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Development of an EKA application to help tuberculosis patients improve medication adherence and self efficacy

Lie Liana Fuadiati, Tintin Sukartini, Makhfudli, Yulis Setiya Dewi, Alfian Nur Rosyid, Arina Qona'ah
Department of Medical Surgical Nursing, Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

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ABSTRACT

Tuberculosis treatment is carried out daily for a long time, causing boredom with taking medication and reducing medication adherence. It results in drug resistance and more prolonged treatment. In response to the situation, this study developed an android-based application called the education, calendar, and medication alarm (EKA) app to improve medication adherence and self-efficacy of tuberculosis patients. Research and development with four steps: evaluation of health education, medication adherence, and self-efficacy; application development; feasibility test; and application socialization. The sample in this study was 38 respondents. This study also uses morisky medication adherence scale (MMAS-8), self-efficacy, and system usability scale (SUS) questionnaires and evaluation sheets to collect the data. Data analysis was done descriptively. The outcomes of the application feasibility test showed that the EKA application received an acceptable value of 81.5 based on acceptance, B value (81.5) based on value scale, an excellent value (81.5) based on adjective rating, and good score (81.5) based on percentile. Socialization on the use of the application goes well, and the patient gets a good understanding and can use the EKA application easily. It proves that the android-based EKA application tested using the SUS questionnaire can be used as a medium for health education and supports medication adherence and self-efficacy.

Corresponding Author:

Tintin Sukartini
Department of Medical Surgical Nursing, Faculty of Nursing, Universitas Airlangga
Kampus C Universitas Airlangga, Mulyorejo, Surabaya, East Java, 60115, Indonesia
Email: tintin-s@fkp.unair.ac.id

1. INTRODUCTION

Tuberculosis is an infectious disease. Thus, the medication must be carried out every day and need the long term, causing boredom and reducing medication adherence. Whereas taking medication that is not routine can cause drug resistance, leading to treatment failure [1]. In Indonesia, the data for tuberculosis treatment in 2019 shows that the patient's medication adherence is 86.6% [2]. However, the success of treatment itself has not reached 90%. Meanwhile, according to the Regulation of the Minister of Heath of Republik Indonesia (PMK), Number 67 by 2016 regarding Tuberculosis Control, the tuberculosis cure target rate must be at least 90% [3].

Based on the WHO statement [4], in mid-March 2021, some countries that had the most significant tuberculosis transmission in 2019 were Southeast Asia (44%), Africa (25%), West Pacific (18%), Eastern Mediterranean (8.2%), America (2.9%) and Europe (2.5%). Moreover, eight countries accounted for two-thirds of the global sum, namely India (26%), Indonesia (8.5%), China (8.4%), Philippines (6.0%), Pakistan (5.7%), Nigeria (4 .4%), Bangladesh (3.6%) and South Africa (3.6%). According to the Ministry of Health of Republik Indonesia (*Kemenkes*), the number of tuberculosis cases has decreased from 566,623 cases in 2018

to 543,874 cases in 2019. Besides, based on the case detection rate, the most tuberculosis cases existed in West Java Province (96.2%), with Gorontalo in second place (94.6%), DKI Jakarta (87.5%) in the third position, and East Java (68.3%) ranked sixth. The success rate for medication treatment of tuberculosis patients in Indonesia in 2017 was 85.7%. After this, it decreased to 84.6% in 2018 and increased again in 2019 to 86.6% [5]. Several factors that affect the success of treatment are lack of medication adherence, difficulty finding people suspected of having tuberculosis, lack of support for tuberculosis treatment and prevention, and other social factors such as poverty, malnutrition, hygiene, sanitation, and population density [3]. Pointing to the 2021 East Java Health Profile Data, in 2020, the tuberculosis rate in Surabaya was 50,840 cases, in Jember 24,901 cases, and in Pasuruan 13,434 cases. However, the recovery rate after treatment in Pasuruan regency still reached 1,020 cases (57.8%), the complete treatment rate was 1,877 cases (58.8%), and the treatment success rate was 2,921 (91.5%) had yet to reach 100%. Meanwhile, the number of deaths from tuberculosis reached 104 cases (3.3%) [6].

