
Effect of Self-Directed Videos and Simulations on Nurse Skills in Advanced Cardiac Life Support: Comparison Study

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KEYWORDS

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Abstract Cardiac arrest is one of the highest causes of death in the world. This condition requires the handling of cardiac arrest based on the chain of survival concept. The chain of survival concept is carried out by nurses who have sufficient skills to handle cardiac arrest. Skills can be obtained either through education and training based on simulation or using technology such as self-directed videos. The purpose of this study was to identify the differences in self-direct video and simulations of nurse skills in advanced cardiac life support. This study used Quasi-Experimental Design by pretest-posttest with a control group approach. The 42 respondents were divided into two groups. Skills are measured before and after learning with each method. Data were analyzed using Wilcoxon and Mann-whitney tests. The results showed changes in skills before and after learning in the two methods, with each p-value = 0.000. There were no differences in skills changes before and after learning in both groups with a p-value = 0.437. Learning using self-directed videos and simulations can improve nurse skills in carrying out advanced cardiac life support.

Introduction

Cardiac arrest is a condition in which the heart fails to contract effectively, which is unpredictable (AHA, 2015). Cardiac arrest is a condition of sudden cessation of normal blood circulation characterized by loss of arterial blood pressure, which causes blood flow to the brain and other organs disrupted (Hardisman, 2014). Cardiac arrest can cause ventricular tachycardia (VT), ventricular fibrillation (VF), pulseless electrical activity (PEA), and asystole. Disorders of cardiac electrical activity such as ventricular fibrillation (VF), ventricular tachycardia (VT), asystole, and pulseless electrical activity (PEA) are the most common arrhythmias in cardiac arrest (Keller & Halperin, 2015; Koplan & Stevenson, 2009).

Cardiac arrest is one of the main problems in the world. The World Health Organization states that nearly 60% of the world's population

deaths are caused by sudden cardiac arrest (WHO, 2016). Due to sudden cardiac mortality, the mortality rate in the world reached 50-100/100,000 people in the world (Wong *et al.*, 2019). The main cause of sudden cardiac arrest is coronary heart disease (Wong *et al.*, 2019). WHO also explained that the first rank of 10 causes of death in the world was caused by ischemic heart disease and stroke, which reached 56.9 million people until 2016 (WHO, 2018). Based on the 2018 Indonesian Heart Association, cardiovascular disease is one of the causes of cardiac arrest. It has a prevalence of around 10 out of 10,000 normal people under 35 years old, and each year was reaching 300,000-350,000 events (IHA, 2018). One type of cardiac arrest that often occurs is Intra-Hospital Cardiac Arrest (IHCA). IHCA is a state of cardiac arrest that occurs in the hospital and is needed to treat chest compression,

defibrillation, or both (Morrison et al., 2016). IHCA conditions often occur when inpatients are hospitalized and become manifestations of worsening of an illness (Attin et al., 2016). The concept of chain of survival had been recommended for the act of rescuing victims in hospitals, especially by monitoring and prevention, introduction and activation of emergency response systems, high-quality CPR, rapid defibrillation, continued life assistance and post-heart attack care (AHA, 2015). The action is carried out by one of the medical personnel, especially nurse.

Nurses have an important role in applying the concept of chain of survival in patients who experience cardiac arrest. The application of the chain of survival concept is very much related to the competencies possessed by nurses, especially skills in providing patient care for cardiac arrest. This competency is the main basis for nurses to improve patient survival rates for cardiac arrest (Rajeswaran et al., 2018). Nurse competency related to cardiac arrest is obtained through the process of education and training. Education and training on treating cardiac arrest can be done using traditional and non-traditional methods (Hsieh et al., 2016). Fawaz and Hamdan-Mansour stated that training with traditional methods could be in the form of simulation. This simulation learning process uses instructors and is proven to be able to improve skills in doing basic life assistance (Fawaz & Hamdan-Mansour, 2016). However, as technology develops, learning methods to strengthen CPR skills can use video in the learning process. Meissner, Kloppe, and Hanefeld stated that one method of learning with videos is self-directed video. This method provides an overview of cases in handling cardiac arrest, which is then studied and practiced directly by respondents (Meissner et al., 2012). This method becomes an alternative to maximize one's skills in carrying out CPR actions (Ettl et al., 2017).

