



Enhancing Emergency Management Skills Through Manikin-Based Basic Life Support Simulations: An Evidence-Based Approach for Nursing Students

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ABSTRACT

Introduction: Effective Basic Life Support (BLS) is crucial in improving survival rates during emergencies. Current nursing education often relies on traditional methods, which may not fully prepare students for the pressure and decision-making required in real-life situations.

Objective: This study explores the effectiveness of Manikin-Based BLS Simulation with Scenarios in enhancing nursing students' skills in emergency management.

Method: This study employed a one-group pre-test post-test design. Thirty nursing students were randomly assigned to participate in a Manikin-Based BLS Simulation training program. Their BLS skills were assessed using a validated and reliable questionnaire based on the American Heart Association (AHA) 2020 guidelines, administered both before and after the training. Data collection occurred in May 2024. The subsequent analysis will compare pre-test and post-test scores to evaluate the effectiveness of the Manikin-Based BLS Simulation in improving students' BLS skills.

Result: Post-training, knowledge improved significantly ($p < 0.001$), with 93.3% of students achieving 'Good' knowledge and 96.7% passing skill assessments.

Conclusion: Manikin-based simulations effectively enhance knowledge and skills, supporting their integration into nursing curricula.

Keywords: basic life support, emergency management, nursing education, simulation

Introduction

One of the emergency conditions is cardiac arrest, cardiac arrest is the leading cause of death globally, regardless of whether the patient has a family history of heart disease or not (AHA, 2020). The most common causes of cardiac arrest cases are ventricular tachycardia (VT) or ventricular fibrillation (VF), coronary heart disease (CHD), liver damage, and other similar conditions (Rustandi et al., 2023). In addition, there is a group of people who are more likely to have a heart attack; people with hypertension, diabetes, obesity, dyslipidemia, smokers, and unhealthy lifestyles (Pertiwi et al., 2021).

Globally cardiovascular disease has claimed 17.9 million lives in 2023, with 16.17% of those deaths caused by heart attacks (WHO, 2023). According to Kemenkes Kesehatan (2023), there are 651,481 annual deaths in Indonesia caused by cardiovascular diseases, and 245,343 of them are direct results of heart disease, with a frequency of 1.6% or about 29,550 events. Central Java is included in the top five provinces in Indonesia for the incidence of heart attacks, and is included in the category of 8 provinces with the highest incidence of cardiac arrest at the national level (Kemenkes, 2018). One of the largest hospitals in Surakarta, Dr. Moewardi Hospital Surakarta, which is also a clinical practice site for nursing students, had 102 cases of deaths related to heart attacks between November 1, 2023 and November 30, 2023 (Portal Jawa Tengah, 2023).

The emergency condition of cardiac arrest requires immediate medical attention, the case can occur suddenly without initial symptoms (Dewantara & Mulyaningsih, 2022). Factors that affect the treatment of cardiac arrest conditions include understanding or knowledge, experience, and motivation. This can result in a large number of deaths and the impact is difficult to handle (Kusyani & Ana, 2023). According to Pawiliyah dkk, (2023) having a strong understanding of the basics of patient management is essential in the implementation of Basic Life Support (BLS).

The effectiveness of starting Basic Life Support (BLS) in minutes can improve the survival of victims with cardiac arrest by up to 4%. This is especially useful when a person is still breathing spontaneously (Putri et al., 2023). Heart failure emergencies, BLS helpers can include doctors, nurses, medical professionals, and even nursing students as first responders, future nursing students must master basic life support (BLS) well to identify the patient's condition, perform CPR, and perform the necessary space management tasks before the arrival of the blue code team (Victoria et al., 2022).

Previous research shows that 68% of Stikes Dharma Husada Bandung students have an inadequate level of knowledge (Prayitno et al., 2020). The lack of knowledge of BHD of nursing students will have an impact on the quality of patient service on the return of spontaneous circulation at the point where the patient's heart stops beating (Rahmawati et al., 2022). Having the role of a nursing student who is proficient in Basic Life Support (BLS) can reduce the number of deaths and illnesses caused by life-threatening illnesses (Wahyuningsih et al., 2022). When faced with a life-threatening emergency, such as someone who stops breathing or his heart stops beating, nursing students are responsible for acting as first responders and providing assistance without delay in their role as medical personnel. Lack of professional care at the time of a heart attack can lead to a decrease in the number of lives saved or the death rate of the victim (Ayu et al., 2022).

