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THE IMPACT OF THE SMARTPHONE EDUCATIONAL APPLICATION INTERVENTION ON THE QUALITY OF LIFE OF PATIENTS WITH CORONARY ARTERY DISEASE

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Abstract

The prevalence of coronary artery disease (CAD) is high among adults globally, and it also affects the quality of life of patients in Indonesia. In recent years, there has been significant progress in smartphone application technology, which has demonstrated positive outcomes in chronic disease prevention and health promotion. Therefore, the aim of this research was to create an educational intervention model that utilizes a smartphone application to enhance the quality of life of CAD patients and investigate its effectiveness. A panel of experts, comprising two cardiologists and an IT programmer, reviewed and validated the content of the smartphone educational application model which was developed as the primary component of the program. A quasi-experimental design, consisting of pre- and post-tests for both intervention and control groups, was employed in this study. It was conducted at M. Djamil Hospital in Indonesia from September 2020 to September 2022, with 250 patients with coronary artery disease selected through convenience sampling and meeting the inclusion criteria (intervention group: 125 patients; control group: 125 patients). Before receiving standard discharge planning from the hospital, both groups underwent a pre-test as a baseline measurement. However, only the intervention group received daily updates on their smartphones via the app for four weeks, while both groups underwent a post-test. The participants' CAD knowledge and quality of life were assessed using the CADEQ Questionnaire-2 and QOL questionnaire at baseline. After implementing the nursing intervention through the smartphone educational application model, a significant improvement was observed in the knowledge of Coronary Artery Disease (CAD) Patients between the pre- and post-tests with a p-value of 0.000. Additionally, there was a significant improvement in the overall QOL of Coronary Artery Disease patients between the pre- and post-tests with a p-value of (p=0.000)..

Keywords: Knowledge, Smartphone Educational App, Coronary Artery Disease And Quality Of Life

1. INTRODUCTION

Heart disease is the primary culprit behind the majority of fatalities among men, women, and a vast majority of diverse communities in the United States. In the span of every 34 seconds, an individual succumbs to the clutches of cardiovascular disease within the nation. The year 2020 witnessed a heart-wrenching 697,000 deaths due to heart disease in the United States, signifying that 1 in 5 individuals faced such an unfortunate demise. The most prevalent heart disease form is coronary heart disease, accounting for the loss of 382,820 lives in 2020. In total, 20.1 million adults aged 20 and above in the country suffer from coronary artery disease, amounting to around 7.2% of the population. The year 2020 saw that 2 in every 10 deaths caused by coronary artery disease belonged to the under-65 age group (CDC, 2022). According to the World Health Organization, coronary artery disease (CAD) is ranked as the number one cause of death among the top 10 leading causes of death worldwide. Therefore, it has become a significant burden to healthcare systems around the world (American Heart Association, 2021).

Coronary artery disease (CAD) is responsible for the highest number of deaths due to heart disease, with 360,900 fatalities in 2019. The incidence of coronary artery disease (CAD) is estimated to be approximately 6.7% among adults aged 20 years and above, which equates to a staggering 18.2 million individuals. Remarkably, CAD has been implicated in the untimely demise of two out of every ten young adults below the age of 65 (American Heart Association, 2021; CDC, 2022). Cardiovascular diseases, including Coronary Artery Disease, accounted for approximately one-third of all deaths in Indonesia in 2012, resulting in the loss of 138,400 lives. This made it the second leading cause of death in the country (Alkatiri et al., 2020). In 2019, coronary heart disease caused 170,000 deaths in Indonesia (World Health Organization, 2021a). Interventions aimed at mitigating coronary artery disease risk factors have become a pressing public priority due to the escalating prevalence of the disease in recent years. The adoption of mobile technology in healthcare services and medical education is an innovative strategy that offers promising results (Wong et al., 2022). The healthcare situation in Indonesia is worrisome due to the widespread problem of restricted access and inadequate quality of care. A significant number of patients who require urgent invasive procedures during their hospital stay are believed to be receiving overly cautious treatments or experiencing delays.

