of literature obtained was based on inclusion criteria. Inclusion criteria in this study were journals published in 2018-2023, discussing the management of Code Blue implementation in hospitals in both Indonesian and English, full text available, and focusing on the Code Blue system.

4. **Mapping and collecting used literature**

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Identification    Artikel yang diidentifikasi dari
                  pencarian database: 100 artikel
                  dari database ScienceDirect,
                  dan 40 artikel dari Pubmed.
                  11 artkel dari AACN

Screening                                          →  Duplikasi
                                                      (n=6)
                  Artikel yang diskrining
                  (n=145)

Eligibility                                        →  Artikel yang tidak
                                                      sesuai dengan
                                                      judul
                                                      (n=78)
                  Judul yang dinilai layak
                  (n = 67)

Included                                           →  Review (n=41)
                                                      Tidak bisa
                                                      diakses full teks
                                                      (n=15)
                  Artikel yang memenuhi
                  kriteria inklusi
                  (n=11)
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RESULT DAN DISCUSSION

Authors	Objective	Methods	Result
Monangi et al. 2018	To analyze survival rates and factors related to survival as well as problems related to the implementation of the CB system (CBS)	Quantitative descriptive Chi-square and regression analysis Patients who have been resuscitated by the code blue team at Army Hospital, New Delhi	There were 720 CB calls during the study, with the exclusion of 24 patients, and 694 cases were analyzed. 620 "true calls", 74 "fall calls". of 620, 422 were heart attacks, 198 were medical emergencies. Overall survival is 26%. survival in heart attack patients 11.13%. as for influencing factors such as age, rhythm of execution, and duration of CPR were found to have a significant effect on survival. As well as the problems encountered related to the number of personnel and completeness

Sinaga, Elvipson. 2022	This study aims to determine the effect of response time and standard operating procedures on the implementation of the code blue system in the inpatient room of Mitra Sejati Medan Public Hospital.	Descriptive-qualitative, Team code blue in the inpatient room of Medan General Hospital	This study shows that response time and Standard Operating Procedures (SPO) are related to the implementation of the Code Blue System at Mitra Sejati Hospital in Medan. The results showed that the effect of the response time was not always on time due to the distance in the room that was too far and the rush in the emergency room/ICU at the same time as the code blue activation event. From the Standard Operating Procedure (SPO) factor, it shows that the implementation of code blue is not always carried out properly according to the existing SPO due to a lack of understanding by code blue officers regarding SPO which should be used as a reference standard in implementing code blue.
Indah, Jita., M. Dirdjo, M. 2021	This study aims to see the relationship between knowledge and code blue training with patient outcomes	Meta data analisis , Literatur review, team code blue	Literatur review ini menemukan beberapa hal penting dalam hubungan pengetahuan dan pelatihan code blue dengan hasil pada pasien yaitu keahlian seorang perawat dalam merespon code blue, bergantung pada tingkat pengetahuan dan ketrampilannya oleh sebab itu perawat harus meningkatkan pengetahuan den keterampilan yang berkaitan dengan code blue
DeGroot, D., et al. 2022	To assess whether the application of the delineation code intervention in an emergency situation will increase defibrillation time and medication administration and improve nurse perceptions of teamwork	Quasi-experimental study, team code blue	There was a significant increase in teamwork, and the right balance between leader and team member participation. Team members demonstrate a clear understanding of roles, appropriate handling when providing code blue interventions. So the implementation of code delineation is an effective method to improve teamwork during code blue
Surya, Iputu, et al. 2019	This research was conducted to find out description of Nurse's Experience in Managing the Activation of the Code Blue System in Patient Cases	R qualitative with phenomenological descriptive approach with 5 nurses with purposive sampling	There are four main themes, namely Nurse Understanding about respiratory arrest and cardiac arrest, nurse's understanding of the code blue system, application of activation

