ORIGINAL ARTICLE

Impact of Mobile Application Intervention: DETAK in Early Detection and Early Treatment of Acute Coronary Syndrome

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ABSTRACT

Introduction: Acute Coronary Syndrome (ACS) is still a major cause of mortality and morbidity globally. One of the factors that cause a prehospital delay is the delay in early detection and inaccuracy of early treatment of ACS. The Internet of Things, which is supported by the high use of smartphones with the DETAK application, can be an opportunity to facilitate ACS education programs so that ACS can be detected early. **Method:** This study has used a quantitative research design with a quasi-experimental approach which pretest and posttest, in which both the experimental and control groups participate. The inclusion criteria of this study were age >45 years; obesity; smoker; Respondents with a history of: hypertension/diabetes mellitus/hyperlipidemia/hypercholesterolemia/CVD/families with cardiovascular disease. 252 respondents who met the inclusion criteria were randomly divided into control (n=126) and intervention groups (n=126). The intervention group was given education through the DETAK application and the control group was given leaflet about ACS. **Results:** The results of the study showed that there was an increased in early treatment ability was only found in the intervention group (p<.001). Mean differences of the ability of early detection (p<.001) and early treatment (p=.019)between intervention and control groups were both significance. **Conclusion:** There is potential for DETAK applications to improve the early detection and treatment capabilities of ACS.
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Keywords: Education, early detection, early treatment, acute coronary syndrome, mobile application

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INTRODUCTION

Acute Coronary Syndrome (ACS) is still one of the major causes of mortality and morbidity globally. Data from the Global Burden of Disease (GBD) in 2019 An estimated 17.9 million people died in 2019, representing 32% of all global deaths.. The prevalence of ACS in Indonesia is also quite high, reaching 2 million cases in 2018, in East Java the incidence of ACS is 1.5% with a higher prevalence in urban areas (1.6%) than in rural areas (1.3%) (1).

The high prevalence of ACS is caused by various risk factors such as hypertension, diabetes, hyperlipidemia and lifestyle. The results of a preliminary study in Blitar Regency, East Java showed that the highest risk factor that could potentially trigger ACS was hypertension (1726 cases) with 33 cases having been identified as having heart disease and diabetes mellitus (502 cases). This shows the high-risk factors for ACS in Blitar Regency, plus the average education level of the population is high school. This condition triggers the lack of knowledge of the people of Blitar Regency regarding the risk factors and symptoms of ACS which can affect the delay in early detection of ACS which triggers the length of the process of seeking help in the event of ACS. This will trigger an increase in morbidity and mortality caused by ACS (2). Delay in prehospital treatment is one of the factors causing the high mortality in ACS patients (3–5). One of the factors that cause a prehospital delay is the delay in early detection of ACS symptoms felt by the patient. One of the factors causing the delay in the early detection of ACS is the lack of knowledge of the risk factors and symptoms of ACS (3–5).

The above conditions indicate the importance of knowledge improvement programs related to ACS to accelerate early detection to reduce prehospital delays in ACS patients. Theoretical approach supporting

changes in health behavior as before demonstrated in self-management of other ACS education programs (6). To improve the implementation of treatment plans, European Society of Cardiology (ESC) ACS guidelines emphasize the importance of conducting educational activities to help patients understand the nature of the illness, and the principles of self-control and self-care as an action to improve healthcare (7).

Programs to increase knowledge related to risk factors and symptoms of ACS are needed as one of the preventive measures to reduce ACS mortality and morbidity. An understanding of the risk factors for ACS that they have, the lifestyle they should take and the actions they should take when ACS symptoms appear will improve their ability to treat and detect early (8–11). The Internet of Things, which is supported by the high use of smartphones, can be an opportunity to facilitate ACS' educational program so that it can reach more people in a short time (12–14). The most recent Indonesia Internet Service Provider Association survey in October 2018 reported that 132.7 million or 51.8% percent of the population of Indonesia is already connected to the internet. Currently, Indonesia is also the third largest smartphone user in Asia-Pacific, allowing the use of mobile applications for ACS education programs(15). So it is hoped that the increase in knowledge will increase the ability for early detection which will reduce ACS morbidity and mortality.

