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THE EFFECT OF CLOSED-LOOP COMMUNICATION ON REDUCING EMERGENCY ERRORS

Dedy Sambahtrah[*1], Yosafat Barus[2]
Universitas Wirahusada Medan, North Sumatra, Indonesia

* Corresponding Author: dedysambahtra@gmail.com

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ABSTRACT

Emergency services are a high-risk area for errors due to time pressure, high workloads, and case complexity that require effective team coordination. One of the main factors contributing to errors in emergency procedures is communication failure among healthcare workers. Closed-loop communication is a structured communication method that emphasizes clear message delivery, repetition by the recipient, and reconfirmation by the person giving the order to ensure the message is understood correctly. This study aims to analyze the effect of closed-loop communication on reducing errors in emergency procedures in the Emergency Department of Bina Kasih General Hospital, Medan. This study used an observational analytical design with a cross-sectional approach. The study was conducted in September 2025 with 20 healthcare workers directly involved in emergency services. Sampling was carried out using a total sampling technique. Data were collected through observation sheets and structured questionnaires, then analyzed univariately and bivariately using the Chi-Square test. The results showed that respondents with good implementation of closed-loop communication experienced a lower level of errors compared to respondents with poor implementation of closed-loop communication. The statistical test results showed a p-value of 0.012, indicating a significant effect between the implementation of closed-loop communication and the reduction in emergency procedure errors. This study concluded that the implementation of closed-loop communication plays a significant role in improving patient safety and reducing the risk of procedure errors in emergency services.

INTRODUCTION

Emergency care is a crucial component of the healthcare system because it plays a direct role in preventing death and disability through rapid identification and timely intervention in critically ill patients (Dünser et al., 2024) . Emergency situations require healthcare workers to make rapid, accurate, and coordinated clinical decisions amidst complex cases, limited information, and dynamic workflows (Gholipour et al., 2025). Several studies have shown that ED environments characterized by high workloads, overcrowding, understaffing, and time pressure increase the risk of medical errors and threaten patient safety (Petrino et al., 2023).

Medical errors remain a major problem worldwide and contribute significantly to patient morbidity and mortality. The World Health Organization (WHO) estimates that in low- and middle-income countries, approximately 134 million adverse events occur annually related to healthcare, resulting in approximately 2.6 million deaths (Kumah, 2025). This figure places unsafe care as a leading cause of death and disability, equal to or even surpassing many infectious and chronic diseases. However, various reports confirm that more than half of these events could be prevented through improvements in safety systems and culture (Radwan, 2022). In analyses of patient safety incidents, particularly in the context of emergency and pre-hospital care, communication failures or errors have been identified as a dominant factor triggering incidents, contributing to approximately one-quarter to nearly three-quarters of all reported incidents (Keshtkar et al., 2025). This suggests that improving communication between healthcare professionals and patients is a key component in reducing the global burden of medical errors and improving patient safety, particularly in emergency situations with their high time pressure and complexity.

In Indonesia, patient safety incidents continue to occur frequently at various levels of healthcare facilities, from community health centers (Puskesmas) to referral hospitals, and many are related to communication failures between healthcare workers and with patients and their families (Adriansyah et al., 2021). A study at a hospital in Surabaya showed that poor communication patterns in more than 60% of work units were associated with a high rate of patient safety incidents, while units with good communication had a much lower proportion of incidents (Adriansyah et al., 2021). Internationally, systematic reviews indicate that poor communication can be the sole cause of approximately 13% of patient safety incidents and a contributing factor in between a quarter and nearly half of all incidents, depending on the context and type of service (Keshtkar et al., 2025). This situation becomes even more complex in the emergency department (ED), which is widely recognized as a high-risk area due to heavy workload, time pressure, overcrowding, and rapid clinical dynamics, so that communication failures, organizational problems, and high workload are often cited as the main factors that threaten patient safety in the ED (Fernández et al., 2025).

Emergency medical errors, such as medication errors, delayed resuscitation, and procedural errors, are often associated with unclear instructions, unconfirmed messages, and misplaced assumptions among team members, reflecting communication and coordination breakdowns within the emergency team (Zimmer et al., 2021). Systematic reviews indicate that in emergency departments and resuscitation settings, medication

errors and other clinical errors can occur in approximately 20–40% of key interventions or tasks performed, with varying study methods and contexts (Nguyen et al., 2024). Studies of prehospital emergency teams and resuscitation simulations have also found that over 80% of scenarios contain at least one significant error, and the quality of teamwork (including communication, leadership, and clarity of instructions) is strongly associated with the occurrence of these errors (Lammers et al., 2012).

One communication approach widely recommended for improving patient safety is closed-loop communication (CLC). CLC is a structured communication method consisting of three steps: the sender delivers a clear and targeted message, the recipient reiterates or reconfirms the message (checkback), and the sender verifies that the message has been received and understood correctly, thereby completely closing the communication loop (Marzuki et al., 2020) . This model originates from military and aviation radio communications and has become a key component of the Crew Resource Management concept in the aviation industry as a strategy to prevent errors in high-risk situations (Hardie et al., 2020).