The assessment of Quality of Life (QoL) has emerged as a crucial element in contemporary medicine, as it acts as a barometer of general health status, particularly in the care of long-term conditions (Barham, Ibraheem, & Sa'ed, 2019). To improve the efficacy and safety of treatment, as well as facilitate shared decision-making, it is essential to consider patients' and social perspectives when evaluating the impact of illnesses. This is encapsulated in the concept of healthcare quality of life, which has become a critical component in modern medicine (Duangchan & Matthews, 2021). The number of individuals who have survived coronary artery disease is rising as the population ages and CAD treatment and management continue to advance. Although previous studies have mainly focused on the morbidity and mortality of survivors, there is an increasing acknowledgment of the importance of quality of life (QoL) as a critical health indicator (Wardoku, 2019).

Assessing the impact of coronary artery disease and its symptoms on overall health is crucial, given the complexity of living with the disease. The development of new technologies in cardiology and cardiac surgery has led to improved quality of life (QoL) for patients by enhancing the accuracy of diagnosis and increasing treatment effectiveness (Dudek et al., 2019). The use of digital technologies in healthcare has led to the development of educational programs that employ smartphones, netbooks, and tablet PCs for discharge education in chronic disease patients.

Technological advancements have facilitated the process of diagnosing, treating and healing patients, making it faster, easier and more connected. Information technology developments in the healthcare sector are evolving and transforming rapidly, even now using artificial intelligence. It is predicted that the medical technology sector will continue to lead the way in healthcare practice (Panda & Mohapatra, 2021)

The study found that inadequate knowledge and awareness of the risk factors associated with coronary artery disease among the general population can increase the chances of mortality and morbidity (Albadrani et al., 2020). Improved health literacy can make specific changes that are needed by a person, namely when making well-

informed and more independent health decisions, improving attitudes, knowledge, and abilities in improving their health and changing lifestyles (Nutbeam & Lloyd, 2021)

Recently, many mobile apps for health management have been developed in Indonesia. The number of health app downloads in Indonesia has increased significantly in recent years. In 2020, there were around 14 million downloads of health apps in Indonesia through the Google Play Store, while in 2016 the number of downloads was only around 3 million (Jocelyn, 2022). Smartphones have become an essential tool for Indonesians, who use mobile phones more frequently than other populations. Smartphones have made it easier to access internet resources and it is widely believed that being always connected through smartphones is significantly impacting people's lives.

Patients with CAD often have various lifestyle-related risk factors, so it is necessary to encourage motivation to learn disease management and lifestyle improvements to prevent recurrence of CAD after discharge. Patients need to be provided with information on health improvement and monitoring. Face-to-face education and utilization of digital applications allow CAD patients to perform health control independently and can be learned repeatedly anywhere and anytime (Su & Yu, 2021). This study aimed to determine the impact of a nursing intervention using a Smartphone Educational Application on improving the Quality of Life among patients with Coronary Artery Disease (CAD).

2. STUDY METHODE

This study was conducted at Dr. M. Djamil Padang Hospital in Padang City, West Sumatra Province, Indonesia. The hospital provides health services for patients with CAD, including screening tests, health education and treatment. Once the CAD patient data is obtained, researchers will conduct home visits to collect data. The study was conducted from September 2020 to September 2022, and the data collection time was conducted from January 2021 with a sample size of 250 subjects.

3. RESULT AND DISCUSSION

a. Sosial Demografi

Table 1: Proportion of characteristics of individual and environment of patients with CAD Patient

No	Variabel	Intervention		Control	
		n	%	n	%
1	**Gender**:				
	a. Male	68	54.4	62	49.6
	b. Female	57	45.6	63	50.4
2	**Age**				
	35 – 44	28	22,4	40	32.0
	45 – 54	34	27.2	58	46,4
	55 – 64	63	50.4	27	21.6
2	**Education:**				
	a. Elementary School	15	12.0	14	11.2
	b. Secondary School	11	8.8	14	11.2
	c. High School	56	44.8	49	39.2
	d. College/University Graduate	43	34.4	48	38.4
3	**Occupation**				