MATERIALS AND METHODS

Study Design

This study applied a quantitative research design with a quasi-experimental approach which also included a pretest and posttest, in which both the experimental and control groups participate.

Population and Sample

The population of this study is the community with a high risk of ACS in Blitar with 4282 cases of cardiovascular disease in 2021. The samples have been obtained in Blitar regency with 22 public health center sub-districts, they are Bakung, Binangun, Doko, Gandusari, Garum, Kademangan, Kanigoro, Kesamben, Nglegok, Panggungrejo, Ponggok, Sanankulon, Selorejo, and Selopuro. Of 22 sub-districts, 4 sub-districts with the highest ACS incidence rate were taken, there are Srengat, Wonodadi, Kademangan, and Selorejo. The sampling technique in this study is a probability sampling technique. The sample from the study was calculated using G*power. An Independent t-test is selected to measure the mean difference between two independent means (two groups). The researcher decided to use the effect size suggested by Cohen d (0,8) with α= 0,05, β=0,95. The estimation for the minimum sample of 105 and assuming an attrition rate of 20% (126 respondents). A total of 252 respondents have been recruited for both groups.

The inclusion criteria of this study were age >45 years; obesity; smoker; Respondents with a history of: hypertension/ diabetes mellitus/ hyperlipidemia/ hypercholesterolemia/ CVD/ families with cardiovascular disease. Exclusion criteria from this study are a community with no high risk for ACS.

Data Collection and Analysis

The instrument of this study is a checklist sheet which is divided into 4 sections, there are socio demography data, clinical factors (16) and early detection skills and early treatment (17) .The mobile application used in this study is DETAK. This application has knowledge and practice features. In the knowledge menu, respondents were asked to fill in the questionnaire in the application which include age, sex, knowledge of coronary artery disease, and sign and symptoms of coronary artery disease that experienced. Whereas in practice menu contains coronary artery disease management recommendations based on the results of early detection measurements using the application.

The data collection process is carried out from March to June 2022. The data used in quantitative research are primary data and secondary data. Primary data is obtained from interviews directly with respondents, then the researcher fills out observation sheets according to the data submitted by respondents.

In this study, respondents have been assessed based on their condition before they are given DETAK application to the intervention group and conventional education to the control group. DETAK based on android mobile application. The respondent follows the instruction of DETAK application from registration until detection ACS. At the beginning of using the application, respondents were asked to register by filling in their name, email, mobile number, and password. The next step is to learn about ACS. Teaching materials from videos and posters about the introduction to ACS, prevention, and treatment of ACS have been provided with attractive designs, and easy and complete explanations. After obtaining information about ACS, respondents were asked to fill in their risk factors. The ability to recognize the risks and symptoms results in conclusions about the ACS risk that the respondent has. This screening is carried out periodically according to the condition felt by the respondent. The results of detection direct respondents to suggestions for treatment that must be done to prevent ACS. After a month of intervention, the researcher conducted a post-test to measure the ability of respondents to early detection and treatment in preventing ACS in the intervention and control groups.
Frequencies (N), percentages (%), mean value (M) and standard deviation (SD) were used to present demographic characteristics (Age, BMI, Gender, Education, Marital status, Health Insurance, Employment Status) and to describe the clinical factor of ACS in Blitar Regency Indonesia. Bivariate analysis has used

Wilcoxon signed rank test to analyze post intervention the effect of the DETAK app for early detection and preventing treatment of ACS in Blitar Regency Indonesia in control and intervention. A Mann Whitney test was conducted to analyze differences in early detection in the control and intervention groups and ACS early treatment in the control and intervention groups.

