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SIMULATION-BASED TRAINING AS A COMPONENT OF IMPROVING NURSING MANAGEMENT IN EMERGENCY CARE

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Abstract

Background. *Providing care for patients in emergency situations, particularly in cases of sudden cardiac arrest, requires nurses to have adequate professional and organizational training, as well as the ability to work effectively as part of a multidisciplinary team. Simulation training allows for a comprehensive assessment of these aspects of professional practice in a controlled environment.* ***The aim of this study*** *is to justify the role of simulation-based training as a component of improving nursing management in emergency situations and to identify areas that require priority attention.* ***Materials and Methods.*** *A descriptive simulation study was conducted involving 112 nurses, divided into 14 groups of 8 participants each. In each group, four participants directly performed clinical and organizational tasks within a standardized scenario of sudden cardiac arrest; one participant timed the performance of the tasks; and three participants evaluated, respectively, clinical performance, the organization of care, teamwork, and communication.* ***Results.*** *Twelve out of 14 teams recognized sudden cardiac arrest in a timely manner; 13 out of 14 called for help; however, only 8 out of 14 began cardiopulmonary resuscitation in a timely manner. Seven teams correctly followed the protocol. Ten teams properly organized the delivery of the crash cart; seven teams demonstrated a clear division of roles, while nine teams showed duplication of efforts. Six teams had a clear leader; seven teams used a closed-loop communication system; and eight teams demonstrated coordinated teamwork.* ***Conclusions.*** *Simulation-based training makes it possible to identify areas for improvement in nursing management, primarily related to the transition from the timely recognition of an emergency to the organized implementation of an algorithm, a clear division of roles, the development of leadership, and effective team communication.*

Key words: *simulation-based training, nursing management, sudden cardiac arrest, crash cart, teamwork.*

1. Introduction

Sudden cardiac arrest in the hospital setting requires timely, sequential actions and effective coordination among healthcare personnel. As nurses are often the first to identify a deterioration in a patient's condition, their professional preparedness should include rapid response, resource organization, and effective teamwork.

Current research demonstrates that simulation-based educational strategies have a positive impact on nurses' ability to promptly recognize patient deterioration and respond appropriately [1]. The advantages of simulation-based training include the ability to reproduce urgent clinical situations without risk to patients and to repeatedly practice challenging elements of care. Such learning conditions make it possible to assess clinical skills, decision-making, equipment use, and team interaction. International experience with simulation-based training among nurses working in emergency care settings confirms its importance in bridging the gap between theoretical education and clinical practice [2, 3].

For nurses, preparedness for sudden cardiac arrest involves more than recognition of the event and technical performance of cardiopulmonary resuscitation. Effective response also requires rapid prioritization of actions, timely activation of additional assistance, allocation of available resources, and coordination of simultaneous tasks. These elements are particularly important in multidisciplinary hospital departments, where the initial response may depend on nurses who work under time pressure before the full resuscitation team arrives. Simulation therefore provides an opportunity to assess how clinical knowledge is translated into coordinated action under conditions that closely reproduce the demands of an actual emergency.

In addition to its educational value, simulation scenarios can help identify organizational gaps, latent safety threats, and problems related to the accessibility and ergonomics of clinical resources. In hospital-based simulation training, sudden cardiac arrest scenarios have been used as a basis for further improvement in the organization of emergency care [4]. This is particularly relevant from the perspective of nursing management, as the effectiveness of emergency response depends not only on individual competence but also on the organization of care processes, timely availability of equipment, distribution of responsibilities, and interaction among team members. Planning, role allocation, leadership, and closed-loop communication are important components of team interaction during cardiopulmonary resuscitation [5, 6].

Simulation also allows these elements to be assessed simultaneously rather than in isolation. During a standardized scenario, it is possible to observe the sequence of clinical actions, identify

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delays in task performance, determine whether team roles are clearly distributed, and evaluate how effectively information is exchanged. This makes simulation useful not only as an educational method but also as a practical tool for identifying organizational factors that may influence the quality and timeliness of emergency care.

In this context, the crash cart is a key resource that ensures timely access to the equipment and supplies required for the transition from basic to advanced resuscitation measures [7]. Its effectiveness, however, depends not only on availability but also on timely delivery, familiarity with its contents, and integration of its use into coordinated team actions. Studies indicate that the location of the crash cart may influence the timeliness of emergency care delivery and the effectiveness of resuscitation efforts [8]. In addition, simulation conducted before and after training has been shown to positively affect clinical reasoning and the organization of nursing activities in emergency settings [9].

The use of simulation is therefore particularly relevant for identifying the relationship between clinical performance and organizational processes during sudden cardiac arrest. A team may recognize cardiac arrest promptly but still experience delays in initiating CPR, distributing roles, preparing equipment, or coordinating further interventions. Assessment of these stages can provide a more comprehensive understanding of nurses' preparedness and indicate which elements should be prioritized in subsequent training.