	Stop Respiratory and Cardiac Arrest.		code blue system and Obstacles and solutions in activating the code blue system Barriers and solution in activating code blue system, Handling obstacles that occurs in the activation of code blue system adapted to obstacles which is found so deep this study identified barriers of the participants are limitations the number of emergency trolleys and their very location far away, Difficulty contacting the call emergency at night, Tools loudspeaker can not be heard throughout the room and the code blue team came long. Of all the obstacles that found by the participants so that the solution taken to overcome obstacles is by contacting doctor MOD and the rest of the code blue team, so that the code blue activation system can be implemented.
Jayasingh, et al. 2018	To assess the compliance of the Code Blue team with the ACLS protocol, to assess resuscitation outcomes, and to compare outcomes between ACLS guidelines followed and those not followed.	Qualitative descriptive clinical audit between 2014 and 2015 at Lourdes Hospital, Kochi, inpatients aged between 30 and 80 years, with witnessed cardiac/respiratory arrest. The patient was pregnant and did not want to be discharged.	The ACLS protocol was followed by 58.7%. The most common deviation found is inappropriate drug use. Return of spontaneous circulation (ROSC) was achieved at 53.3%. 28.5% (P < 0.05), indicating a significant relationship between compliance with ACLS compliance and ROSC.
Yan et al, 2020	to summarize quantitatively the available epidemiological evidence on survival rates of out-of-hospital cardiac arrest (OHCA) patients receiving cardiopulmonary resuscitation (CPR).	systematic review and meta-analysis	A total of 141 eligible studies were included in this meta-analysis. The combined incidence of return of spontaneous circulation (ROSC) was 29.7% (95% CI 27.6-31.7%), survival rate to hospital admission was 22.0% (95% CI 20.7-23.4). %), survival rate to hospital discharge was 8.8% (95% CI 8.2–9.4%), pooled 1-month survival rate was 10.7% (95% CI 9.1–13 .3%), and the 1-year survival rate was 7.7% (95% CI 5.8–9.5%). Subgroup analysis showed that survival to discharge was more likely among OHCA patients whose cardiac arrest was witnessed by bystanders or emergency medical services (EMS) (10.5%; 95%

			CI 9.2–11.7%), who receiving bystander CPR (11.3%, 95% CI 9.3–13.2%), and living in Europe and North America (Europe 11.7%; 95% CI 10.5–13.0%; America North: 7.7%; 95% CI 6.9–8.6%). Survival to disposal (8.6% in 1976–1999 vs. 9.9% in 2010–2019), 1 month survival (8.0% in 2000–2009 vs. 13.3% in 2010–2019), and 1-year survival (8.0% in 2000–2009 vs. 13.3% in 2010–2019) the rate of OHCA patients undergoing CPR improved significantly over the study period. The Egger's test showed no evidence of publication bias for the outcomes of OHCA patients undergoing CPR
Dame, B. et al. 2018	to find out the profile of nurses' knowledge about the code blue system at Prof. Hospital. Dr. R.D. Kandou Manado	descriptive study with a cross sectional design, 91 nurses who served in the medical ward of Prof. Hospital. Dr. R.D. Kandou Manado	The results showed that 27 nurses (29.67%) had a high level of knowledge about the code blue system; 23 nurses (25.28%) have a fairly high category; 24 nurses (26.37%) had a low category, and 17 (18.68%) nurses had a very low category. The majority of nurses at Prof. Hospital. Dr. R. D. Kandou Manado has a high level knowledge category about the code blue system.
Ngo, Dallis Q. et al. 2020	To ensure the safety of patients and medical teams during code blue events, we believe that code blue or emergency response lectures and simulations should be implemented or expanded for resident doctors around the world.	Role play simulation, 19 Resident Desert Regional Medical Center (DRMC) in Palm Springs, California	Utilization of simulated code blue scenarios and special ACLS didactic lectures to complete the BLS/ACLS certification required for residents in training has demonstrated its ability to enhance self-reported competence in crisis scenarios as well as measurable reductions in patient mortality.
AL-omari, awad. et al. 2019	Evaluate the effectiveness of rapid reaction team (RRT) implementation in reducing mortality, cardiac arrest, and ICU hospitalization	prospective cohort study A total of 154,869 patients in the 3 year period before the rapid response system (January 2010 to December 2012) and a total of 466,161 during the 2.5 year period post RRT implementation (January 2014 to June 2016).	Results showed that ward nurses activated RRT more frequently than physicians (1104 activations [69%] vs. 499 activations [31%]), with cardiovascular and respiratory disorders being the most common triggers. Serious concern about the patient's condition by the ward staff was the trigger for activation in 181 (11.29%). RRT provides a variety of

diagnostic and therapeutic interventions. Most of the patients treated with RRT were admitted to ICU 1103 (68.81%), and the remaining 500 (31.19%) were admitted to the ward. After the implementation of the PRC project, the mortality rate in hospital fell from 7.8 to 2.8 per 1000 hospitalizations. The hospital cardiopulmonary arrest rate fell from 10.53 per 1000 admissions to 2.58. The implementation of rapid response teams also facilitates discussions of end-of-life care. PRC project implementation has shown dramatic reductions in total ICU admissions, average ICU occupancy rates, total in-hospital deaths, and total ICU deaths. These findings strengthen the evidence that RRT implementation is effective in reducing in-hospital mortality and cardiopulmonary arrest among other outcomes related to the quality of health services.