	Employment	11	8.8	9	7.2
	Unemployment	114	91.2	116	92.8
4	**Monthly Income (Rupiah)**				
	< 2,999,000	44	35.2	32	25.6
	3,000,000 – 5,999,000	59	47.2	75	60.0
	> 6,000,000	22	17.6	18	14.4

In the following Table 1, the distribution of participants by the characteristics of individual and environment of patients with CAD can be clearly seen, that the intervention group in the age bracket of 35- 44 years were 28 (22,4%), 45-54 years were 34 (27,2), were 55-64 years old 63 (50,4 %) respondents were males while 68 (54,4%) were females 57 (45,6%) of the respondents' monthly Income (Rupiah) was less than <2,999,000, 44 (35,2%) of the respondents' monthly Income (Rupiah) were between 3,000,000 – 5,999,000, 59 (47,2%) of the respondents' monthly Income (Rupiah) were > 6,000,000 while 22 (17,6%).

b. The effect of application educationa toward Quality of life of coronary artery disease (CAD) Patients

Table 2: Proportion Quality of life of patients with CAD (*n* = 250).

Variabel QoL		Pre	Post	SD	*SE Mean*	t score	P value
QoL Overall	Intervensi	4.54	6.46	1.221	.2.161	3.837	0.00*
	Control	2.46	3.46	.972	.589	.194	0.847
Physical Domain	Intervensi	17.86	18.66	5.058	3.500	3.500	0.001*
	Control	18.23	18.96	2.560	3.179	3.179	0.002*
Psycological Domain	Intervensi	13.73	15.59	5.058	2.191	2.191	0.030*
	Control	13.59	14.73	3.227	0.299	0.299	0.765
Social Domain	Intervensi	7.44	8.43	1.507	0.135	3.837	0.00*
	Control	9.18	8.78	1.376	0.119	0.073	0.942
Environment Domain	Intervensi	27.75	27.85	2.711	3.827	0.611	0.00*
	Control	27.53	27.74	2.507	.242	0.622	0.542*

Table 2 presents a comparison of the application of educational intervention models to improve quality of life between the intervention and control groups of coronary artery disease (CAD) patients before and after four weeks of nursing care. There was a significant effect on overall QOL among coronary artery disease (CAD) intervention patients with a p-value (p=0.000), whereas in the control group there was no effect on QOL with (p value 0.847). In the qol physical health domain, there was a significant difference in qol physical health between the two groups after the intervention (p=0.001), whereas in the control group there was a significant difference in qol physical health (pvalue 0.002). In the psychological health domain, there was a significant difference in the intervention group with a p value of 0.030 and the control group had no effect with a p value of 0.765. The social domain has a significant effect on the intervention group with a p value of 0.000 and the control group has no significant effect with a p value of 0.942. The environment has a significant influence between the intervention group (p value 0.00) and the control has no effect (p value 0.542).

4. DISCUSSION

The results of the comparison of the effectiveness of the educational intervention model to improve the quality of life of coronary artery disease (CAD) patients before and after four weeks of nursing care. The study found a significant improvement in the overall QOL of CAD patients between the intervention and control groups, with a p-value of 0.000. QOL showed significant differences in physical (p 0.002), psychological (p 0.003), and social QOL domains (p 0.000).

The study findings indicated that the quality-of-life domains, including physical, psychological, social, and environmental aspects, were measured for CAD patients. The pre-test mean scores for the intervention group were 14,269 and 15,398, while for the control group were 14,198 and 14,734. According to the World Health Organization, quality of life is defined as an individual's perception of their position in life within the context of their culture and value system, as well as their goals, expectations, standards, and concerns. This concept is complexly influenced by various factors such as physical health, psychological state, personal beliefs, social relationships, and the environment in which the person lives (World Health Organization, 2021b).