Preliminary studies conducted by the researchers stated that there were 221 cases of cardiac arrest, with the number of patient deaths reaching 71 cases in 2017-2018. The results of observations made by researchers found that only a few nurses were able to carry out cardiac arrest management. Generally, nurses have not been right to handle cardiac arrest properly, especially when providing quality cardiopulmonary resuscitation, have not been exposed to defibrillators and heart rhythm readings. Nurses only provide cardiopulmonary resuscitation without seeing the heart rhythm that appears so that cardiac arrest handling is not maximal. The purpose of this study was to identify the differences in self-direct video and simulations of nurse skills in advanced cardiac life support.

Materials and Methods

The research used a quasy-experiment design through pretest-posttest with a control group approach. The research respondents were 42 nurses from RSUD dr. Slamet Martodirdjo Pamekasan which divided into 2 groups, namely the self-directed video group and the simulation group. Self Directed videos used by researchers were following the 2015 AHA guidelines and simulations given by instructors who have licenses from the AHA (AHA, 2015). Videos given to respondents lasted about 10 minutes, and respondents' simulations ranged from 10-20 minutes. The inclusion criteria of respondents in the form of nurses with work experience of at least 2 years had done cardiac arrest management and were willing to become respondents. AHA certified instructors carry out skill measurements. Measurements were made before and after the intervention. Bivariate analysis conducted through Wilcoxon and Mann Whitney tests. This research was carried out after obtaining ethical clearance from the ethics commission at RSUD dr. Slamet Martodirdjo Pamekasan.

Results and Discussion

Table 1 Characteristics of Respondent Based on Age, Length of Work, and Skill

	N	Mean	Median	Min-Max	SD
Age	42	34.74	33	25-55	7.245
Length of work	42	12.26	10	4-28	6.56
Skill					
-Pre	42	8.55	9	7-10	1.041
-Post	42	10.74	11	9-12	0.857

Based on Table 1, we assume that the respondent's youngest age was 25 years, and the most senior age was 55 years, with an average age of 34.74 years. The longest working time of respondents was 28 years, and the youngest was 4 years, with an average length of work of 12.26 years. The highest skill score before learning is 10, and the lowest is 7, with an average was 8.55. After learning, the highest skill score was 12, and the lowest was 9 with an average was 10.74.

Table 2 Characteristics of Respondent Based on Characteristics of Gender, Level of Education and Competence

No	Variable	Category	f	%
1	Gender	Male	25	59.5
		Female	17	40.5
2	Level of Education	Diploma 3	28	66.7
		Bachelor+RN	14	33.3
3	Competence	Basic Life Support	42	100
Total			42	100

Based on table 2, we assume that the dominant gender was male with 24 respondents. The dominant level of education was diploma 3, with 28 respondents. The dominant competency was basic life support with 42 respondents.

Table 3 Changes in Nurses' Skills Before and After the Provision of Self-Directed Video Training at RSUD Dr. Slamet Martodirjdo Pamekasan

Measurement	Median (Min-Max)	P-value
Skills before learning	9 (7-10)	0.000
Skills after learning	11 (9-12)	

Table 3 explained p-value = 0.000 ($p < 0.005$), so it can be concluded that there are changes in skills before and after learning with self-directed videos.

Table 4 Changes in nurses' skills before and after the provision of simulation at RSUD dr. Slamet Martodirjdo Pamekasan

Measurement	Median (Min-Max)	P-value
Skills before learning	8 (7-10)	0.000
Skills after learning	10 (9-12)	

Table 4 explained p-value = 0.000 ($p < 0.005$), so it can be concluded that there are changes in skills before and after learning with simulation

Table 5 The Difference in Changes in Nurses' Skills Before and After Self-Directed Videos and Simulations in RSUD Dr. H. Slamet Martodirdjo Pamekasan

Groups	Median	Min-Max	P-value
Video	2	2-3	0.437
Simulation	2	2-3	

Table 5 explained p-value = 0.437 to clarify that there are no different changes in nurses' skills before and after training in the self-directed video and simulation groups at the RSUD dr. H. Slamet Martodirdjo Pamekasan.

Discussion

This study indicated changes in nurses' skills in helping patients with cardiac arrest before and after learning using self-directed videos at RSUD dr. Slamet Martodirdjo Pamekasan with p-value = 0.000. This study obtained an average skill increase of 2.24, where the post-test score of skills was higher than the pretest skill score. The results obtained in this study group showed a change in the respondent's ability regarding handling patients with cardiac arrest, which consisted of the introduction of heart attacks, emergency responses, pulse and breathing checks, quality CPR, defibrillation, and drug use.