Ethical Clearance

This study was approved by Research Ethics Committee, Institute of Health Science STRADA Indonesia No. 3102/KEPK/VI/2022.

RESULTS

Table I shows that in the control group 50% of respondents aged between 45-59 years, 54.8% were female, 34.9% had a high school education level. In the intervention group 54% of respondents aged between 45-59 years, 57.9% were female, 33.3% had high school education level. All social demographic variables showed p value > 0.05 so the data were homogeneous between the control and intervention groups.

Table II shows the clinical factors of ACS, in the control group it was found that 68.3% had hypertension, 29.4% had diabetes mellitus, 20.6% had hyperlipidemia, 31.7% were active smokers and 37.3 were overweight. Clinical factor of ACS in the intervention group found 72.2% with hypertension, 30.2% with diabetes mellitus, 69.8% with hyperlipidemia, 26.2% were active smokers, 38.1% were overweight. All ACS risk factor data showed p value > 0.05 so the data were homogeneous between the control and intervention groups. Based on the normality test, the data is not normally distributed, so it uses a non-parametric test.

Table I: Socio Demographic Characteristics of Intervention and Control Group

Variable	Group				*p*
	Control		Intervention		
	f	%	f	%	
Age					0.101*
<45 years	22	17.5	23	18.3	
45-59 years	63	50.0	68	54.0	
60-75 years	41	32.5	35	27.8	
>75 years	0	0	0	0	
Total	126	100	126	100	
Gender					0.849*
Male	57	45.2	53	42.1	
Female	69	54.8	73	57.9	
Total	126	100	126	100	
Education					0.487*
Elementary school	33	26.2	30	23.8	
Junior high school	27	21.4	35	27.8	
Senior high school	44	34.9	42	33.3	
Bachelor's	22	17.5	19	15.1	
Total	126	100	126	100	
Marital status					0.537*
Single	9	7.1	10	7.9	
Married	117	92.9	116	92.1	
Total	126	100	126	100	
Health insurance					0.355*
Yes	18	14.3	10	7.9	
No	108	85.7	116	92.1	
Total	126	100	126	100	
Employment status					0.572*
Employed	68	54.0	60	47.6	
Unemployed	42	33.3	50	39.7	
Retired/Sickness disability	16	12.7	16	12.7	
Total	126	100	126	100	

*Chi Square test

Table II: Clinical factor of ACS of Intervention and Control Group

Variable	Group				*p*
	Control		Intervention		
	f	%	f	%	
Hypertention					1.00*
Yes	86	68.3	91	72.2	
No	40	31.7	35	27.8	
Total	126	100	126	100	
Diabetes mellitus					0.055*
Yes	37	29.4	38	30.2	
No	89	70.6	88	69.8	
Total	126	100	126	100	
Hyperlipidemia					0.752*
Yes	26	20.6	88	69.8	
No	100	79.4	38	30.2	
Total	126	100	126	100	
Current smoker				26.2	0.992*
Yes	40	31.7	33	73.8	
No	86	68.3	93	100	
Total	126	100	126		
Obesity/BMI					0.128*
<18.5 : underweight	20	15.9	20	15.9	
18.5-24.9 : normal weight	27	21.4	32	25.4	
25.0-29.9 : overweight	47	37.3	48	38.1	
30.0-34.9 : obesity class I	32	25.4	26	20.6	
35.0-39.9 : obesity class II	0	0	0	0	
>40 : obesity class III	0	0	0	0	
Total	126	100	126	100	
History ACS					0.906*
Yes	75	59.5	82	65.1	
No	51	40.5	44	34.9	
Total	126	100	126	100	

*Chi Square test

Table III shows an increase in the ability of early detection of ACS in the control group with a p-value of 0.025. However, there was no increase in the ability of early treatment in the control group with a p-value of 0.102. The data showed an increase in early detection of ACS (p-value 0.00) and early treatment of ACS (p-value 0.00) in the intervention group.

