Pharmacy Education (2022) 22(2) 36 - 40
https://doi.org/10.46542/pe.2022.222.3640

IAI SPECIAL EDITION

RESEARCH ARTICLE

The impact of mobile application: "Friends of Heart" in knowledge and compliance of patients with coronary heart disease

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Keywords
Adherence
Health mobile application
Knowledge

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Abstract

Background: The quality of life of coronary heart disease (CHD) patients can be improved by increasing patient compliance with treatment and health literacy rates. Over the past decade, mobile health (mHealth) has improved treatment adherence and demonstrated strong potential to increase health literacy rates. **Objectives:** Analyse the effect of "*Friends of Heart*" application on the compliance and knowledge of coronary heart disease patients. **Methods:** A randomised controlled trial (RCT) was conducted. The test group (intervention group) used the *Sahabat Jantung/* "*Friends of Heart*" application developed for the Android 4.1 operating system, while the control group did not. Compliance was measured for 30 days in outpatient settings; it included pill count and time deviations in taking medication. Knowledge was assessed using questionnaires. **Results:** Statistical results showed significant differences in knowledge and adherence between the intervention and the control group ($p = 0.0001$). **Conclusion:** The use of the "*Friends of Heart*" application could improve compliance and knowledge of coronary heart disease patients.

Introduction

Primary or secondary prevention of Coronary Heart Disease (CHD) includes non-pharmacological strategies, such as lifestyle modification to prevent the occurrence of CHD (Chen *et al.,* 2018), in addition to medication therapy, including statins, antiplatelets, beta-blockers, and nitrates (Anderson *et al.,* 2016; Roffi *et al.,* 2016). Compliance and knowledge are required whether in preventing or treating CHD. In practice, medication adherence of CHD patients discharged from the hospital is inadequate, irrespective of the social-economic status of the patient (Chen *et al.,* 2018).

Medication adherence is the extent to which the patient adheres to the interval and dosage regimen of the drug prescribed to overcome the disease (Nobre and Domingues, 2017). It has a complex set of behaviours consisting of initiation, implementation, and termination phases (Rehman *et al.,* 2017). Factors that support poor patient compliance include, among others, polypharmacy, poor knowledge of the disease, low health literacy rates, barriers in accessing treatment, skipping medications and regular visits to the doctor and costs (Zullig, Ramos & Bosworth, 2017).

Low health literacy can prevent patients from obtaining information related to prescribed medications. Moreover, knowledge has been correlated with patient medication adherence (Perera *et al.,* 2012). It should be improved by providing adequate information on active ingredients, indication, dosage, frequency, dosage form, drug and food interactions, and storage. Also, communication and collaboration between healthcare professionals can help them address patient needs and improve treatment (Fröhlich, Dal Pizzol & Mengue,

2010). The quality of life of CHD patients can be improved by increasing patient compliance with treatment and health literacy rates (Rehman *et al.,* 2017).

Over the past decade, mobile health (mHealth) has improved treatment adherence and demonstrated strong potential to increase health literacy rates. This technology integrates treatment compliance and promotes health behaviour changes through messaging, emphasising healthy habits, and tracking treatment success. It is an innovative, practical, and inexpensive way of managing patient compliance with their treatment (Park *et al.,* 2017).

Based on the above, this study aims to explore the differences in treatment compliance and knowledge of CHD patients using the *Sahabat Jantung*/"*Friends of Heart*" application and the control group. The ultimate goal is to increase knowledge and adherence, thereby reducing the morbidity and mortality of CHD patients and improving their quality of life.

Methods

This Randomised Control Trial (RCT) utilised an experimental pre-test and post-test design, with an intervention group (used the mobile application) and a control group (did not use the mobile application) randomly assigned. Measurements were taken before and after the intervention. Comparative data analysis was performed in this study.

The samples consisted of CHD outpatients of the Sidoarjo Regional General Hospital. Inclusion criteria were as follows: 1) aged 30-56 years; 2) diagnosed since at least three months; 3) controlled two months before the study; 4) taking CHD medications (statins, beta-blockers, calcium channel blockers, or others); 5) outpatient at Sidoarjo Hospital; 6) owning an Android smartphone 4.1 and above; 7) willing to take the interview; and 8) willing to participate in the study, evidenced by the patient's signature on the statement of willingness (Consent Form Statement). Exclusion criteria included 1) hearing loss; 2) illiteracy; 3) memory impairment (dementia or Alzheimer's disease); and 4) using other reminder applications. The final sample consisted of 50 participants divided into two groups of 25 patients each.

The application used in this study was developed and designed with Adobe XD, phpMyAdmin software, Sublime Text, and Android Studio. Furthermore, MySQL was used to construct the database. Before it was released on the Google Play Store, the *Sahabat Jantung*/"*Friends of Heart*" application was put through its paces. At the implementation stage, the application and a knowledge questionnaire were used.

Results

A total of 50 CHD outpatients took part in this research. They were asked to fill out sociodemographic information, such as gender, age, education level, occupation, and place of residence. According to these data, most participants were men, with 17 (68.0%) and 20 (80.0%) in the control and intervention groups, respectively. Most patients were in their 50s and 55s, with 15 (60.0%) patients in the control group and 14 (56.0%) in the test group. The majority had a high school/vocational education. Table I displays patient characteristics.