In this study, before being given learning with self-directed videos, respondents had an average skill score of 8.57 out of a total score of 12. Almost the respondent was unable to do quality CPR, defibrillation, and drugs according to the heart rhythm appear. This shows that nurses still do not have sufficient skills related to handling cardiac arrest. Previous research also showed that nurses who before being given back learning related to basic life support had less skills. The average respondent cannot provide appropriate CPR actions, especially in

regulating the speed, depth, and rhythm of CPR (Hernández-Padilla et al., 2015).

However, after being given learning with self-directed videos, there was an increase in nurses' skills related to quality, defibrillation, and drug CPR with an average score of 10.81. This explains the handling of patients with cardiac arrest who are given using self-directed videos can improve respondents' skills. Previous research also showed that nurses who, after being given back learning related to basic life support, had good skills. The average respondent can provide appropriate CPR actions, especially in regulating CPR's speed, depth, and rhythm (Hernández-Padilla et al., 2015).

This study's result was also in line with research conducted by Mardegan, Schofield & Murphy in 2015, Lee et al. In 2011, and Blewer et al. in 2016 explained the training method using innovative technology media such as video improved skills in handling cardiac arrest. The presence of a demonstration in the video made it easier for respondents to observe and repeat the action (Blewer *et al.*, 2016; Lee *et al.*, 2011; Mardegan *et al.*, 2015).

In practice, the respondent looked at the video provided first, and the respondent focused on the steps to handle cardiac arrest demonstrated in the video. After the respondent understands these steps, the respondent practices directly on the mannequin provided according to the respondent's case. The video demonstration provided a good

cognitive stimulus to increase the urge to learn and then improved the respondent's skills as evidenced by the increase in post-test (Jäncke *et al.*, 2009; Lee *et al.*, 2011).

The learning process with advanced technology-based methods increased the activation of the prefrontal cortex in the human brain. This increase in activation triggered cognitive stimulation and strengthened the memory of someone who had studied a material. Besides, modern technology improved the learning process and skills (Jäncke *et al.*, 2009; Raja & Nagasubramani, 2018).

They improved nurse skills after being given self-directed video learning related to work experience, education, and gender. In this study, the average respondent had a length of work experience and had BLS education and competencies. Previous research described respondents who have a length of work experience, BLS education, and competencies facilitated the improvement of respondents' skills in performing CPR actions in cardiac arrest patients (Weidenauer *et al.*, 2018).

The gender of the respondents had a relationship with skills where the male can perform CPR skills better than the female. In this study, respondents were more male (59.5%) than female (40.5%). Previous research explained that the male gender was related to chest compressions skills more deeply than female respondents. The male was able to do deeper compression with a ratio of 30: 2. However, female respondents could do chest compressions more deeply when using a 15: 2 ratio (Sayee & McCluskey, 2012). Based on the above explanation, self-directed videos had a significant influence on improving skills regarding treating cardiac arrest.

This study also explained that there was a change in nurses' skills to help patients with cardiac arrest in RSUD dr. Slamet Martodirdjo Pamekasan before and after learning using simulations with p -value = 0.000. This study

obtained an average skill increase of 2.15 where the post-test score of skills was higher than the pretest skill score.

The results obtained in this study group showed a change in the respondent's ability regarding handling patients with cardiac arrest, which consisted of the introduction of heart attacks, emergency responses, pulse and breathing checks, quality CPR, defibrillation, and drug use. In this study, before being given learning by simulation, respondents had an average skill score of 8.52 out of a total score of 12. The average respondent could not do quality CPR, defibrillation, and drugs according to the heart rhythm that appeared. This shows that nurses still do not have sufficient skills related to handling cardiac arrest. Previous research also showed that nurses who were given back learning related to basic life assistance had less skills before being given back learning. The average respondent cannot provide appropriate CPR actions, especially in regulating CPR's speed, depth, and rhythm (Pedersen *et al.*, 2018).

However, after being given learning by the method, there was an increase in nurses' skills related to quality, defibrillation, and drug CPR with an average score of 10.67. This explains the handling of patients with cardiac arrest given using simulations can affect the increase in respondents' skills about handling cardiac arrest. Previous research also showed that nurses who, after being given back learning related to basic life support, had good skills. The average respondent provided appropriate CPR actions, especially in regulating CPR's speed, depth, and rhythm (Pedersen *et al.*, 2018).

The results of this study are in line with the research conducted (McRae *et al.*, 2017; Everett-Thomas *et al.*, 2016) explained the method of handling cardiac arrest with simulations that improved respondents' skills in conducting quality CPR actions systematically and accurately (Everett-Thomas *et al.*, 2016;

McRae *et al.*, 2017). Kardong-Edregan, Oerman, Odom-Maryon & Ha in 2010 explained that the simulation method is an effective traditional training method and was often used to improve CPR skills (Kardong-Edgren *et al.*, 2010).