Table IV shows that there are significant differences in the control and intervention groups in the early detection and early treatment ability of ACS with p-values 0.00 (early detection) and p-values 0.019 (preventing treatment).

DISCUSSION

Early Detection of ACS

The results showed that there was a significant difference in the ability to early detection of ACS between the control and intervention groups. The intervention group showed a greater increase in ability related to ACS early detection with an average difference of 36.26. This condition shows that the effectiveness of using the DETAK application is greater than the conventional way

Table III: Pre-Test and Post Test for Early Detection and Treatment in Preventing ACS of Intervention and Control Group

	Group		N	Mean Rank	Sum of Ranks	*p*
Control	Early detection of ACS	Negative Ranks	4	8,50	34,00	0,025*
		Positive Ranks	13	9,15	119,00	
		Ties	109			
		Total	126			
	Early to treatment of ACS	Negative Ranks	1	3,50	3,50	0,102*
		Positive Ranks	5	3,50	17,50	
		Ties	120			
		Total	126			
Intervention	Early detection of ACS	Negative Ranks	1	28,50	28,50	0,000*
		Positive Ranks	66	34,08	2249,50	
		Ties	59			
		Total	126			
	Early to treatment of ACS	Negative Ranks	0	0	0	0,000*
		Positive Ranks	39	20,00	780,00	
		Ties	87			
		Total	126			

*wilcoxon signed rank test

Table IV: The Difference in Early Detection and Early Treatment of ACS between Control and Intervention Groups

Group	N	Mean Rank	Sum of Ranks	*p*
Early detection of ACS				0,000
Control	126	103.37	13025.00	
Intervention	126	149.63	18853.00	
Total	252			
Early to treatment of ACS				0,019
Control	126	116.54	14684.50	
Intervention	126	136.46	17193.50	
Total	252			

*Mann Whitney test

of providing education.

The results above show the importance of increasing knowledge related to risk factors and symptoms of ACS towards increasing early detection ability in both the control and intervention groups. Increased knowledge related to ACS symptoms is closely related to the faster ability to recognize the early symptoms of ACS. This will increase awareness regarding ACS symptoms, so there is no need to wait for symptoms to worsen to decide to seek help (3,7–10,18–21).

The significant increase in ability related to early detection of ACS in the intervention group showed that virtual and mobile educational media made it much easier for respondents to understand the symptoms and risk factors of ACS. This is following the research of Bashi et al. (2018) which shows the effectiveness of using mobile applications to improve the early detection of ACS symptoms. The DETAK application is very easy to access and learn, combining audio-visual through educational videos, and infographics that make it easier for respondents to understand the symptoms and risk factors of ACS. Attractive virtual media will provide a pleasant stimulus and learning experience that will increase understanding (12,22–25).

Increased knowledge through the DETAK application has shown to increase respondents' self-efficacy in first aid for ACS (19,25). The independent learning experience through the media provided has made respondents feel more confident because they can learn and try to identify themselves regarding the symptoms and risk factors they feel. This independent learning process will increase the sense of having control over their health condition so that their confidence in understanding their health condition will increase (19,22,24,25). With an increased understanding of the symptoms and risk factors of ACS, it will be accompanied by an increase in the ability to recognize the symptoms of ACS that are felt early so that decisions related to asking for health help can be taken immediately (7,26,27).

The difference in early detection ability between the control and intervention groups was strongly influenced by the method of providing education. Conventional health education relies on health workers who provide education regarding the timing of education and the process of providing education. The activeness of participants will not be optimal, this will reduce motivation and learning needs. Although two-way communication or consultation is possible in conventional education, limited access to repetition will make understanding less than optimal(19,22,28,29). While learning using the DETAK application is very flexible regarding the time and learning process. Audiovisual learning media that have been provided can be accessed anytime and anywhere according to their wishes and needs. Material repetition can also be done as needed so that the level of understanding will be more optimal.