The lack of training in Cardiopulmonary Resuscitation (RJP) for prospective medical personnel and the low knowledge of nursing students related to BLS and the provision of BLS that is not in accordance with procedures will increase the death rate of victims with

cardiac arrest. One of the significant factors in influencing students' abilities is the way the approach is applied to increase their level of knowledge in the field. The learning approach known as simulation giving, which describes and simplifies real-world situations or phenomena, is highly effective because it helps students understand real-life situations and prepare for emergency situations (Atmaja et al., 2023).

The assistant in assisting the BLS, should have knowledge of the subject, have relevant work experience, and be able to handle the medical base. One effective way to increase one's knowledge is the use of simulations. This allows for more accurate learning by simulating real-life situations. The application of BLS in various settings, both at home and outside the home, provides valuable opportunities for nursing students (Atmaja et al., 2023).

Research Simamora dkk., (2023) entitled "The Effect of Cardiopulmonary Resuscitation (CPR) Simulation and Video on Attitude and Information of Athletes from Malang City", This study compared the effect of video provision with RJP simulation showing the results of the average percentage of pretest scores in the video intervention group of 61% with a posttest score of 86% so that the difference in score increase was 25%, while the simulation intervention group showed the results of an average percentage of pretest scores of 61% and posttest 90% with a score difference of 29%. By referring to the data presented, it shows that the results of the RJP simulation have a higher change in knowledge level than the video intervention, with a p-value of $0.02 < 0.05$, it can be concluded that there is an effect of the provision of RJP simulation on the level of knowledge.

Based on the results of a preliminary study conducted by the researcher from January 2024 to February 2024, there were 103 sixth-semester students at Kusuma Husada University, 157 at the University of Muhammadiyah Surakarta, 72 at Duta Bangsa University, and 115 at Universitas 'Aisyiyah Surakarta. The preliminary study at Kusuma Husada University Surakarta revealed that students are required to complete BLS training before starting clinical practice in hospitals during their third semester. They also take an emergency course in the sixth semester and participate in an emergency clinical station practice at the end of the sixth semester. At the University of Muhammadiyah Surakarta, students receive theoretical and laboratory emergency courses in the sixth semester but only undertake emergency stage clinical practice during the professional nursing program. At Duta Bangsa University, students take emergency courses in the first semester and again in the sixth semester, but they only participate in clinical practice at the end of the sixth semester. Meanwhile, at Universitas 'Aisyiyah Surakarta, students receive BLS-related materials during laboratory courses in the sixth semester to prepare for Emergency-Community clinic practice. BLS training, however, is specifically targeted at professional nursing students. Interviews with five sixth-semester students showed that three had limited knowledge, one had moderate knowledge, and one had good knowledge of Basic Life Support (BLS).

This research was conducted at the University of 'Aisyiyah Surakarta using a simulation method. This approach was chosen because Basic Life Support (BLS) training for students was only provided during the sixth semester in laboratory courses and delivered solely through demonstration methods. Meanwhile, simulation-based training was primarily focused on the nursing profession. Simulation training has been proven effective in enhancing students' knowledge and supporting their skills before they enter clinical practice in hospitals.

Cardiac arrest remains a leading cause of mortality worldwide, requiring immediate and competent intervention. Effective Basic Life Support (BLS) training is essential for nursing students, equipping them with critical skills necessary for real-life emergencies.

Objective

The purpose of this study is to determine the level of knowledge of students before and after they take part in the Basic Life Support Simulation (BLS), as well as to analyze the impact of the simulation on their skill.

Method

This study employed a quantitative research design, utilizing statistical analysis to compare outcomes before and after the intervention. A quasi-experimental design with a one-group pre-test-post-test format was adopted. The study was conducted at a university in Surakarta, Indonesia. The population of this study comprised sixth-semester undergraduate nursing students from Universitas 'Aisyiyah Surakarta. A sample size of 30 participants was determined using Slovin's formula, accounting for potential dropouts. Purposive sampling was employed to select participants.

The study established specific criteria for participant inclusion and exclusion. Inclusion criteria required participants to have completed an emergency nursing theory course, not participated in a clinical practicum in emergency nursing, and agreed to join the study. The exclusion criterion involved those unable to attend all simulation sessions. Participants underwent a Basic Life Support (BLS) simulation intervention, incorporating role-playing exercises to enhance practical skills. Their knowledge and skill levels were systematically assessed both before and after the intervention to evaluate its effectiveness.