The learning process with simulations improved respondents' skills in handling cardiac arrest caused by this method, providing respondents with an opportunity to learn the basic principles of CPR that are learned, guided, and evaluated directly by the instructor in the simulation (Sahu & Lata, 2010). The training process with this method allowed respondents to discuss further with instructors related to the quality of CPR so that they can be improved the skills of respondents to conduct CPR (Pedersen *et al.*, 2018).

The instructors' presence in the simulation process became an important figure in providing direction and evaluation related to the implementation of CPR conducted by respondents (Everett-Thomas *et al.*, 2016). The existence of this evaluation can be immediately corrected and carried out again with guidance from the instructor. This process also increases respondents' confidence in carrying out CPR actions (Everett-Thomas *et al.*, 2016).

Improving nurse skills after being given simulation learning relate to work experience, education, and gender. In this study, the average respondent had high work experience and had diploma education and BLS competencies. Previous research describing respondents who have high work experience and BLS education and competencies facilitated the improvement of respondents' skills in performing CPR actions in cardiac arrest patients (Weidenauer *et al.*, 2018).

The gender of the respondents had a relationship with skills where the male performed CPR skills better than the female. In this study, respondents were more male than female. The quality of chest compression is related to gender, especially in the compressor

section. Respondents who were male were able to do compression well, especially in the accuracy of compression depth, compression speed, and proper compression position compared to female respondents (Zhang *et al.*, 2013). Based on the explanation above, the simulation had a significant effect on improving skills regarding cardiac arrest handling.

However, other results from this study also showed no difference in nurses' skills before and after learning in the self-directed video and simulation groups with a p-value = 0.437. This study obtained an average skill increase of 2.24 in the self-directed video group and an average skill increase of 2.15 in the simulation group. Based on these results, there was no significant difference between the self-directed video and the simulation groups.

This study's results are similar with published article (Chung *et al.*, 2010), who explained that training methods for handling cardiac arrest using self-directed videos and simulations did not have a significant difference in skills change. Together, both of these methods increased knowledge through their respective methods (Chung *et al.*, 2010).

However, a study conducted by Assadi *et al.* (2015) stated that there were differences in skills in working CPR in groups with instructors and groups without instructors who obtained higher knowledge in groups without instructors. In groups without instructors, research respondents are more flexible in learning good quality RJP in various ways so that the respondent's skills were higher than the group with the instructor (Assadi *et al.*, 2015).

Each method had its advantages to improve the skills of respondents. In the self-directed video group, respondents looked at the video provided first, and the respondent focused on the steps to handle cardiac arrest demonstrated in the video. After the respondent understands these steps, the respondent practices directly on the mannequin

provided according to the respondent's case. The video demonstration provided a good cognitive stimulus to increase the urge to learn and then improve the respondent's skills, as evidenced by the post-test increase (Jäncke et al., 2009; Lee et al., 2011). The learning process with sophisticated technology-based methods increased the activation of the prefrontal cortex in the human brain. This increase in activation triggered cognitive stimulation and strengthened the memory of someone who has studied a material. Besides, modern technology improved the learning process and the skills one has (Jäncke et al., 2009; Raja & Nagasubramani, 2018).

Whereas in the simulation group, there is an increase in the skills of respondents in handling cardiac arrest where this method provided an opportunity for respondents to be able to learn the basic principles of CPR that are learned, guided, and evaluated directly by the instructor in conducting the simulation (Sahu & Lata, 2010). The training process with this method allowed respondents to discuss further with quality. Instructors related to CPR can improve the skills of respondents to conduct CPR (Pedersen et al., 2018).

Instructors' presence in the simulation process became an important figure in providing direction and evaluation related to the implementation of CPR conducted by respondents (Everett-Thomas et al. 2016). The existence of this evaluation can be immediately corrected and carried out again with guidance from the instructor. This process also increases respondents' confidence in carrying out CPR actions (Everett-Thomas et al., 2016).

Based on the explanation above, it can be concluded that there is no difference in changes in nurse skills in handling cases of cardiac arrest. Each method can improve skills through different mechanisms.

Conclusion

It can be concluded that there are changes in nurses' skills in carrying out advanced cardiac life support before and after being given learning with self-directed videos and simulations. There is no difference in skill changes in the self-directed video and simulation groups.

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