The implementation of closed-loop communication in emergency services has been shown to improve team coordination and reduce errors by increasing the clarity of instructions, speed of response, and completeness of critical task execution. In pediatric trauma resuscitation, the use of closed-loop communication accelerated task completion by more than three times compared to open communication, which indirectly reduced the chance of errors in time-dependent interventions (El-Shafy et al., 2018). Simulation-based training in a pediatric emergency department (ED) demonstrated a decrease in the number of serious medical errors from 19 to 5 (approximately 70% reduction) after staff were systematically trained in closed-loop communication (Diaz & Dawson, 2020). In the operating room and trauma bay, requests communicated and confirmed using closed-loop communication achieved near-perfect task completion rates (97–100%), higher than those without closed-loop communication (approximately 80%) and were associated with improved overall team technical performance (Lee et al., 2025).

Given the high incidence of errors in emergency situations rooted in communication problems, systematic efforts are needed to assess and improve the effectiveness of communication strategies used by healthcare professionals. Numerous reports indicate that communication failures contribute significantly to sentinel incidents and serious clinical errors, including in intensive care units, emergency departments, operating rooms, and trauma resuscitation rooms. In this context, closed-loop communication (CLC) stands

out as a promising approach because it can improve the clarity of instructions, the reliability of message delivery, and the completeness of clinical order implementation in emergency teams (Diaz & Dawson, 2020). This study aims to analyze the effect of closed-loop communication on reducing errors in emergency procedures.

RESEARCH METHODS

This study used an observational analytical design with a cross-sectional approach, which aimed to analyze the effect of closed-loop communication on reducing emergency treatment errors. The study was conducted in September 2025 at the Emergency Department (ER) of Bina Kasih General Hospital, Medan. The population in this study were all healthcare workers directly involved in emergency services in the ER. The sampling technique used total sampling, so that all respondents who met the research criteria during the data collection period were included, with a total of 20 respondents.

Data collection was conducted using structured observation sheets and questionnaires to assess the implementation of closed-loop communication and the incidence of emergency response errors. The independent variable in this study was the implementation of closed-loop communication, while the dependent variable was the level of emergency response errors. Data analysis was performed univariately to describe the characteristics of the respondents and bivariately to test the influence between variables using the Chi-Square test, with the statistical significance level set at $p < 0.05$.

The inclusion criteria for this study were healthcare workers assigned to the Emergency Department of Bina Kasih Hospital, having worked for at least 6 months in the emergency unit, being directly involved in emergency patient care, and being willing to participate by signing an informed consent form. Exclusion criteria included healthcare workers on leave, performing administrative duties, not being directly involved in emergency procedures, or not completing the research instrument completely.

RESULTS AND DISCUSSION

Table 1. Respondent characteristics (n=20)

Characteristics	n	%
Age (years)		
20–30	7	35,0
31–40	9	45,0
>40	4	20,0
Gender		
Male	8	40,0

Female	12	60,0
Last Education		
D3 Nursing	6	30,0
S1 Nursing/Nursing	11	55,0
Other profession related to emergency situations	3	15,0
Duration of Service in the Emergency Unit		
< 5 years	8	40,0
5–10 years	7	35,0
> 10 years	5	25,0
Emergency Training (BTCLS/PPGD/ATLS/ACLS)		
Yes	14	70,0
No	6	30,0

Table 2. The Effect of Closed-Loop Communication on Reducing Emergency Action Errors

Application of Closed-Loop Communication	Action Error				p-value*
	Low		High		
	n	%	n	%	
Good	9	45,0	2	10,0	0,012
Poor	2	10,0	7	35,0	

* Chi-Square Test

The results showed that most respondents were in the age range of 31–40 years, female, had a Bachelor's degree in Nursing, and had attended emergency training. In the bivariate analysis, respondents with good implementation of closed-loop communication experienced more low action errors compared to respondents with poor implementation of closed-loop communication (Table 1). The results of the Chi-Square test showed a p value = 0.012, which indicates a significant influence between the implementation of closed-loop communication and a decrease in emergency action errors (Table 2).

The implementation of closed-loop communication in emergency services has been shown to significantly reduce errors. The results of this study indicate that healthcare workers who effectively implement closed-loop communication tend to make fewer errors than those who do not. This finding supports the researchers' assumption that structured and confirmed communication can minimize miscommunication in critical clinical situations.

Characteristically, the majority of respondents were of productive age and had adequate educational backgrounds, which are theoretically associated with better cognitive abilities, clinical decision-making, and communication skills. This aligns with

the concept of nursing professional development, which emphasizes that clinical experience and continuing education are key factors in developing competencies, including in the emergency department. Longer work experience and exposure to complex cases have been shown to contribute to improved nurses' clinical decision-making and critical response skills in the emergency department and other emergency services (Fajardo & Baun, 2025).

