



Health Education and Simulation Effectively Increase the Knowledge and Ability to Perform Cardio Pulmonary Resuscitation

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Abstract

Background: Increasing bystander knowledge and ability to perform Cardio Pulmonary Resuscitation (CPR) is vital in providing essential life support to Out of Hospital Cardiac Arrest patients. The method can be used by providing training through health education and simulations.

Methods: Study using a quasi-experimental with a pretest-posttest control group. Samples were taken using a purposive technique totalling 72 people divided into control and intervention groups with equal numbers. The intervention is given with educational details for 30 minutes and a 60-minute simulation. The instruments consisted of a self-reported questionnaire and practice assessment sheets. Analysis of intragroup and intergroup differences using the Paired T-test and Independent T-test.

Results: The mean increase in basic life support knowledge and skills in the intervention group was more significant than in the control group (42.8>1.4 and (74.7>-1.5). The intragroup test results in the control group showed knowledge (p0.381) and ability (p0.353). In contrast, the intervention group showed knowledge (p0.002) and ability to perform CPR (p<0.001), comparison of knowledge and ability to perform CPR between the control and intervention groups p<0.001 and p<0.001.

Conclusions: Health education and simulation effectively increase the knowledge and ability to perform Cardio Pulmonary Resuscitation pada bystander.

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INTRODUCTION

Sudden cardiac arrest is a severe threat and factor as the leading cause of death for millions worldwide (Qara et al., 2019). Sudden cardiac arrest causes about 11% of deaths yearly in Germany (Theresa M Meissner et al., 2012). Besides that, it also causes 420,000 and 275,000 deaths per year in the US and Europe (Chen et al., 2019). In people who experience sudden cardiac arrest, early cardiopulmonary resuscitation (CPR) is a fundamental component and essential to treatment success. Providing quality CPR increases the chances of survival for patients with a heart attack (Abella, 2013). The majority of sudden cardiac arrests are cases of out-of-hospital cardiac arrest (OHCA). The incidence of OHCA in adults is estimated at 95.9 points per 100,000 people per year (Perkins et al., 2012). The results showed that OHCA occurs in 2/3 of heart disease (Hawkes et al., 2017) and more than half is due to coronary heart disease (Tseng et al., 2018).

The existence of awareness from the community in performing high-quality CPR has a good impact on the success of handling cardiac arrest. Most people encountering OHCA cases for the first time are relatives and nonmedical (Chen et al., 2017; Rajapakse et al., 2010). Based on this, the introduction of OHCA increased knowledge, and the ability to perform CPR by bystanders are essential factors that determine the possibility of survival of OHCA patients (Rajapakse et al., 2010). Studies show that although the chances of survival for OHCA patients are as much as 3-30%, they have increased after public education and increased utilization of automatic external devices. The survival rate of OHCA patients is better in patients who receive CPR by bystanders compared to those who do not (Berdowski et al., 2010).

The results of previous studies suggest CPR training for ordinary people to improve their knowledge and skills. This is very important to increase the response of bystanders if there are OHCA cases around them. There are many approaches to training in adult CPR delivery. The CPR method recommended by the American Heart Association (AHA) for bystanders uses "hands-only" CPR, emphasizing chest compressions

without providing ventilation (Panchal et al., 2020). Several studies have shown that training is effective in increasing the ability to perform CPR, such as using self-instruction programs (Lynch et al., 2005), traditional courses vs video self-training (Einspruch et al., 2007), video education (Blewer et al., 2016), and mobile applications (Blewer et al., 2020). In this study, the research team used the face-to-face meeting method by providing education and continuing with simulation practices.

The results of a systematic review show that the results of health education provide significant evidence that it is effective in increasing the knowledge and performance of nurses performing CPR (Kuchaki et al., 2022), further research is needed to apply this to bystanders. Furthermore, using simulation practices positively increases the ability to carry out an intervention (Buist & Webster, 2019). Based on this description, the researcher aims to determine the effect of health education and simulation on knowledge and ability to perform CPR on bystanders.