The instrument used in this study was a questionnaire consisting of 20 items assessing Basic Life Support (BLS) knowledge. Each correct answer scored 1, while incorrect answers scored 0. Knowledge was categorized as Good (76-100%), Moderate (56-75%), or Poor (<55%). The instrument underwent validity testing at Kusuma Husada University, with 20 valid items retained (r range: 0.369-0.718). Reliability testing yielded a Cronbach's alpha of 0.867, indicating high reliability. Additionally, skills were assessed using an American Heart Association (AHA) 2020 checklist, with passing set at >65 points.

Data analysis is conducted after collecting data from respondents to address the research questions. The process begins with editing, where observation sheets are reviewed for completeness, and incomplete data is returned to respondents for correction. Next, coding converts textual data into numerical form, with codes assigned to variables (e.g., 1 for Good, 2 for Moderate, 3 for Poor knowledge; 1 for Pass, 2 for Fail skills). The coded data is then transferred into software for analysis while anonymizing respondents. Finally, tabulation involves cleaning, organizing, and summarizing data using SPSS 23 to derive frequency distributions and ensure accurate analysis.

Result

Based on the study results, it was found that most students' knowledge levels before the training were categorized as poor, with 23 respondents (76.7%), and sufficient, with 7 respondents (23.3%). After the training, the majority of students' knowledge levels improved to the good category, with 28 respondents (93.3%), while 2 respondents (6.7%) remained in the sufficient category. Regarding skill levels, before the training, all respondents (30 students, 100%) did not pass. However, after the training, the majority of respondents (29 students, 96.7%) passed, while only 1 respondent (3.3%) did not pass, as shown in Table 1.

Table 1. Frequency Distribution of Respondents Before and After Intervention (n=30)

Category	Before Intervention		After Intervention	
	Frequency	%	Frequency	%
Knowledge level assessment:				
Good	0	0	28	93,3
Enough	7	23,3	2	6,7
Less	23	76,7	0	0
Skill level assessment:				
Pass	0	0	29	96,7
Not Passed	30	100	1	3,3

Tabel 2. Effect of Manikin-Based Basic Life Support (BLS) Simulation with Scenarios Enhance Nursing Students' Knowledge and Skills (n=30)

Variable	Mean	Difference	SD	-t	P-Value	Information
Knowledge						
<i>Pre Test</i>	47,33	-40,5	12,412	-17,872	0,001*	Signifikan
<i>Post Test</i>	87,83					
Skills						
<i>Pre Test</i>	31,30	-53,76	14,438	-20,397	0,000*	Signifikan
<i>Post Test</i>	85,07					

*Paired sample t test

There is a significant influence of students' knowledge and skills in carrying out Basic Life Support (BHD) after being given training using the simulation method, as evidenced by the p-value of knowledge level $p=0.001$ ($p<0.05$), and skill level $p=0.000$ ($p<0.05$).

Discussion

Based on the bivariate test of the Paired Sample T-Test with the help of SPSS Software version 27, a p-value of $0.001 < 0.5$ can be interpreted significantly, which shows that there is a meaningful influence between the level of knowledge of students before and after being given the Basic Life Assistance (BHD) simulation treatment. This is in line with previous research conducted by Ardiansyah (2023) The results showed a value of $p=0.000$ ($p<0.05$) which means that H_a was accepted and H_0 was rejected, that is, there was an effect of providing a simulation of Basic Life Support (BHD) with Motion Graphics on the level of knowledge in Karang Taruna (Ardiansyah &Utami, 2023).

In this study, after the intervention of Basic Life Support Simulation (BHD) with the roleplay method or role-playing for students, it has a great impact on the change in the level of knowledge. An effective Basic Life Support (BHD) simulation is influenced by several factors, namely educational methods, message materials delivered in the form of lectures and roleplay simulations, if not done properly in the process, it will have an impact on the level of knowledge of each individual (Mumek et al., 2022).

The simulation method approach in the form of demonstration (roleplay) makes it easier for trainees to increase their knowledge. The research method in this study is the lecture and role-playing method. The lecture method is a way to explain ideas, understandings, or messages orally to individuals or groups in order to obtain information that can increase knowledge and be included in the provision of education (Frienjelita Afnita Mumek et al., 2022). This is supported by research Simamora et al (2023) who said that the learning method with simulation for the enforcement of Cardiopulmonary Resuscitation (CPR) provides a real

experience by conducting demonstrations from instructors, direct guidance, and learning evaluation at the end of the session on the implementation of RJP. The simulation method approach in the form of demonstration (roleplay) makes it easier for trainees to improve their knowledge (Simamora et al., 2023).