Thus, simulation-based training should be considered more broadly than merely as a method for practicing cardiopulmonary resuscitation. It can be used for the comprehensive assessment of clinical performance, organization of care, teamwork, and communication. At the same time, further clarification is needed regarding which aspects of nurses' performance during simulated sudden cardiac arrest demonstrate the greatest potential for improvement.

Aim of the study. To substantiate the role of simulation-based training as a component of improving nursing management in emergency care through the analysis of nurses' performance during a standardized sudden cardiac arrest scenario.

2. Materials and methods

The object of the study was nurses' performance in providing care to a patient with sudden cardiac arrest in a simulated environment. An observational simulation-based study was conducted involving 112 nurses, who were divided into 14 groups of 8 participants. All groups performed a standardized clinical scenario of sudden cardiac arrest using a high-fidelity manikin. To ensure a uniform observation structure across all groups, the participants' roles were predefined (Table 1).

The total number of study participants was 112, while the team (n = 14) was the primary unit of analysis for scenario performance.

For structured analysis, the results were categorized into three areas. Clinical performance included timely recognition of sudden cardiac arrest, timely activation of assistance, initiation of cardiopulmonary resuscitation, and correct adherence to the resuscitation algorithm. Organization of care included crash cart delivery, allocation of functions among team members, and the occurrence of duplicated actions. Teamwork

Table 1

Distribution of participants' roles and functions during a simulated sudden cardiac arrest scenario

Participant No.	Role in the simulation scenario	Main functions
1	Nurse first at the scene	Recognition of sudden cardiac arrest, initial assessment of the patient's condition, and activation of emergency assistance
2	Nurse first called to assist	Initiation of basic resuscitation measures and participation in cardiopulmonary resuscitation (CPR)
3	Nurse responsible for the crash cart	Delivery of the crash cart and preparation for advanced resuscitation measures
4	Nurse responsible for procedures and medications	Preparation of equipment, performance of required procedures, and preparation of medications
5	Nurse responsible for time recording	Recording of time, sequence, and completion of key actions
6	Observer of clinical performance	Assessment of cardiac arrest recognition, initiation of CPR, and adherence to the resuscitation algorithm
7	Observer of care organization	Assessment of role allocation, crash cart delivery, sequence, and organization of actions
8	Observer of teamwork and communication	Assessment of leadership, coordination, closed-loop communication, and overall teamwork

and communication included the presence of a clearly identified leader, use of closed-loop communication, and overall team coordination.

Timeliness and correctness of actions were assessed according to a predefined simulation scenario checklist based on the European Resuscitation Council (ERC) algorithm. Participation in the study was voluntary. Statistical data processing was performed using Microsoft Excel 2021.

3. Results and Discussion

Based on the results of the 14 simulation scenarios, timely recognition of sudden cardiac arrest was observed in 12 of 14 teams (85.7%), timely activation of assistance in 13 of 14 teams (92.9%), and timely initiation of cardiopulmonary resuscitation in 8 of 14 teams (57.1%). Correct adherence to the resuscitation algorithm was demonstrated by 7 of 14 teams (50.0%).

These findings indicate that the initial stages of emergency response, particularly recognition of the critical condition and activation of assistance, were performed more consistently than the subsequent stages requiring coordinated implementation of the resuscitation algorithm. The decrease in performance between recognition of cardiac arrest and timely initiation of CPR may reflect the increasing complexity of team actions once several tasks have to be performed simultaneously. At this stage, clinical competence is closely linked to the ability of team members to rapidly distribute responsibilities, prioritize interventions, and maintain a coordinated sequence of actions.

The fact that only half of the teams demonstrated correct adherence to the full resuscitation algorithm further emphasizes the importance of simulation not only for assessing isolated clinical skills but also for evaluating the continuity and consistency of the entire response process. In this context, simulation-based training provides an opportunity to identify specific stages at which delays, deviations from the algorithm, or loss of coordination may occur and to use these observations for targeted improvement of nursing practice.

Appropriate organization of crash cart delivery was observed in 10 of 14 teams (71.4%), while clear role allocation was identified in 7 of 14 teams (50.0%). Duplication of actions occurred in 9 of 14 teams (64.3%).

These results demonstrate that the availability and timely delivery of the crash cart alone do not ensure optimal organization of emergency care. Effective use of this resource also requires a clear understanding of individual responsibilities and coordinated distribution of tasks among team members. The relatively frequent duplication of actions suggests that some teams experienced difficulties in defining responsibilities during the simulated emergency. Such duplication may reduce the efficiency of team performance by directing several participants toward the same task while other necessary interventions remain insufficiently addressed.

