



Si-Hajar an App to Improve CPR Knowledge and Skills for Teenagers in Lubuklinggau City



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ABSTRACT

Aims Cardiac arrest is a sudden cessation of heart function and results in death if not immediately assisted with Cardiac Pulmonary Resuscitation (CPR). Chances of survival increase if immediately assisted CPR by people around or bystanders. There is a need to increase the quantity and quality of CPR bystanders through CPR education and training using application media that can be used anytime and anywhere. This study was done to determine the effect of CPR training using the Si-Hajar app on the knowledge and skills of teenagers about CPR.

Materials & Methods This study used a quasi-experimental design with a pre-and post-test approach to CPR training using the Si-Hajar app. Samples were taken by purposive sampling from 40 teenagers in Lubuklinggau City Juni in December 2021. CPR knowledge was measured from knowledge about out-of-hospital cardiac arrest (OHCA), which was measured using a questionnaire. Skill was measured by how the subject performed CPR using a CPR standard checklist regarding operating procedures.

Findings After the implementation of the Si-Hajar app, we found a statistically significant difference in knowledge and skill scores between the Si-Hajar and control ($P < 0.001$ for both) groups. There was a correlation between group intervention and knowledge ($p = 0.001$), but there was no correlation between knowledge and the history of cardiac arrest ($p = 0.0761$) and willingness to perform CPR ($p = 0.0585$). Regarding the CPR skill, there was a correlation between group intervention and skill ($p = 0.001$), but there was no correlation between skill and the history of cardiac arrest and willingness to perform CPR. so, there was a significant correlation between the indirect path connecting academic stress and research self-efficacy through research spirit ($p < 0.01$).

Conclusion Using the Si-Hajar app has a significant effect on the knowledge and skills of teenagers in OHCA knowledge and CPR management.

Keywords Cardiopulmonary Resuscitation; Knowledge; Heart Arrest; Social Skills

CITATION LINKS

[1] Public knowledge and attitudes towards bystander cardiopulmonary resuscitation in ... [2] An exploration of attitudes toward bystander cardiopulmonary ... [3] The impact of bystander cardiopulmonary resuscitation on ... [4] Heart disease and stroke statistics-2021 ... [5] Influence of nationwide policy on citizens' awareness ... [6] Factors influencing Chinese university students' ... [7] Pengaruh simulasi tindakan resusitasi jantung paru (rjp) ... [8] Impact of bystander cardiopulmonary resuscitation and ... [9] Pemberian feedback pada home learning cpr untuk meningkatkan ... [10] Bystander cardiopulmonary resuscitation is clustered ... [11] Bystander CPR dalam upaya kesiapsiagaan bencana pada siswa ... [12] The effect of mabar applications on cardiac arrest among high ... [13] Cardiopulmonary resuscitation skill training and trial in ... [14] Pelatihan penatalaksanaan prehospita henti jantung dan anak ... [15] Use of a real-time training software (Laerdal QCPR ®) compared to ... [16] The effects of a disaster preparedness app on community knowledge and intentional behavior in hurricane ... [17] Heart disease and stroke statistics - 2018 update: A report from the American ... [18] Hubungan tingkat pengetahuan kognitif dengan ... [19] Analisis pengaruh pelatihan resusitasi jantung paru dewasa terhadap retensi pengetahuan ... [20] The effect of high-fidelity cardiopulmonary resuscitation (CPR) ... [21] Perbandingan pelatihan rjp dengan mobile application dan simulasi terhadap ... [22] Kaderisasi remaja tanggap cardiac arrest dengan aplikasi smartphone ... [23] Effectiveness of the 40-minute handmade manikin program to teach ... [24] The influence of high fidelity simulation on first responders retention of ... [25] Improving CPR skill through the use of two exciting learning ... [26] Impact of multi-media tutorials in a computer science laboratory ... [27] Development of a mobile game application to boost students' motivation in learning ... [28] State of Virtual Reality Based Disaster Preparedness and Response ... [29] Nursing students perceptions about traditional and innovative teaching ... [30] Proses kognitif dalam pembelajaran ... [31] Pengaruh penggunaan software phet sebagai media pembelajaran terhadap hasil belajar fisika ditinjau dari kemampuan awal siswa kelas X IPA SMA Negeri 1 ...

Introduction

Cardiac arrest is when the heart's function stops suddenly, and if proper help is not immediately given, the results will be fatal. Cardiopulmonary resuscitation (CPR) is first aid for patients with cardiac arrest [1, 2]. Out-of-hospital cardiac arrest (OHCA) is a severe problem with a global incidence of around 55 per 100,000 people per year [3]. In the United States, there are more than 356,000 cases annually [4]. As reported, 97.7% of OHCA cases in South Korea and 80% of cases in China [1, 5] died before receiving help from health workers [6].