Technological development with medication adherence assistance is needed to establish a holistic, patient-centered treatment model. Furthermore, digital technology can work optimally when health workers empower patients so that they can improve the quality of patient care [7]. Manyazewal *et al.* [8] making monitors of taking medication patients with standard face-to-face meetings, but not yet equipped with rules for taking medication. Mohammed *et al.* [9] developed SMS reminder to take the medication in tuberculosis patients. Nevertheless, the results have not effectively increased medication adherence in tuberculosis patients. in other research, digital monitoring improves medication adherence by reminding patients to take medication and assisting in complex treatment regimens [9]. Daily and weekly reminder system significantly increased patient adherence to tuberculosis treatment at each continuation of the treatment phase [10]. Drabarek *et al.* [11] said medication reminder alarm for tuberculosis patients is an implementation that can improve medication adherence and can be used daily. By the Health Promotion theory, the commitment model to carry out health promotion behavior is influenced directly or indirectly by prior related behavior, which can be changed by focusing on individual belief in the positive results of actions that are expected to occur after the health behavior (perceived benefit of actions). Based on this background, researchers are interested in developing an android-based application equipped with education about tuberculosis, medication calendar, medication reminder alarm system, and medication rules to increase commitment to health behavior to improve the medication adherence and self-efficacy of tuberculosis patients (EKA). The EKA application does not only contain medication reminders but is equipped with an educational menu and a calendar to monitor the treatment a tuberculosis patient is undergoing.

2. METHOD

2.1. Research design

The research design used in this study is research and development (R&D). Here, R&D is a research method that produces a product in a particular area of expertise, followed by certain by-products, and has the effectiveness of a product [12]. Products from R&D research can be hardware or software [13]. Development research is a descriptive procedural model with development steps [14]. The steps in this research include research and information collecting, research planning, development of design (develop preliminary product), feasibility test (operational field testing), and socialization on the use of the application. This study is divided into two research stages. The first stage evaluates medication adherence, self-efficacy, and implementation of health education and preparation of applications through focused group discussions (FGD) and expert consultations. The second stage is the application feasibility test and socialization on the use of the application.

The resulting product is the EKA application. EKA is abbreviation in Indonesia, E for "*edukasi*" it means education, K is "*kalender*" it means calendar and A is "Alarm". The EKA application was developed from a health application for tuberculosis patients that previously existed by combining 3 features: education, calendar and medication alarm.

2.2. Setting and samples

This research was conducted at the Pulmonary Disease Polyclinic at Bangil Hospital, Pasuruan, from August to September 2022. Sampling in phase I of the study used a non-probability sampling technique through consecutive sampling, with 28 respondents calculated by (1) and (2).

$$n = \frac{\mathrm{N}.z^2.\sigma^2}{\mathrm{d}^2(\mathrm{N}-1)+z^2.\sigma^2} \quad (1)$$

$$n = \frac{30.(1.96)^2.(0.5)^2}{0.052\,(30-1)+(1.96)^2.(0.5)^2} = 28 \quad (2)$$

Information:
n=sample size z=normal curve value depending on alpha; N=population size; d=selected fault tolerance (0.05)

Inclusion criteria in this phase included tuberculosis patients undergoing tuberculosis treatment at the Pulmonary Disease Polyclinic at Bangil Hospital in Pasuruan. Moreover, male, and female respondents aged 15-60 were willing to be respondents by agreeing to informed consent and patients being able to read. On the other hand, the exclusion criteria in this investigation included tuberculosis patients with disabilities, complications, and comorbidities.

In phase II of the research, the sample validity test was applied to 10 respondents with the inclusion criteria set. This is in accordance with Sharfina and Santoso research [15], the measurement of application validity with ten respondents was declared valid if the measurement results obtained a value above 0.7. Inclusion criteria in this phase were tuberculosis patients undergoing treatment at the Pulmonary Disease Polyclinic at Bangil Hospital, male and female respondents aged 15-60 years old, willing to be respondents by signing informed consent, owning a smartphone, and being able to use a smartphone.