Prior research has established the significance of cardiac rehabilitation as a component of secondary prevention methods. Cardiac rehabilitation (CR) is a secondary prevention model that can reduce mortality and the risk of re-occurrence and improve the quality of life of cardiovascular disease (CVD) patients. Results from several studies show that CR can reduce mortality from various causes and the risk of heart attack reoccurrence. In addition, improved quality of life for CVD patients is also associated with higher levels of physical activity. In the setting of cardiac rehabilitation, inpatient treatment for CAD can be reduced by up to 18% (Winnige et al., 2021). Health-related quality of life (HRQOL) is defined as "a multidimensional construct that includes physical, social, and psychological functioning and has emerged as an essential outcome measure in chronic health conditions." Mobile applications in healthcare have the potential to enhance patient outcomes for those with chronic diseases by better controlling risk factors. To develop an app that provides health education and secure and effective follow-up for vascular disease patients, key points should be taken into consideration. Economic disparity often causes problems for patients, making prevention crucial in reducing medication costs, hospitalization expenses, and transportation costs. The use of apps is a successful tactic to invest in the quality of life of chronic patients through quick and systematic follow-up (Su & Yu, 2021).

In this study, the conceptual framework for selecting variables that may impact overall quality of life was guided by the revised Wilson and Cleary model of health-related quality of life (Duangchan & Matthews, 2021). To assess the impact of the overall model on quality of life, six separate regression analyses were conducted on overall quality of life, health satisfaction, and the four domains of quality of life (physical, psychological, social, and environmental). For the last few decades, numerous HRQOL models have been created and employed to direct research and healthcare practices. HRQOL encompasses various health-related areas, such as physical health, mental health, emotional well-being, and social functioning (Duangchan & Matthews, 2021)

Based on the data obtained from the results of interviews conducted, the patient reported experiencing physical limitations such as shortness of breath and easy fatigue during activities, feeling depressed because of the inability to carry out any activities at home, and frequently being hospitalized due to the illness. They also feel useless since all their daily needs are being taken care of by other family members.

The reason for this is that patients who did not receive intervention were afraid to engage in physical activity due to the chest pain and shortness of breath they experienced, which often resulted in hospitalization. Furthermore, these patients lacked knowledge regarding their illness progression, treatment plans, and post-hospitalization lifestyle adjustments. This caused anxiety, depression, and a sense of helplessness among CAD patients, who were unsure about which activities they were allowed to perform. As a result, their quality of life was negatively impacted across all domains.

The physical role domain describes the limitation of daily activities due to physical problems. A low score in the physical role domain may be caused by patients feeling that their ability to carry out activities is limited when experiencing pain, resulting in a reduction in working hours and a limitation of activities. This study found that CAD patients with high HRQOL described limitations in daily activities due to physical problems. The ability to perform daily activities without physical limitations is important to achieve a better quality of life (Sudevan et al., 2021). A low score in the physical role domain may be caused by patients feeling that their ability to carry out activities is limited when experiencing pain, resulting in a reduction in working hours and a limitation of activities. As a result, they spend most of their time doing other work or activities that do not cause pain or shortness of breath. Proper physical role function allows a person to achieve a better quality of life, and physical function is closely related to the physical role in CAD patients (Sudevan et al., 2021). If a CAD patient's physical function is good, their physical role will also be good. The questionnaire results showed that the control group had a low mean pain domain score of 25.8, while the intervention group had a high mean pain domain score of 26.61. This means that the pain can have a negative impact on a person's physical activities as well as other aspects of their life.

Inadequate pain control often leads to the negative impact of pain on a patient's quality of life and unmet needs. To reduce the pain experienced by CAD patients, a comprehensive intervention phase including health education, counseling, and gradual physical exercise can be implemented. Clear health education provided to patients and their families about their illness, how to manage it, and the importance of following treatment programs can help reduce psychological problems such as anxiety, which in turn, can lessen the pain experienced by patients. Gradually increasing physical exercise can also help CAD patients control the pain they experience during physical activities, as it allows them to adapt gradually to the pain. Counseling regarding a healthy lifestyle is recommended to CAD patients, including smoking cessation and adopting a high-fiber, low-fat diet. If CAD patients stop smoking and reduce fat intake, it can help prevent atherosclerosis. When there is no atherosclerosis, the myocardial oxygen supply and demand will be balanced, and recurrent angina attacks can be prevented. With the absence or reduction of pain experienced by patients with coronary heart disease, their quality of life can improve.