On the other hand, formal education (e.g., postgraduate education, advanced certification) and continuing professional development programs (e.g., coaching, in-service training) have been shown to improve nurses' knowledge, skills, attitudes toward evidence-based practice, and confidence in emergency clinical practice (Lindström & Falk, 2023) . This combination of field experience and structured education plays a crucial role in strengthening emergency competency, improving patient safety, and ensuring high-quality nursing practice in high-stress environments such as the emergency department and prehospital care (Zoromba et al., 2025).

The study also showed that most respondents had participated in emergency training such as BTCLS, ATLS, or ACLS. These trainings not only improve technical skills but also emphasize the importance of effective team communication. According to Diaz and Dawson (2020) , simulation-based training that specifically emphasizes the use of closed-loop communication has been shown to improve staff perceptions of their communication skills and is associated with a significant reduction in medical errors in pediatric emergency patients with the highest severity (ESI 1). Similar approaches across emergency settings have shown that integrating closed-loop communication into simulation scenarios can clarify information exchange, expedite clinical task completion, and enhance teamwork and coordination during resuscitation and other critical situations (Ulmer et al., 2022).

The significant relationship between the implementation of closed-loop communication and a reduction in errors supports the concept of Crew Resource Management, which places communication as a key element of safety in high-risk environments. According to Diaz and Dawson (2020) , closed-loop communication is designed to ensure that messages are not only heard but also received and understood correctly through a series of call-out steps, reiteration by the recipient, and final verification by the sender. This verbal feedback mechanism helps build a shared mental model among team members, reducing the possibility of false assumptions, duplication of tasks, and missed messages. Several studies in the emergency and resuscitation contexts

have shown that the use of closed-loop communication is associated with increased accuracy and rapid task completion, as well as a reduction in medical errors and failure to follow-up that could potentially harm patients.

In the emergency department (ED) context, time pressure, high workload, and case complexity often lead to errors. This study aligns with the findings of Halinen et al. (2024) in the emergency department, which showed that communication failures and incomplete information flow are among the leading causes of patient safety incidents, including misdiagnosis, delayed therapy, and worsening patient conditions after discharge from the ED. Implementing closed-loop communication, with clear instructions, repeated orders by the recipient, and final confirmation by the person giving the order, helps ensure that messages are heard, understood, and acted upon, thereby reducing dropped requests, reducing miscommunication, and improving team response coordination in critical situations (Gjøvikli & Valeberg, 2023).

This study is also consistent with the findings of El-Shafy et al. (2018) who showed that the implementation of closed-loop communication in pediatric trauma resuscitation significantly accelerated the completion of critical tasks; orders delivered and confirmed via closed loop were recorded as being completed approximately 3.6 times faster than open communication, thereby increasing the speed and efficiency of the procedure. Furthermore, several other studies in trauma and emergency teams have found that the effectiveness of closed-loop communication is associated with reduced miscommunication and errors in the implementation of clinical orders, as the mechanism of message repetition and final confirmation allows for early detection of errors before they impact the patient (Härgestam et al., 2016).

This study has several limitations that should be considered when interpreting the results. First, the use of a cross-sectional observational design limits the ability to infer causal relationships between the implementation of closed-loop communication and the reduction of emergency procedure errors. Second, the sample size was relatively small (n = 20) and obtained from a single emergency department, which may limit the statistical power of the Chi-Square analysis and increase the risk of type II error. Although the Chi-Square test showed a significant association, some expected cell counts may be close to the minimum recommended threshold, and therefore the findings should be interpreted cautiously. Third, this single-center setting may limit the generalizability of the results to other hospitals or emergency care contexts with different organizational structures, workloads, and team dynamics. Future studies with larger sample sizes, multi-center

designs, and longitudinal or experimental approaches are recommended to strengthen the evidence and improve the external validity of the findings.

CONCLUSIONS AND SUGGESTIONS

The implementation of closed-loop communication was shown to have a significant effect on reducing emergency procedure errors in the Emergency Department of Bina Kasih General Hospital, Medan. Healthcare workers who applied closed-loop communication effectively tended to experience lower levels of action errors compared to those with suboptimal communication practices. These findings highlight the critical role of structured, clear, and confirmed communication in enhancing team coordination and improving patient safety in high-risk emergency settings.

Based on these results, it is recommended that closed-loop communication be consistently integrated into routine emergency care practices and reinforced through regular training and simulation-based exercises for healthcare teams. For future research, studies employing larger sample sizes and multi-center designs are recommended to improve generalizability and strengthen external validity. In addition, intervention-based or longitudinal studies are suggested to evaluate the effectiveness of structured closed-loop communication training programs over time and to assess their impact on clinical outcomes, team performance, and patient safety indicators in emergency care settings.

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