2.3. Measurement and data collection

2.3.1. In phase I of the study

The researcher used some questionnaires: i) Health education system evaluation sheets. The evaluation sheets adopted from Sari [16], it is based on the Indonesian Nursing Intervention Standards. It comprises five parts: health education methods, media used, implementation time, place, and health education content. The questionnaire rate comes with two kinds of answers: 2 for "Yes" and 1 for "No." Assessment is completed by adding up the scores of all question items. Then the data is presented in percentages; ii) Morisky medication adherence scale (MMAS-8) questionnaire. MMAS-8 was adopted from ii's research which used the Morisky questionnaire in 1986 [17]. It consists of 8 question items with two answer choices (yes and no). The answer "yes" was given a score of 0, and the answer "no" was assigned a score of 1. However, for unfavorable questions, "yes" was given a score of 1, and the answer "no" was given a score of 0. Suppose the value of "no" is ≤2. Then it is said to obey the treatment; (iii) Self-efficacy questionnaire. Adopted from previous research, it consists of closed questions using a Likert scale with five answer choices [18]. Each query item consists of a question that is supportive or positive (favorable). The scoring system for these questions starts from very sure=5, sure=4, quite sure=3, not sure=2, and very unsure=1. The range of the results of this questionnaire measurement is 20-100. If the score is 20-46.7, it is categorized as low self-efficacy, 46.8-73.3 moderate self-efficacy, and 73.4-100 high self-efficacy [18].

2.3.2. In phase II of the research

The researchers used a system usability scale (SUS) questionnaire, which is a measurement tool with ten items. This questionnaire provides a subjective view of the usefulness of an object [15]. The SUS questionnaire has been developed in Indonesian with a Cronbach alpha value of 0.841, which concludes that this version is reliable to use [15]. The SUS questionnaire uses a Linkert scale consisting of scores of 1 (strongly disagree), 2 (disagree), 3 (undecided), 4 (agree), and 5 (strongly agree). There is a contribution score in each question calculation on the SUS questionnaire. First, the score for questions 1, 3, 5, 7, and 9 minus one. Meanwhile, the contribution score is five minus the scale score for questions 2, 4, 6, 8, and 10. The resulting SUS score can be interpreted into several assessment components as follows:

i) Acceptability ranges, it consists of not acceptable (score <50), marginal (score >70), and acceptable (score 70-100).
ii) Grade scale, the grading system consists of A (score between 90-100), B (score between 80-90), C (score between 70-80), D (score between 60-70), and F (score below 60).
iii) Adjectives rating, interpretation based on the SUS score becomes a final assessment of the usability and rating of the resulting software. Usability discusses how users can utilize existing products or services to achieve their goals and needs. This adjective rating consists of worst imaginable (score 0-25), poor (25-40), ok (score 40-50), good (score 50-75), excellent (score 75-85), and best imaginable (85-100).
iv) Percentiles, the percentile calculation compared the current and previous research data with the average SUS score of 68. It explains that if the SUS score is above 68, it is considered above average or "good," and below 68 is "poor."

2.4. Data analysis

To analyze the data, the researchers used the Microsoft Excel program to see implementation of health education, medication adherence, and self-efficacy. Then the results of the data analysis are interpreted descriptively. The implementation of health education was measured using a health education observation sheet. This observation sheet consists of five sub-sections: health education methods, media used, implementation time, place and content of health education. The questionnaire raters were 2 for a yes answer

and 1 for a no answer. Assessment is carried out by adding up the scores of all question items. Then the data is presented in percentages.

Self-efficacy was measured using a self-efficacy questionnaire. The self-efficacy questionnaire consists of self-efficacy indicators which are adjusted to indicators for Tuberculosis, which is treatment and prevention. prepared in the form of closed questions using a Likert scale using 5 answer choices. Each score will be divided into answers: very sure, sure, quite sure, not sure, very not sure. Each question item consists of questions that are supportive or positive (favorable), the question scoring system starts from very sure =5, sure =4, quite sure =3, not sure =2, very unsure =1. The final score of the self-efficacy questionnaire is by adding up the total score for each question, namely a maximum score of 100 and a minimum score of 20. The interpretation of the self-efficacy questionnaire is low self-efficacy =20 – 46.7, medium self-efficacy =46.8 – 73.3 and high self-efficacy =73.4–100.

Medication adherence was measured using the MMAS-8 questionnaire. This questionnaire is used to measure treatment compliance. This tool consists of 8 question items. The answer choices in the question consist of 2 answer choices (yes and no). The answer "yes" is given a score of 0 and the answer "no" is given a score of 1. However, for unfavorable questions "yes" is given a score of 1 and the answer "no" is given a score of 0. The range of measurement results for this questionnaire is 0-8, which is said to be compliant with treatment if the value "no" ≤2. Then the results are presented as a percentage and presented descriptively.