CAD patients who underwent interventions experienced an improvement in their quality of life, as reflected in their Physical Domain, Psychological Domain, Social Domain, and Environment QoL. Approximately 74% of patients who received interventions reported understanding their disease, the treatment process, and the necessary self-care. They gained knowledge of suitable activities and lifestyle changes that they need to make. Consequently, rehabilitated patients were able to perform activities without fear, experienced reduced anxiety, and adapted more easily to their condition. They could also adopt a healthy lifestyle to prevent further heart attacks, resulting in significant improvement across all domains of their quality of life.

Mobile applications in the health sector have the potential to improve outcomes for patients with chronic health conditions by enhancing their ability to manage risk factors and promoting health-related quality of life (HRQOL). The creation of effective and safe mobile applications that provide health education and follow-up for patients with vascular disease is crucial. To ensure the creation of an appropriate tool, key points should be considered. Additionally, it is important to note that many of the challenges faced by patients are linked to their socioeconomic status. Investing in prevention can be an effective means of reducing the expenses associated with medication, hospitalization, and travel. Utilizing mobile applications is a practical strategy for providing chronic patients with a rapid and systematic follow-up to improve their quality of life (Wong et al., 2022).

According to the study's findings, participants who did not receive any intervention had a low average score of 6.25 in the social function domain. In contrast, those who received the intervention had a significantly higher average social function score of 18.64. The findings of this study are in line with research on the quality of life of myocardial infarction patients, as most participants reported a below-average score in the social functioning domain (Sudevan et al., 2021). Researchers believe that social functioning relates to how frequently physical health issues and emotions impact social activities. Improving quality of life scores in mental health is indicative of improved social functioning, which is crucial in supporting social and community relations. This includes having positive social interactions, being an active member of the community, and experiencing minimal difficulties in social relationships. Interventions aimed at CAD patients have been shown to be effective in increasing their knowledge, improving their physical function, reducing their anxiety, and enhancing their self-care behavior (Goudarzi Rad et al., 2021). With reduced anxiety and depression, CAD patients can carry out social interactions with ease and actively participate in social activities with family, friends, and neighbors, as well as become active members of their communities. This, in turn, enhances the social functioning of CAD patients.

The study results indicated that respondents who did not receive any intervention scored low in the general health domain, specifically 20.69. These participants reported frequently falling ill, experiencing a decline in their health, and feeling that their health had worsened compared to before, according to the research questionnaire. In contrast, participants who underwent the intervention had a high average score of 37.64 in the general health domain. Public health experts emphasize that an individual's comprehension of health and illness is critical. For coronary heart disease patients, excessive activity can trigger chest pain and shortness of breath, resulting in frequent hospitalizations. Consequently, patients may feel unproductive at work and worthless to their families. A comprehensive intervention program that

comprises health education, counseling, and gradual physical exercise can reduce depression and anxiety in patients with coronary heart disease. Intervention programs that are effective can enhance patients' knowledge, improve their physical function, encourage self-care behavior, and promote the appropriate use of medication. By doing so, patients with coronary heart disease can reduce their risk of recurrence or repeated attacks. Improved general health in coronary heart disease patients can result in a better quality of life.

The quality of life of CAD patients is influenced by changes in their physical, psychological, and social conditions. Health status is an objective measure that can be used to determine the quality of life of patients, and it is typically determined by three factors (Duangchan & Matthews, 2021). Cardiac rehabilitation is a comprehensive program that aims to alleviate the physiological and psychological effects of heart disease through education, training, risk factor modification, and counseling. The program's goal is to enhance the physical, emotional, social, and spiritual well-being of patients (Winnige et al., 2021).

5. SUMMARY

In conclusion, the study found that interventions targeted at CAD patients had a significant positive effect on their overall quality of life. Despite the majority of participants having a low monthly income, they were able to access healthcare services through local health insurance provided by the government. Healthcare providers should emphasize the benefits of health insurance to CAD patients with low income to ensure they receive appropriate healthcare services. Additionally, social support from family and friends is crucial for many patients, and participation in cardiovascular clubs can provide peer group support, which can alleviate the burden of being a CAD patient.

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