METHODS

Study Design

This study used a quasi-experimental design with a control group pre-posttest design. The research was conducted at a private university in Yogyakarta, Indonesia, on 10 and 11 August 2022. The independent variables were providing health education and CPR simulations, while the dependent variable was knowledge and ability to perform CPR.

Samples

The study population consisted of 176 non-teaching employees at a private university in Yogyakarta. Sample calculation using the Slovin formula,

With details n =number of samples; N =number of the population; d =precision, the researchers used 10%. Based on this formula, the researcher calculated that the minimum sample required was 64 people. The number of samples participating in the study was 72, equally divided into two groups, control (36 people) and intervention (36 people). Samples were taken based on inclusion criteria: a

minimum of high school education, age 22-55 years, never attended basic life support training and were willing to be respondents. Pregnant employees and people with heart disease are the study's exclusion criteria. The sample was selected using a purposive sampling technique; the Human Resource Department assisted the researcher in selecting the sample to ensure that each unit at the university was the research sample and then divided into control and intervention groups.

Instruments

The research instruments consisted of questionnaires and assessment sheets for implementing CPR practices prepared by the researchers. The knowledge questionnaire consists of 20 questions covering: definition, purpose, benefits, indications vs contraindications, steps, and discontinuation of essential life support. The questionnaire consists of favourable and unfavourable statements with "True" and "False" answer choices. The scores used, "0" and "1", are then converted to percentages so that the minimum score is 0 and the maximum is 100. The CPR practice assessment sheet complies with the 2020 AHA resuscitation guidelines for laypeople; instructions are based on hand-only CPR (chest compression without ventilation). The minimum score for the ability to perform CPR is 0, and the maximum is 100. The knowledge questionnaire and the CPR implementation assessment sheet were tested for validity by two experts in the field of emergency nursing with an average score of 0.90. Health Education uses PowerPoint presentation materials totalling 16 slides delivered with an LCD projector. The material presented follows the aspects assessed in the questionnaire. Simulation of basic life support using mannequins to demonstrate how CPR is performed.

Data Collection

Data collection for the control group was carried out on August 10, 2022. This group did not receive an intervention. Respondents filled out a questionnaire about basic life support knowledge first and then practised using mannequins. Measurements were carried out twice, namely pretest and posttest, with a

difference of 90 minutes. Data collection for the intervention group was carried out on August 11, 2022. All respondents from the intervention group were collected in one room, and baseline data were collected.

Furthermore, respondents received education about essential life support for 30 minutes. The researcher practised CPR simulation using a mannequin for 60 minutes. After all the interventions were given, the respondents' knowledge and ability to carry out essential life support were measured as posttest data. Filling out the questionnaire for the intervention group was carried out with attention to the arrangement of the respondents' seats; the respondents answered according to their abilities. Researchers were also supervised during the process of filling out the questionnaire. Respondents have measured one by one in the ability to perform CPR; each respondent practised in front of an assessor. The assessors consist of three people who are trainer providers who organize emergency trauma and cardio training at the national level with the criteria of having a minimum of 2 years of training experience, having Basic Trauma and Cardiac Life Support (BTCLS) certificates, Advance Cardiac Life Support (ACLS), and Training of Trainers (TOT) Emergency field.

Data Analysis and Ethical Consideration

All respondents received an explanation about the research process, their rights and responsibilities. Respondents signed informed consent as a legal aspect of consent to be involved in the research. The research was conducted after obtaining ethical clearance from the Institutional Review Board of Respati University Yogyakarta, number 098.3/FIKES/OL/VII/2022. Research data is processed using SPSS 21 software. The number of respondents is the same from the beginning to the end of the study; the response rate is 100%. Normality test using Kolmogorov Smirnov with normally distributed results ($p > 0.05$). Respondent characteristics are presented using a frequency distribution. Differences in intragroup pretest and posttest were tested using the Paired T-Test, while differences between the control and intervention groups were tested using the Independent T-Test.