The high OHCA mortality rate is because the victims were not immediately given appropriate action at the time of the incident because no one was watching, no one was able to provide help, and the distance to health facilities was far away. OHCA victims will experience a 7-10% chance of survival per minute if no help is provided [1]. Witnesses are essential in helping before health workers appear or are known as CPR bystanders.

Data collection on the incidence of cardiac arrest in Indonesia is not recorded properly, which can increase the incidence of cardiac arrests, such as the incidence of coronary heart disease (CHD). It is estimated that 30 people experience cardiac arrest every day in Indonesia, or an estimated 10,000 people annually [7]. In Lubuklinggau, the incidence of cardiac arrest has not been recorded neatly, either at the statistics agency or the health office. Based on preliminary studies, many deaths due to cardiac arrest are considered to be deaths due to heart attack. These data show that there are still differences in perceptions about cardiac arrest and heart attack; thus, the magnitude of the cardiac arrest problem outside the hospital cannot be described statistically. A factor that can increase the chances of survival for OHCA victims is the presence of a CPR supervisor, which has become twice as good [8]. Bystander CPR is an essential link in the survival chain and is closely related to increasing OHCA survival [9, 10], a CPR bystander is someone at the scene who can assist in CPR for OHCA victims to save lives and prevent further injury [11]. This translation implies that the quantity of CPR bystanders needs to be increased to increase the chances of OHCA victims being helped.

CPR training for school students aged 15-16 years in Hong Kong is an effective way to develop the next generation of CPR volunteers, and training media using proven practical applications can increase CPR knowledge and skills in adolescents [12].

All groups of people should own CPR knowledge and skills. From all walks of life, youth are the group with the most significant number; thus, they have the potential to become candidates for CPR bystanders. The Central Bureau of Statistics (BPS) of the Republic of Indonesia reports that Indonesia's 15-19-year-old population is the largest and more than 60% are currently in education. There would be a lot of CPR

bystanders if all teenagers knew about it. Teaching CPR at school age is the best way to increase the number of trained laypeople and increase the number of CPR bystanders [13].

Basic life support training helps increase knowledge and skills in administering CPR. Wijaya *et al.* (2021) said "CPR training significantly affected the knowledge of high school students in Karanganyar Klanten" [14]. CPR training for school students is an international priority [15]. Training with faster, easier, cheaper, and more sustainable application media can be a solution in today's digital era [16].

Therefore, we compared the effect of using training media through the developed CPR application media called Si-Hajar and traditional lecture and simulation methods on the knowledge and skills of adolescents in carrying out CPR in patients with cardiac arrest outside the hospital.

Materials and Methods

Research design

This research is quantitative with a quasi-experimental design with a pre- and post-test approach that was conducted from June to December 2021. The subjects were divided into two groups; the control group was trained using traditional methods (materials and simulations) in six meetings for three months, two times per month, and the treatment group used the Si-Hajar app.

Research Sample

Using purposive sampling, a sample of 40 people was selected. The inclusion criterion was men or women aged 15-18 years with smartphones that can download and install the Si-Hajar app and the exclusion criteria were having physical limitations and not having a smartphone that supports installing the Si-Hajar app.

CPR Knowledge Questionnaire

Data on knowledge about OHCA and hand-only CPR were collected by a questionnaire with two pre-test and post-test CPR training assessments using the traditional method and the Si-Hajar app. This questionnaire has been tested for validity and reliability. The indicators used in this questionnaire include recognition of cardiac arrest, activation of the emergency system, and implementation of CPR measures. Its ten questions are in the form of closed questions. Respondents choose the answer that is considered correct by placing a cross (X) on options a, b, c, or d. Correct answers are scored 1 and incorrect answers are scored 0.

CPR Skill Assessment Format

Both groups measured CPR skills using the CPR standard operating procedures (SOPs) issued and obtained through the SOPs for the Nursing book. This standard operating procedure was assessed using three assessments: one point for a well-done action score, one point for the value of the action taken could be better, and zero point for the value of the action

not performed. The maximum value of this SOP is 28, which is then presented as 100%.

Si-Hajar Application

Si-Hajar app is used as a medium to perform CPR simulations. It has all the attributes to perform high-quality CPR simulations, with a maximum compression depth of 5 cm and fast spring recoil. This application contains educational media, such as materials, videos, and live simulations through the Android application media (Figure 1).