Table I: Patient characteristics

Patients'demographic		Control n=25		Test n=25	
		N	%	N	%
Gender	Male	17	68.0	20	80.0
	Female	8	32.0	5	32.0
Age(years)	35-39	3	12.0	2	8.0
	40-44	3	12.0	4	16.0
	45-49	4	16.0	5	20.0
	50-55	15	60.0	14	56.0
Educational background	No education	0	0.0	0	0.0
	Ungraduated from elementary school	0	0.0	1	4.0
	Graduated from elementary school	0	0.0	2	8.0
	Graduated from junior high school	5	20.0	3	12.0
	Graduated from senior high school	18	72.0	14	56.0
	Graduated with a bachelor's degree	2	8.0	5	20.0
Job	Civil servants	2	8.0	6	24.0
	Private sectors	9	36.0	12	48.0
	Businessman	3	12.0	1	4.0
	Farmer	2	8.0	0	0.0
	Jobless	8	32.0	5	20.0
	Other	1	4.0	1	4.0
Living with others	Family	25	100.0	25	100.0
	Alone	0	0.0	0	0.0

The results showed that patient compliance rates in the control group ranged from poor to moderate in the pre-test. After 30 days (post-test), re-measurements showed no discernible differences in compliance levels. The pre-test compliance levels of the intervention group ranged from low to moderate. After using the

application for 30 days, some patients had increased compliance levels at re-measurement (post-test). The difference in the intervention group was statistically significant (p = 0.001), as shown in Table II.

The results showed that patient knowledge was mostly low in the control and the intervention group pre-test. It significantly improved post-test in the intervention group (p = 0.001), as seen in Table III.

Table II: Frequency and percentage of patient's compliance

Patient's compliance	Control					Test				
	Pre-test		Post-test		*p* - value	Pre-test		Post-test		*p* - value
	N	%	N	%		N	%	N	%	
Low	5	20.0	6	24.0	0.527	5	20.0	0	0.0	0.0001
Moderate	20	80.0	19	76.0		20	80.0	22	88.0	
High	0	0.0	0	0.0		0	0.0	3	12.0	

Table III: The profile of patient's knowledge in both groups

Patient knowledge	Control				*p* - value N	Test				*p* - value Post-test %
	Pre-test		Post-test			Pre-test		Pre-test		
	N	%	N	%		%	N	%	N	
Low	14	56.0	14	56.0	0.166	14	56.0	2	8.0	0.0001
Moderate	9	36.0	9	36.0		11	44.0	13	52.0	
High	2	8.0	2	8.0		0	0.0	10	40.0	

Discussion

The study started with sociodemographic data collection via questionnaire sheets. In both groups, patients were predominantly male. Most participants were 50-55 years. Men generally suffer from heart disease at a younger age and have a higher potential for CHD than women (Bots, Peters & Woodward, 2017) due to abdominal obesity, often called apple obesity, which is strongly associated with risk factors for CHD (Fodor and Tzerovska, 2004; Wiklund *et al.,* 2008). Besides obesity type, men do not benefit from the protective effect of the steroid hormones, especially oestrogen, like women (Bots, Peters & Woodward, 2017). Oestrogens are beneficial because they prevent atherosclerotic plaque development, favour vasodilation, regulate blood pressure, and have antioxidant and anti-inflammatory properties (Jamee, Abed & Jalambo, 2013). Decreased oestrogen levels in women, e.g. during menopause, make them at equal risk of CHD as men (Maas & Appelman, 2010; Jamee, Abed & Jalambo, 2013; Mozaffarian *et al.,* 2015; Regitz-Zagrosek *et al.,* 2016; Bots, Peters & Woodward, 2017).

The success of therapies delivered by healthcare providers to patients, particularly those with chronic conditions like CHD, depends on patient medication adherence. Indeed, non-adherence to pharmacological treatment can harm the patient and raise the risk of a heart attack (relapse). Measuring and monitoring CHD therapy in outpatients is critical for determining treatment success and avoiding adverse drug reactions in those patients. However, it is essential to dedicate time and assign clinical pharmacists to supervise therapy for successful outcomes (Kini & Ho, 2018). For more than four decades, much research has been conducted on measuring compliance levels about treatment accurately and precisely. However, nothing is considered the standard of measuring patient compliance levels with treatment (Lam & Fresco, 2015). Direct methods include measuring the concentration of drugs (or metabolites) found in body fluids. Although it is considered the most accurate and adequate method, it causes discomfort in patients. Indirect methods include pill count, electronic health records, and self-reported measures (Questionnaire) (Lam & Fresco, 2015; Anghel, Farcas & Oprean, 2019).

The medication adherence questionnaire (MAQ), average time deviation, and pill count were utilised as measurement methods in this study. The results showed that patient compliance rates in the control group ranged from poor to moderate pre-test. At re-measurement after 30 days (post-test), there was no discernible difference in the patient compliance levels, where 24 patients did not see improvement in compliance, and one had decreased compliance from moderate to low. Patient compliance levels in the intervention group ranged from low to moderate pretest. Thirty days after using the application (post-test), some patients had increased adherence levels, where compliance increased from moderate to high in three patients, from low to moderate in five patients, and remained the same in 17 participants.

These results are consistent with previous findings showing improved compliance among 104 CHD patients in Sydney, Australia, after using the MedApp-CHD mobile application (Santo *et al.,* 2017). Another study also reported an improved adherence among patients using mHealth (Ni *et al.,* 2018). In our modern era, health applications deserve to be taken into account to become one of the options for improving patient compliance (Santo *et al.,* 2017; Ni *et al.,* 2018).

Patient knowledge of their treatment is essential. Research shows that poor health literacy is a barrier to prescribed medication adherence (Perera *et al.,* 2012). The results showed the *Sahabat Jantung*/"*Friends of Heart*" application could increase patient knowledge. This result is consistent with previous findings showing that patients with atrial fibrillation who used the mAF application had significantly improved knowledge levels compared to patients who received regular care (Guo *et al.,* 2017).

Conclusion

The *Sahabat Jantung*/"*Friends of Heart*" application could influence the compliance and knowledge of coronary heart disease outpatients.

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