Eroglu, 2014	To analyze code blue reports issued by hospitals which are defined as patients with unexpected cardiac or respiratory arrest requiring resuscitation and activation of hospital alerts.	Retrospective study analysed, Sebanayak 89 kasus pengaktifan code blue selama 5 bulan (1 januari 2012 sampai 1 juni 2012)	Results show In 94 activations of the blue code, 3 were excluded due to incomplete data and 2 were excluded because the announcement of the blue code was canceled by the second announcement. Retrospective information was obtained on 89 activations. Median patient age was 68 years (range, 37–84 years). In this series, 58 (65.2%) were women and 31 (34.8%) were men. The activation was diagnosed as cardiopulmonary arrest (8 patients, 9.0%), altered mental status (18, 20.2%), presyncope (11, 12.4%), chest pain (12, 13.5%), impaired conversion (18, 20.2%), and staff concern about patients (22, 24.7%). According to these results, 81 (91.0%) incorrectly activated code blue in our hospital. Statistical analysis showed that the number of false activations for female

patients was greater than for male patients (P<0.001) Code blue activation was performed by physicians in 68 (76%) of all patients, the remainder by nurses and other hospital staff. The most common reasons for activation are concern about the patient's clinical situation, pressure from the patient's relatives due to worsening of the condition and the need for assistance.

The code blue system is one of the emergency procedure codes that must be activated immediately if a person is found and has a condition of cardiac or respiratory arrest American Heart Association (AHA), 2015. Success in handling cardiac arrest depends on human resources, facilities and infrastructure that support preventive, promotive, curative, and rehabilitative in primary healthcare settings (Ministry of Health, 2019). The Code Blue System aims to reduce mortality and increase the return of spontaneous circulation. Delayed cardiac arrest treatment is associated with reduced life expectancy of cardiac arrest patients. To achieve the goal of implementing the code blue system, early recognition of cases of cardiac arrest is required; in this case, knowledge of an ideal code blue system must be able to facilitate resuscitation in patients with medical emergencies and cardiac arrest conditions with an adequate response (Mulya & Fahrizal, 2019).

According to Saed & Mohd, 2011 (in Indah, Jita & M, Maridi, 2020), System code blue was established to ensure that emergencies at the hospital been provided with resuscitation and stabilization treatment with an immediate response time. This response system is divided into two stages, namely the initial response (First Person) must always be from hospital staff, who have been equipped with Basic life support (BLS) skills, and the second response (second person) from a unique and trained team from the department formed by the hospital and supported by BLS equipment placed in strategic locations to support fast response.

The management of resuscitation in cases of cardiac arrest that is implemented according to the AHA protocol that has been made standard has also not gone well; this is because first responders consisting of the hospital community often feel unable to carry out essential life support accompanied by a lack of confidence and lack of knowledge of case identification (Maisyaroh et al., 2015). Williams et al. (2016) also concluded that lack of knowledge, lack of self-confidence, unable to control anxiety could result in the handling of cardiac arrest not going well due to poor team performance. Therefore, code blue simulations, often mock codes, are highly recommended to prepare for team performance.

Activation of the emergency system and resuscitation for cardiac arrest in the hospital, involving all components of human resources (medical and non-medical), facilities (equipment and drugs), operational procedure systems (SPO), as well as control and evaluation mechanisms (Surya, 2019). this is in line with the research of Lisnawati et al. 2019, the results of the analysis showed that four factors influenced the management of code blue in hospitals: HR, Facilities, Response Time, and SPO. Alafik et al. (2018) stated that fast response time dramatically influences the survival of patients who experience emergencies. An emergency call with a response time of less than 5 minutes will increase patient survival compared to a more than 5 minutes response time. Response time of less than 5 minutes will prevent brain damage so that patients with cardiac arrest will not experience physical disability or death.