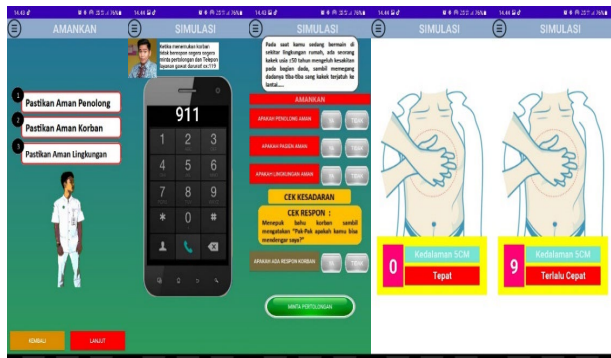


Figure 1) Si-Hajar Application.

Statistical Analysis

Data analysis was done using paired t-test and independent t-test by SPSS 22 with a confidence level of 96% (p<0.005).

Findings

Table 1 shows the characteristics of the respondents in the traditional group. Most respondents were 15 years old (50%), with 28 females (70%). Only six participants had a CPR training history (15%), and 10% had a cardiac arrest (6.67%). Only 55% of respondents were willing to perform CPR, and 100% wanted to learn CPR. Also, three respondents had OHCA events, and all were willing to take CPR training.

Table 1) Characteristics of the traditional group

Characteristic	Categories	Total	
		No.	%
Age (year)	15	10	50
	16	8	40
	17	2	10
Gender	Male	15	75
	Female	5	25
Training history	Ever	3	15
	Never	17	85
Cardiac arrest	Ever	3	15
	Never	17	180
Willing to perform CPR	Yes	10	50
	No	10	50
The desire to learn CPR	Yes	20	100
	No	0	0

Table 2 shows that half of the respondents in the Si-Hajar group were 15 years old (50%), dominated by 13 women (65%), only one respondent (15%) had attended CPR training, only one respondent had OHCA events, 12 (60%) respondent were willing to

perform CPR, and all the respondents willing to take CPR training.

Table 2) Characteristics of the Si-Hajar group

Characteristic	Categories	Total	
		No.	%
Age (year)	15	10	50
	16	6	30
	17	3	15
	18	1	5
Gender	Male	13	65
	Female	7	35
Training history	Ever	1	5
	Never	19	95
Saw cardiac arrest	Ever	1	20
	Never	19	180
Willing to perform CPR	Yes	12	60
	No	8	40
The desire to learn CPR	Yes	20	100
	No	0	0

Table 3 shows a significant difference in knowledge between both groups after the training (p=0.001), with the highest mean score in the Si-Hajar group (9.43). Both training methods increased the knowledge score of respondents, but the Si-Hajar app was more effective than the traditional method. Table 3 also shows the mean difference in skill before and after receiving the training. There was a significant increase in the mean score of skills before and after the intervention in both groups (p=0.001), with a highest mean score in the Si-Hajar group (93.03).

Table 3) Knowledge and skill level of both groups after training

Variable	Traditional group (M±SD)	Si-Hajar group (M±SD)
Knowledge (pre-test)	4.85±1.137	4.90±1.165
Knowledge (post-test)	8.10±0.85	9.43±0.67
Skill (pre-test)	50.53±8.76	52.32±8.92
Skill (post-test)	76.25±9.07	93.03±7.37

According to the results of the analysis of covariance (Table 4), there was a correlation between group intervention and knowledge (p=0.001), but there was no correlation between knowledge and the history of cardiac arrest (p=0.0761) and willingness to perform CPR (p=0.0585). Regarding the CPR skill, there was a correlation between group intervention and skill (p=0.001), but there was no correlation between skill and the history of cardiac arrest and willingness to perform CPR (p>0.05).

Table 4) Results of analysis of covariance

Variable	P-Value (analysis of covariance)		
	Group Intervention	History of cardiac arrest	Willing to perform CPR
Knowledge	0.001	0.0761	0.585
Skill	0.001	0.37	0.33

Discussion

Four Of 40 respondents had cardiac arrest outside the hospital, supported by the research by Benjamin et al. (2018) [17] who stated that the majority of high-

quality chest compression (HJLRS) incidents occurred in public places (39.5%) and at home (27.5%)^[17]. It can be said that one in 15 respondents had seen cardiac arrest and CPR in their respective environments.

Table 3 shows the mean knowledge scores before and after the training. There was a significant increase in the mean knowledge score before and after the intervention in both groups. This increase in knowledge scores results from exposure to specific information sensed by the subjects i.e. CPR in OHCA patients. CPR education and training have traditionally shown changes in adolescent knowledge. In principle, training through lecture and simulation methods is a process to increase knowledge, skills, and attitudes^[18].