From the perspective of nursing management, organization of care during sudden cardiac arrest includes not only access to equipment and medications but also the ability to allocate available human and material resources according to clinical priorities. Therefore, the crash cart should be considered as part of a broader organizational process rather than solely as a source of emergency equipment. Simulation scenarios make it possible to assess whether its delivery and use are properly integrated into the sequence of resuscitation actions and whether team members are able to maintain continuity of care while additional resources are being mobilized.

Clear leadership was observed in 6 of 14 teams (42.9%), closed-loop communication was used in 7 of 14 teams (50.0%), and coordinated teamwork was demonstrated by 8 of 14 teams (57.1%).

The results indicate that teamwork and communication represent important areas for further improvement. Leadership during resuscitation is essential for maintaining a shared understanding of priorities, assigning responsibilities, monitoring task completion, and adapting team actions to changes in the clinical situation. The relatively limited presence of clearly expressed leadership may have contributed to difficulties in role allocation and duplication of actions observed in several teams.

Similarly, closed-loop communication was used in only half of the teams. In high-stress situations such as sudden cardiac arrest, structured communication helps ensure that instructions are clearly transmitted, acknowledged, and completed. Its absence may increase the risk of misunderstood commands, repeated actions, or failure to complete necessary tasks. Coordinated teamwork, demonstrated by 8 of 14 teams, therefore appears to depend not only on individual clinical competence but also on the quality of communication and leadership within the team.

The use of simulation scenarios emphasizing teamwork and closed-loop communication may contribute to improved team performance during resuscitation [10].

The effectiveness of interprofessional simulation-based training in improving teamwork, developing interprofessional competencies, and enhancing communication among healthcare professionals has also been demonstrated [11; 12]. Such training provides an opportunity to practice coordinated decision-making, clarify professional roles, and improve interaction between team members under time-sensitive clinical conditions. Simulation studies further demonstrate the potential for targeted assessment and development of leadership skills during resuscitation scenarios, which may support better coordination of actions, prioritization, role allocation, and monitoring of task performance [13].

Considering the findings of the present study and international evidence, simulation-based training may be regarded as an important tool for the continuous improvement of initial resuscitation actions, team organization, and local care processes [14]. Its effectiveness largely depends on systematic implementation and integration into continuing professional development. Regular training sessions, standardized clinical scenarios, structured debriefing, and team-based learning are important elements of staff preparedness for in-hospital cardiac arrest [15]. Repeated simulation also makes it possible to identify recurrent difficulties in clinical performance, organization of care, and team interaction and to address them through targeted training.

The simulation environment additionally provides an opportunity to systematically develop professional communication skills by allowing healthcare professionals to practice information exchange, task confirmation, interaction among team members, and coordination of actions in a safe setting. Subsequent structured debriefing enables participants to analyze their performance, identify communication and organizational gaps, and determine specific areas for further improvement [16].

4. Conclusions

Simulation-based modeling of sudden cardiac arrest demonstrated a relatively high level of timely recognition of the critical condition and activation of assistance by nurses. However, lower performance was observed at subsequent stages requiring coordinated execution of the resuscitation algorithm, particularly timely initiation of CPR, correct role allocation, leadership, and structured team communication.

The findings indicate that successful management of sudden cardiac arrest depends not only on clinical competence but also on the organization of care and the quality of teamwork. Simulation-based training should therefore integrate three key areas: clinical performance, organization of care, and teamwork and communication. Such an approach may improve nurses' preparedness for coordinated and timely response to emergency situations.

A promising direction for further research is the development and evaluation of a structured simulation-based training program for nurses working in multidisciplinary departments of a super-cluster hospital, focusing on three key areas: clinical performance, organization of care, and teamwork and communication. Further evaluation using a pre-/post-intervention design would allow the impact of such training on the timeliness and accuracy of nurses' actions in emergency care to be determined.

A separate research direction should involve integrating a standardized crash cart utilization model into simulation scenarios and assessing its impact on the organization of care, allocation of responsibilities, accessibility of essential equipment, and coordination of team actions. The findings may contribute to the further scientific substantiation of an organizational and functional model of nursing management in emergency care within a super-cluster hospital and to the development of practice-oriented training programs for nurses preparing for advanced practice.

Study limitations

The study was conducted in a simulation center; therefore, the findings may not fully reflect nurses' performance in real clinical situations. In addition, the primary unit of analysis comprised 14 teams, which limited the possibilities for more extensive statistical analysis and generalization of the findings.

Conflict of interest

The authors declare no conflict of interest.

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Author contributions

A. A. Markovych – study conception and design, data collection and analysis, and manuscript preparation; A. A. Hudyma – scientific supervision, methodological support, interpretation of the findings, and critical revision of the manuscript.

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