RESULTS AND DISCUSSIONS

Distribution characteristics of the respondent

The results showed that the male sex predominated in both groups, totalling 94.4%. Most respondents were early adults (44.4%) with the same composition in both groups. The respondent's level of education was sufficient,

with the majority of senior high school graduates, the control group 55.5% and the intervention group 50.0%, with a total of 52.8% for both groups. Most respondents work in the public service department (54.2%). Details of the characteristics of the respondents are shown in table 1.

Table 1 Distribution Characteristics of Respondent (N=72)

Variables	f (%)	Control Group	Intervention Group	Total
		(n=36)	(n=36)	
		f (%)	F (%)	
Gender	Male	34 (94.4)	34 (94.4)	68 (94.4)
	Female	2 (5.6)	2 (5.6)	4 (5.6)
Age	Early adult	16 (44.4)	16 (44.4)	32 (44.4)
	Middle adult	14 (38.9)	14 (38.9)	28 (38.9)
	Late adult	6 (16.7)	6 (16.7)	12 (16.7)
Position's	Public Service	14 (38.9)	25 (69.4)	39 (54.2)
	Cleaning Service	14 (38.9)	7 (19.4)	21 (29.2)
	Security	4 (11.1)	2 (5.6)	6 (8.3)
	Parking Guard	4 (11.1)	2 (5.6)	6 (8.3)
Education	Bachelor	9 (25.0)	9 (25.0)	18 (25.0)
	Diploma	2 (5.6)	0 (0.0)	2 (2.8)
	Senior High School	20 (55.5)	18 (50.0)	38 (52.8)
	Junior High School	5 (13.9)	9 (25.0)	14 (19.4)

Table 2 Effect of Health Education and Simulation on Knowledge and Ability to Perform CPR (N=72)

Variables	Control Group				Intervention Group				Δ Mean	P [#]
	Baseline Mean±SD	Posttest Mean±SD	Δ Mean	P [*]	Baseline Mean±SD	Posttest Mean±SD	Δ Mean	P [*]		
Knowledge	32.5±13.5	33.9±10.8	1.4	0.381	31.0±9.6	73.8±9.3	42.8	0.002	41.4	<.001
Ability	15.3±6.7	13.8±5.8	-1.5	0.353	15.3±6.7	90.0±5.8	74.7	<.001	76.2	<.001

Homogeneity test of knowledge among control-intervention group p=0.659

Homogeneity test of Ability among control-intervention group p=0.738

p=p-value; SD=Standard Deviation; Δ = Difference; *Tested using Paired T-Test #Tested using Independent T-test

Intragroup and Intergroup Comparison in term of Effect Knowledge and Ability to Perform CPR

Table 2 shows that the intervention group showed an average increase in basic life support knowledge that was greater than the control group (42.8>1.4), with a difference between the two at 41.4. The ability to practice CPR in the control group decreased during the posttest compared to the intervention group, which showed an increase (-1.5 vs 74.7) with a difference of 76.2. The control group showed no significant difference in knowledge (p0.381) and ability to perform CPR (p0.353) during

the pretest and posttest. Different results were seen in the intervention group; the provision of health education and simulations had a significant effect on increasing knowledge (p0.002) and the ability to perform CPR (p<0.001). Comparison of knowledge and ability to perform CPR between the control and intervention groups showed that there were significant differences between the groups that were given and not given health education and simulations (p<0.001 and p<0.001).

The study results provide reasonable evidence that providing education and practising CPR practice increases respondents'

knowledge and abilities. Many previous studies have been in line with this research; providing health education increases knowledge (Nugroho et al., 2022), using video as a means of education. In this study, the researchers directly provided education using PPT slides. The use of video as an educational tool has several areas for improvement, including the lack of interaction between the teacher and the audience, so further explanation is difficult to obtain if there is something to be discussed, in contrast to direct education (Brame, 2016). Providing education also increases students' knowledge (Fadlilah et al., 2022), previous research used online education with zoom media. Disadvantages of online education include lack of feedback from participants, limited attention, and lack of discipline (Mukhtar et al., 2020). These deficiencies can be avoided in this study.