2.5. Ethical considerations

Researchers in this study uphold research ethics, namely confidentiality (privacy), justice (justice), and expediency (beneficence). The researchers will describe the research to be conducted, its purpose, and benefits, then ask the respondent's willingness to become the research object. Once the patient is willing to be a research respondent, the researchers will ask the patient to fill out an informed consent form. Ethical clearance in this study was created by Bangil Hospital in Pasuruan and declared in the Ethical Eligibility No: 445.1/010/424.072.01/2022 on July 20, 2022.

3. RESULTS AND DISCUSSION

3.1. Evaluation of the health education system

In the Pulmonary Disease Polyclinic, health education has been carried out. Researchers carried out health education observations using observation sheets. The results of the evaluation of the health education implementation system for 28 respondents who received outpatient treatment at the Lung Disease Polyclinic are described in Table 1.

Most respondents said that the health education was done in lecture-based method, and the media usually used are posters on the walls of the Pulmonary Disease Polyclinic room. Specifically, health education is carried out in the treatment room when patients consult with doctors and nurses and in the waiting room when patients wait in line before being checked ups by nurses and doctors. There was no specific schedule for health education there. Even some patients said they knew minimal how many times the health education was held. Moreover, some patients say they do not know the kinds of OAT and how to deal with the side effects of OAT.

3.1.1. Evaluation of medication compliance

Compliance evaluation was measured using the MMAS-8 questionnaire. The MMAS-8 score results are categorized into 2 categories, namely compliant and non-compliant. Compliance with taking medication for 28 respondents who sought outpatient treatment at the Lung Disease Polyclinic is explained in Table 2.

3.1.2. Evaluation of self-efficacy

Self-efficacy evaluation was measured using a self-efficacy questionnaire. The self-efficacy score results are categorized into 3 categories, namely high, moderate, and low. The self-efficacy of 28 respondents who sought outpatient treatment at the Lung Disease Polyclinic is explained in Table 3.

3.1.3. Application validity test

Testing the validity of the EKA application is beneficial to assess the eligibility and user acceptance of the development results of an android-based application developed using the SUS questionnaire. This assessment is based on evaluating the results of the questionnaires that the respondents filled out. The finding is shown in Table 4.

Table 1. Evaluation of the health education implementation system

No.	Parameter	Data	N	%	Strategic issues
	The implementation of Health Education				
1.	Health education methods				Lecture-based and discussion methods
	Lecture-based	Yes	26	93	Health education is carried out while waiting in line before the checkups time and during the medical checkups in the treatment room
		No	2		
	Discussions	Yes	24	86	Discussion regarding perceived complaints
		No			
	Health education media				Leaflets and posters
	Leaflets	Yes	17	61	Patients said they rarely read leaflets when at home
		No	11	39	
	Poster	Yes	23	82	Posters cannot be taken home
		No	5	18	
	Execution time Intensity				There is no specific time and routine
	There isn't any	Yes	5	18	Not all patients get health education
	Once a month	Yes	6	21	There is no specific time and routine
	> 2 times a month	Yes	18	64	There is no specific time and routine
	Duration				
	15 minutes	Yes	23	82	Time for discussion is 15 minutes
	16-30 minutes	Yes	5	18	Time for discussion is 16-30 minutes
	Place				There is no specific room
	Care room	Yes	23	82	Health education in the treatment/care room
	Waiting room	Yes	5	18	Health education in the waiting room
	Contents of Health Education	Good	11	39	Health education about tuberculosis and antitubercular medications (OAT) treatment, with OAT material, the purpose of giving OAT, benefits, types, how it works, the side effects of OAT, and the impact of drug withdrawal. However, there are still patients who do not understand the various types of OATs, how it works, how to deal with the side effects, how and when is the right time to take OAT. Dominantly, the health educations are explained briefly by doctors and pharmacists.
		Not good	17	61	
	Definition of OAT	Yes	24	86	
		No	4	14	
	The purpose of giving	Yes	26	93	
	OAT	No	2	7	
	OAT benefits	Yes	26	93	
		No	2	7	
	Various oats	Yes	15	54	
		No	13	46	
	Mechanism or way of	Yes	16	57	
	working of OAT	No	12	43	
	OAT administration	Yes	26	93	
	time	No	2	7	
	OAT side effects	Yes	25	89	
		No	1	11	
	Impact of drop out	Yes	25	89	
		No	1	11	
	How to deal with	Yes	16	57	
	OAT side effects	No	12	43	
	Health Workers who Provide Education				Most of the patients said they discussed with the doctor about the complaints they felt
	Nurse	Yes	25	89	The nurse explains the importance of taking medication and motivates them to adhere to take medication
		No	3	11	
	Doctor	Yes	26	93	Most of the patients said they discussed with the doctor about the complaints they felt
		No	2	7	
	Pharmacy officer	Yes	25	89	The pharmacist explains how and when to take OAT
		No	3	11	