The developed Si-Hajar app contains not only textbook material but also videos, photos, and simulation media that can be done via a smartphone so that it can be an effective method that can be carried out independently because knowledge is a mental activity. Through the learning process, questions and answers are created and stored in memory, and retrieved when needed through memory form^[19]. The problem given in the simulation will help participants analyze the problem, increasing the value of the knowledge possessed by the subject^[20].

Table 3 shows a significant difference in knowledge between the two groups. Other studies also have reported a significant effect on changes in knowledge before and after being given CPR training using designed applications^[21], supported by similar research demonstrated by Rachmawati *et al.*^[22], who used using the smartphone application in teaching high-quality CPR, and showed that there were significant differences in the cognitive ability variables after the training.

There was a significant increase in the mean score of skills before and after the intervention in both groups; the highest skill average mean score after CPR training was 93.03 in the Si-Hajar group. Skills result from an exercise accompanied by increased changes by people who learn these skills due to specific activities^[19].

The traditional methods through lectures and simulations are considered suitable for improving the skills of adolescents because they can show a direct way of high-quality CPR simulation. The CPR training process using traditional methods will allow respondents to perform CPR actions monitored directly by the trainer and a direct guidance and evaluation process from the trainer throughout the training process^[21]. The process of education and simulation during training, accompanied by trainers using traditional media through mannequin media, improves CPR skills as a whole^[23].

By improving skills influenced by direct feedback from the trainer during the CPR training process, the subject can find out and immediately correct the

errors performed in the procedure. In line with the previous description, Everett-Thomas *et al.*^[24] also said that the feedback provided by the trainer would make it easier for participants to correct mistakes made during the training process. Simulation is a better method for improving CPR skills^[25].

The use of the Si-Hajar app has the advantages that can be obtained from technology-based learning, which is the ease of acquiring a clinical skill for someone who increases the attention of trainees at a certain time and creates an audio-visual effect^[26]. This attention will lead to increased frontal and parietal cortex activation, stimulating cognitive aspects, and strengthening memory^[12].

According to Elaish *et al.* (2019), learning methods with components of images, sound, and motion animation have the advantage of attracting more attention, very easy to remember, increasing motivation, and retaining knowledge of the studied material^[27]. According to Rachmawati *et al.*^[22], using game-based smartphone applications improves cognitive abilities. Learning methods using mobile applications can be carried out independently as long as learning support devices are available and accessible^[28]. The learning process using mobile applications can be reviewed independently of the material that has been given^[29].

Table 3 shows a significant difference in skill scores between the two groups. The higher average skill score in the Si-Hajar app group was 93.03. This is supported by previous research^[12, 16], which shows that increased knowledge, behavioral intention, and skills are higher using mobile applications than traditional media.

Based on the dual coding theory, the appropriate combination of verbal and visual media simultaneously can make it easier for the receiver to absorb the information presented and reduce the abstract understanding stage^[30]. Asriyadin *et al.* (2018) found that the level of attainment of knowledge through the senses of sight and hearing reached 75% and 13%, respectively; besides, media containing pictures and words was more effective in increasing knowledge^[31]. Therefore, the group using the Si-Hajar app experienced a higher increase in knowledge than the traditional group because the Si-Hajar app contained textbook material, sound, and video, and there was also a menu of simulation activities that could be carried out repeatedly by respondents, even in the absence of a coach.

One of the limitations of this study was its sample size as it adopted a relatively small sample size of 40 teenagers, which might not fully represent the diverse population of teenagers. Also, this study was done in Lubuklinggau City, which cannot represent the broader cultural and geographical diversity found in other regions. Another limitation was lack of control for external factors, which can affect the participants' knowledge and skills. The researcher's suggestion is to download Si-Hajar from the Play

Store to improve the knowledge and skill in CPR. Furthermore, the Si-Hajar application can be developed by adding a regular assessment menu to determine the ability of adolescents' knowledge resilience in OHCA countermeasures and CPR actions.

Conclusion

CPR training using traditional methods and applications (Si-Hajar) has a positive effect on adolescents' knowledge and skills regarding the problem of OHCA incidents and CPR management. However, better results can be obtained using application media. Therefore, the application media, especially the developed Si-Hajar, can be recommended for CPR training for ordinary people, especially teenagers.

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Ethical Permission

This study was conducted according to the guidelines of the Declaration of Helsinki. The ethical approval was issued by the Palembang Health Polytechnic Ethics Committee (1155/KEPK/Adm2/VIII/2021). All participants were asked to fill out and sign a consent form after receiving information about the research, and they had the right to participate in this study. The researcher assured that the confidentiality of the information will be guaranteed.

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