CPR is the immediate action given in cardiac arrest conditions and can positively save patients from heart attacks as a common cause of death in the community (Rea, 2015). Out-of-hospital cardiac arrest (OHCA) is one of the leading causes of death worldwide. Heart attacks can happen to anyone, anytime, anywhere, so people's alertness in dealing with this situation is essential. Bystander CPR is an independent factor in increasing OHCA survival. It is necessary to increase knowledge about basic life support, followed by training in CPR. Research in Sweden shows that bystanders' knowledge and attitudes about CPR are still deficient (Andréll et al., 2021), In contrast, out of 1073 respondents in Taiwan, half said they knew how to do CPR properly (Pei-Chuan Huang et al., 2019), in Indonesia, there is no national data on this matter.

The role of the bystander in administering CPR in OHCA cases has proven to be very important. The relationship between CPR administration by bystanders and patient survival has been proven by previous researchers (Song et al., 2018; Yan et al., 2020). A meta-analytic study showed that patients who received CPR by bystanders had twice the chance of survival compared to those who did not (Song et al., 2018). Giving CPR for OHCA cases requires a bystander role; this action can delay cell damage, especially

in elderly patients (Holmberg et al., 2001). Based on Danish national data, giving CPR by a bystander increases survival and reduces the risk of brain damage (Kragholm et al., 2017). Other studies have shown that CPR bystander is positively associated with 30-day survival, requiring shorter ambulance response times and faster initiation of advanced resuscitation therapy (Rajan et al., 2016).

Providing knowledge and training to non-clinical laypeople in CPR can increase the role of bystander CPR rates so that the American Heart Association and the National Academy of Medicine are intensively promoting CPR training for laypeople (Rea & Eisenberg, 2015; Sasson et al., 2013). Knowledge development alone is needed in implementing CPR because CPR is an action that needs to be carried out. So providing education followed by practice simulations is very appropriate. This study's results align with previous research that training for families with heart disease is effective in increasing CPR abilities (Blewer et al., 2020). The difference can be seen from the educational method provided; previous researchers used a mobile application to train CPR compared to the group that only received video + manikin. Previous research used a randomized control trial design, while this study did not use randomization. Blewer et al. measure CPR ability, while this study adds respondents' knowledge. Similar studies have also shown that training increases adolescents' knowledge and skills in performing CPR (Wijaya et al., 2022). The difference can be seen from the media used, in the form of CPR pillows, while this study used CPR mannequins and respondents were given health education about basic life support beforehand.

The imbalance between the number of male and female respondents in this study made it difficult for researchers to analyze differences in knowledge and ability to perform CPR. Previous studies have shown that the quality of women's CPR performance is lower than that of men. Women tend to have higher compression rates but lower compression depths than men (Blewer et al., 2018; Blewer et al., 2020; Leary et al., 2017). All the respondents were mature and productive, so the researcher did not further analyze the differences in each category. Studies

also show that older people perform worse in CPR than younger people (Blewer et al., 2017; Blewer et al., 2018). The respondent's education also influenced their knowledge and ability to perform CPR. The researcher determined that the minimum education of the respondents was high school, based on previous research showing that basic life support training at the high school education level showed effective results in increasing knowledge (T. M. Meissner et al., 2012).

This study has several weaknesses and strengths; the CPR training method that begins with health education has the benefit of further increasing the respondent's understanding of CPR. Providing direct education and practical simulations makes the interaction between instructors and participants more active. The absence of randomization is one of the limitations of this study; besides, the respondents are non-educational employees at a university, so the generalizability of the research results could be better. Measurement of knowledge using self-reported questionnaires allows for memory bias.

CONCLUSION

The study results show that providing education followed by practical simulations provides good evidence of increasing knowledge and ability to perform basic life support for general employees. In the intervention group, there was an increase in average knowledge and ability to perform basic life support, inversely proportional to the control group. Providing education followed by practice simulations can be used as an effective method of training lay people's ability to perform CPR.

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