Table 2. Results of medication compliance evaluation

Variable	Parameter	N	%
Medication adherence	Obey	25	89
	Not obey	3	11
	Total	28	100

Table 3. Self-efficacy evaluation results

Variable	Parameter	N	%
Self-efficacy	High	16	57
	Moderate	10	36
	Low	2	2
	Total	28	100

Table 4. Evaluation results of application usage by users

Menu components	Category	Measurement value
Acceptability ranges	Not accepatble (0-50)	Acceptable (81.5)
	Marginal (50-70)	
	Acceptable (70-100)	
Grade scale	A (score between 90-100)	B (81.5)
	B (score between 80-90)	
	C (score between 70-80)	
	D (score between 60-70)	
	F (score under 60)	
Adjectives rating	Worst imaginable (0-25)	Excellent (81.5)
	Poor (25-40)	
	OK (40-50)	
	Good (50-75)	
	Excellent (75-85)	
	Best imaginable (85-100)	
Percentiles	Good (>68)	Good (81.5)
	Poor (<68)	

3.2. Discussion

The evaluation results of health education at the Pulmonary Disease Polyclinic at Bangil Hospital have yet to be effective. Health education there still uses some conventional methods, namely lecture-based and discussion methods, so it is less attractive to patients and causes boredom for most of them. In addition, the health education received was primarily oral and in writing, but not all patients acquired educational media they could take home. Moreover, some patients still needed to learn about the types, ways the medication works, and how to deal with the side effects of OAT. Dominantly, health education is held in the treatment and waiting rooms and only focuses on patient complaints.

In fact, health education helps patients gain the knowledge, skills, adherence, self-efficacy, and confidence to be active in their medication treatment to achieve their healthy life goals. Point out the previous studies which explain that based on King's interaction system theory, medication adherence will increase by improving the patient's personal system and upgrading the correct perception of tuberculosis by providing the proper knowledge and learning for patients [19].

Health education must be directed to the needs of individuals and communities with appropriate materials. However, there will be a challenge in dealing with tuberculosis if the medication treatments are discontinued. It means that treatment must start from the beginning and can cause resistance to certain drugs [20]. Health education is critical as an effort to promote health. Simulation learning activities have the potential to create awareness and generate health worker initiatives to improve health promotion strategies [21]. Health education with conventional methods is considered less effective and efficient because it causes boredom. Today, people are more interested in using smartphones than reading books. Therefore, many modern learning methods have been developed by utilizing technological media, which have proven to be more attractive, efficient, effective, and high-quality [22]. The empowerment program has four structures: lectures with slides, videos, manuals and brochures, learning exchanges, and group discussions [23]. The educational method using a lecture-based strategy is less effective because it causes boredom. Thus, visual educational media is needed to attract patients to read and see [24].

Prasetyo *et al.* said the tuberculosis health promotion program uses three Pender health promotion model components: perceived benefits after the action, perceived barriers to action, and perceived self-efficacy. On the other hand, the health promotion activities were divided into four sessions. Those include tuberculosis education, personal counseling, group discussions, and individual monitoring. Health education about tuberculosis focuses on increasing knowledge, skills, and medication adherence. The research findings show that tuberculosis health promotion contributes to increasing medication adherence and knowledge of tuberculosis patients [25].

The medication adherence evaluation results showed that most respondents had good medication adherence, but some patients were still in the non-adherent category. In addition, some patients still do not take their medicine when traveling. It is because patients experiencing other health problems, far from health services, forgetting to take their medication, and not understanding the side effects of drug withdrawal. So, it is necessary to have health education media that is accessible and interesting for patients.

Compliance with taking medication can be influenced by several factors, including length of treatment, education, knowledge, and ability to seek health information [26]. Knowledge is often associated with patient behavior in self-care and medication management. Good knowledge will encourage patients to have a positive attitude towards good self-care. In other words, health education interventions, patient counseling, and material support can increase knowledge and medication adherence in tuberculosis patients

undergoing treatment [27]. The factors influencing medication adherence in tuberculosis patients are knowledge, self-efficacy, self-stigma, and family support [28].