The level of knowledge that occurred in the 6th semester students of Universitas 'Aisyiyah Surakarta after the Basic Life Support Simulation (BHD) was carried out, based on the results of the research, the majority of students had an increase in the level of knowledge, namely in the good and medium categories. The difference or increase in the level of student knowledge is caused by the existence of education or learning processes that stimulate more than one sense, namely sight and hearing, so that the absorption of information can be maximized.

This study aims to test the effectiveness of BHD training with simulation methods in improving the BHD skills of nursing students. The results of the study showed a significant improvement in BHD skills after participating in simulation training as evidenced by the value of $p=0.000 < 0.05$. In line with the research conducted by Khalilati et al., (2020) who examined the effectiveness of simulation with student skills at SMA N 1 Tabunganen, it was obtained that a roleplay-based simulation method was given with a value of $p=0.000 < \alpha$, then it was concluded that the hypothesis was accepted, which means that there was a difference in the effectiveness of skills before and after the simulation.

These findings support the research hypothesis that simulation is an effective method in improving BHD skills. This skill improvement is in line with Bandura's theory of social learning, which states that individuals learn through observation and imitation of models. This training improves understanding of BHD actions, the use of tools, and quick response in emergency situations (Smith & Brown, 2023) Several studies have found that simulation methods are effective in improving students' skills and self-efficacy in doing BHD. (Johnson & et al., 2022) In addition, health education about BHD with simulation methods can also improve students' skills in saving lives in emergencies (Garcia & Lee, 2021).

The development of knowledge can be seen from a person's ability to apply one of them in the form of skills. The skill development process can be carried out after the follow-up learning activities of the learning activities. The effectiveness of simulation in improving BHD skills can be explained through several mechanisms. In addition to social learning theory, constructivism theory is also relevant in explaining the learning process that occurs in simulation. Students actively build their own knowledge through interaction with simulations. In addition, the simulation provides immediate and specific feedback, so students can revise their understanding (Khalilati et al., 2020; Novita, 2019; Rondhianto et al., 2023).

Skills development must start from what the student has mastered to the skills he has not mastered. The existence of new information about something can provide a new cognitive foundation for the formation of knowledge about it. The education and training they have is expected to improve their abilities, both in knowledge, skills and attitudes. These skills must always be improved and maintained so as to ensure that nurses can carry out their roles and functions professionally (Khalilati et al., 2020).

The results of this study have significant implications for nursing education. Simulation can be an effective tool to train students in performing BHD and other clinical skills. In addition, the results of this study also have implications for the policy of providing emergency nursing materials that can use the simulation method. The significant improvement in skills aligns with Bandura's social learning theory, emphasizing the role of observation and practice in

knowledge acquisition. However, limitations such as sample size and lack of control group should be addressed in future research.

Further research can explore the factors that affect the effectiveness of simulations, such as the level of realism of the simulations, the duration of training, and the individual characteristics of participants. Additionally, comparative research between the various BHD training methods can provide more complete information on which methods are most effective. Research can also investigate the long-term effects of simulated training on students' clinical performance after they graduate.

Conclusion

The findings from the study indicate that students' knowledge and skills can be improved through manikin-based Basic Life Support (BLS) simulations incorporating scenarios or roleplay. Researchers suggest that this approach may serve as a valuable factor for future research. This study confirms the efficacy of manikin-based BLS simulations in nursing education. Institutions should integrate regular, scenario-based BLS training to better prepare students for real-world emergencies.

Conflict of interest

The researchers stated that there is no conflict of interest related to the implementation and publication of the results of this research. The entire research process, from planning, data collection, analysis, to report preparation, was carried out independently without any influence or pressure from any third party. A commitment to research ethics is upheld throughout the research process, ensuring transparency, accuracy and honesty in reporting results. Respondents' participation was voluntary with informed consent, and their confidentiality and privacy were maintained in accordance with applicable research ethics standards. With this statement, researchers hope that the research results can be trusted and used as a valid reference for the development of science and health practices related to ethnomedicine and reproductive health.

Ethical consideration

The study protocol was approved by the Health Research Ethics Committee (KEPK) of Universitas 'Aisyiyah Surakarta (approval number 178/V/AUEC/2024).

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Authors' contribution

Each author makes an equal contribution to all parts of the research. All authors have reviewed and approved the final draft critically and are responsible for the index and similarity of the manuscript.

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