However, there were still respondents who did not experience an increase in their early detection ability in the intervention group (60 out of 126 respondents)

and the control group (113 out of 126 respondents). Several factors that cause no increase in early detection ability are age and education level. The main inhibiting factor is age, there are more than 30% of respondents are over 60 years old, and this certainly greatly affects the ability to learn and use technology. The decline in cognitive abilities and not being too familiar with mobile technology makes respondents difficulty in the learning process, so understanding related to symptoms and risk factors is also not optimal (3,4,15,22). In addition, the level of education is also one of the inhibiting factors in increasing the ability to early detection of ACS. More than 60% have elementary or junior high school education. Low education will affect the learning experience so the level of understanding will decrease (4,7–9,21).

Early Treatment

The results showed that there was a significant difference in the ability of early ACS treatment between the control and intervention groups. The intervention group showed a greater increase in ability related to ACS early treatment P=0.000. This condition shows that the effectiveness of using the DETAK application is greater than the conventional way of providing education in increasing the ability of early treatment of ACS.

An increase in the ability to early treatment of ACS in the intervention group shows the effectiveness of the DETAK application in increasing knowledge of ACS prevention and early treatment. This is obtained from increasing knowledge about the latest ACS symptoms so that the ability to detect early ACS symptoms increases. This increase in early detection capabilities will increase the ability to make decisions faster regarding what actions to take. This speed of decision-making will certainly reduce prehospital delay which will reduce ACS morbidity and mortality (8,9,19–21).

In addition, the increase in early treatment capabilities is also influenced by increased knowledge about ACS risk factors and preventive measures that have been provided in the DETAK application. Increased knowledge about the risk of ACS will increase awareness so that preventive actions will be more optimally carried out. Knowledge of appropriate precautions will also improve skills related to self-care to prevent the occurrence of ACS (5,10,26,30). Guidance on what to do when ACS occurs has also been provided in the DETAK app. This guide will provide a better understanding of the actions to be taken immediately when ACS symptoms occur. Appropriate early action will reduce the severity and complications caused by ACS (3,4,11,21,31–34).

Education through mobile applications will also increase the self-efficacy of ACS patients. Increased knowledge, self-confidence, and self-control related to ACS care will increase self-care skills. So that the preventive measures taken will be more optimal. In addition, when symptoms appear, the speed of problem-solving will also increase. They will know what to do immediately so that the stressor will be reduced and appropriate action can be taken (6,34–37).

The ability to treat early ACS in the control group did not increase, while in the intervention group less than 50% of respondents experienced an increase in the ability to treat early ACS.. This is partly due to a previous history of ACS. Respondents who do not have a history of ACS are not fully aware of the importance of preventive measures (14). In addition, the lack of direct experience of experiencing ACS makes them less quick to make decisions because they are not familiar with detecting ACS symptoms that appear. The stress factor that appears at the first attack also makes it difficult for them to think and make the right decisions because they focus on the threat of the symptoms they feel (7,34,35,37).

In addition, old age, and low level of education makes it difficult for some respondents to access applications because they are not familiar with the use of technology. This condition can reduce motivation and engagement in learning related to early treatment of ACS (12,19,38). However, education through mobile applications remains a great opportunity in improving the ability of ACS patients in early treatment. The availability of easy-to-access menus, and various audio-visual-based educational media in the form of posters and videos make it easier for the public to get and learn the right information regarding the initial management of ACS (12,13,15,19,22).

CONCLUSION

The DETAK application has the potential to increase the ability of early detection and treatment of ACS. Ease of access, and interactive educational media provide convenience for the community in learning. This condition will provide an optimal increase in knowledge and will have an impact on increasing the ability to early detection and treatment of ACS. However, the age factor, education level, and lack of familiarity with a technology need to be a concern in providing education. Future researchers need to pay attention to the factors that influence the increase in knowledge such as age and level of education. The need to involve the family and social environment in caring for ACS patients is also very important to support the care of ACS patients

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