Human resources are one of the *factors* included in the code blue system, consisting of trained doctors and nurses. Meanwhile, Surya et al., 2019 state that handling cardiac arrest in hospitals requires education from staff, optimal patient monitoring, and a system that can effectively activate an emergency response. In addition, effective management of the code

blue system in hospitals requires a regulatory system that regulates medical and non-medical human resources involved in the resuscitation process and infrastructure, including medicines and emergency equipment. According to Guetterman et al. (2019), Standard Code blue System equipment includes a defibrillator (AED), stethoscope, tensimeter, portable oximetry, and handheld flashlight. Placement of BLS equipment in various strategic locations within the hospital area to facilitate a quick response that can be carried out by the code blue team for medical emergencies is also the goal so that the handling of emergencies can be carried out correctly (Elvipson, 2022).

Implementation of the activation of the Code Blue emergency system in hospitals in Indonesia, using a telephone network connected directly to the central operator to a number that has been determined and agreed upon in each hospital, then informed to all Code Blue teams on duty. After receiving the notification, the team immediately went to the incident scene. The duration of time between receiving the message "code blue" (Code blue activation) and the arrival of the Code blue team at the scene of the incident was 5 to 10 minutes (Monangi et al., 2018). Based on some of the research descriptions above, it was found that the factors that influence the effectiveness of the code blue system. However, there were several obstacles during its implementation. Lisnawati's 2019 research found that response time correlated with code blue management, with the category not being on time due to insufficient human resources and the distance of the secondary code blue team to where the patient had a cardiac arrest was quite far—the Standard Operating Procedures (SPO) which has a significant effect on the management of Code Blue.

The problem of team organization caused by limited human resources was felt to be one of the complications in implementing code blue in saving victims of cardiac and respiratory arrest in the hospital environment. Olson et al. (2017), in the presentation material Before Code Blue Arrives, mention the importance of the principle of crisis resource management. Many things must be considered in resource management during a crisis, one of which stands out is establishing and dividing roles. Moreover, remember to choose a leader who will ensure all the steps go well and correctly. Another factor affecting the implementation of Code Blue is the need for more experienced human resources (HR) in resuscitation management and inadequate collaborative processes in team dynamics. Degroot et al. (2022), N.Bakan, et al. (2018), E Gilliam et al. (2020) state that to achieve the goal of an effective code blue system, early recognition of cardiac arrest cases is required, in this case, including knowledge of the code blue system. and essential life support (BLS). The expertise of nurses and doctors depends on their knowledge and skills as part of the code blue team. In addition, teamwork and the right balance between leader and team member participation. Team members clearly understand roles and appropriate handling when providing code blue interventions. So implementing code delineation is an effective method for increasing teamwork during the code blue Degroot et al. (2022).

Another problem or obstacle often encountered in providing cardiac and pulmonary arrest assistance in the code blue system is the accuracy of patient identification. This problem turned out to be a big problem. Eroglu (2014) stated that code blue cases are rare. Precisely non-cardiac arrest cases dominate, including the factor of concern for officers. Eroglu got 89 code blue activations, found: cardiorespiratory arrest 8 cases, change in mental status 18, presyncope 11, chest pain 12, conversive disorder 18, staff concern for patients 22. Starting from identifying patients with cardiopulmonary arrest, activation of the code blue system, code blue team response, team management, evaluation and documentation. This lengthy process must be done correctly and quickly; however, it involves many parties. On the other hand, many officers said the Code Blue emergency was very stressful. There are many incidents, even though they have been certified in Basic Life Support (BLS), they often feel they need more confidence or feel unsure about their role in assisting (Castro et al., 2014). The limited facilities and infrastructure at the hospital were the obstacles encountered when providing relief efforts. These various obstacles can be solved with the support of the hospital's internal leaders, who have the authority to provide policies related to cardiac arrest management. In Indonesia, there is still a limited number of emergency trolleys, and the location is still far away; difficult contacting emergency calls at night, and loudspeakers cannot be heard throughout the hospital room (Surya et al., 2019).

CONCLUSION

Based on the scoping review research conducted, obstacles were found in the implementation of the code blue system, including good human resources, lack of human resources and in which there is also the ability of the team to carry out resuscitation, starting from the identification of patients with pulmonary, cardiac arrest, activation of the code blue system, response of the code blue team, management by the team, evaluation and documentation, inadequate facilities and infrastructure, which ultimately correlated in the response of the code blue team in dealing with cardiac arrest.

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