Respondents' knowledge was obtained from information provided by health workers and health education media itself. Similarly, Nezenega [26] said non-compliance with tuberculosis treatment was caused by factors of social support from the family, reminders from the family, motivational encouragement to recover, distance from home to health services, busy work, stigma, discrimination, perceptions of health, economic constraints and medical expenses.

The results of the self-efficacy evaluation of tuberculosis patients at the Pulmonary Disease Polyclinic at Bangil Hospital, Pasuruan, found that most respondents had high self-efficacy. However, some others still have the moderate and low efficacy categories affected by patient knowledge. High self-efficacy tends to affect medication adherence. Low self-efficacy will also affect low medication adherence. Because so patiently believe in the ability to perform self-care, they will achieve the desired results. Self-efficacy is influenced by knowledge [29].

EKA application development is prepared by finding strategic issues in FGDs with health workers at the hospital. These issues are derived from filling out health education evaluation sheets at the Pulmonary Disease Polyclinic at Bangil Hospital, Pasuruan. However, the FGD's results in implementing health education did not reach the maximum level. Due to the conventional education methods, some patients had little time to discuss with doctors or nurses. Besides, not all patients received health education media leaflets and posters to take home. The evaluation also found that some patients needed more knowledge regarding tuberculosis and OAT treatment. Even some patients were non-adherent to treatment and had moderate and low self-efficacy.

To solve thias problem, technological advances are widely used in smartphone applications as a medium of health education to improve medication adherence [30]. Using technology in medication methods allows health workers to transfer health information to patients [31]. It is in line with Thomas *et al.* [32] statement that people currently use the android operating system on mobile phones because it is easy to open and use. Making it easier for researchers to develop applications according to the patient's needs and problems [32]. In addition, Android has many advantages. Those include cell phone choices with various notifications system, multitasking, and easy access [33]. The advantages mentioned before then become the basis for researchers to develop applications adapted to the problems experienced by tuberculosis patients. mobile-assisted medication adherence support (Ma-MAS) is an example of an android application that can increase motivation and adherence to taking medication in tuberculosis patients [34].

The prepared application from this research is called EKA, which stands for education, calendar, and medication alarm as a media to support health education and treatment of tuberculosis patients to increase compliance and self-efficacy. Usually, when verbal information is explained to the patient, they tend to forget it immediately. However, once the visual health education media comes into use and can be accessed at home, it will increase patient interest in repeating material they got before. Health education with media will be more exciting and can increase knowledge and attitudes toward health problems effectively and efficiently [35].

Medication adherence can also be determined by access to health services and communication between nurses and patients. Nevertheless, access to treatment for tuberculosis patients has been disrupted due to restrictions on contact between health workers and patients during the COVID-19 pandemic [34]. Thus, digital technology is needed to help with medication adherence [7]. Gashu *et al*. [10] said that refilling the reminder system's daily and weekly medication alarm will significantly increase tuberculosis patients' medication adherence during the treatment phase. It is because the patient will continue to be reminded by the alarm before taking medicine. As a result, it can improve tuberculosis treatment success [10]. Increasing the frequency of taking medication reminders would result in high medication adherence. Patients would continue to be reminded when they forgot [36]. At the same time, based on other research increasing the frequency of reminders is the best strategy to improve medication adherence [37].

Health education through apps has become essential for increasing self-management, knowledge, self-efficacy, adherence to medication, and recovery of tuberculosis patients [38]. Knowledge is the basis for changing one's behavior. Health education helps patients understand the risks and improve health behavior to increase confidence in their abilities and self-efficacy to carry out healthy habits [39]. Increasing awareness and knowledge about health behavior would raise awareness of healthy habits. At the same time, self-efficacy is vital in supporting the treatment and prevention of tuberculosis transmission [40].

The Kill-TB drug reminder mobile application for reminders to take medication for tuberculosis patients, if a patient misses taking medication more than twice in a row in a month then they are considered non-adherent to treatment [41]. Web and android-based application for monitoring tuberculosis patients, this application was created to make it easier for health workers to monitor patient medication adherence [42]. This web application is web-based which can be accessed by admins, nurses and medication supervisors [42]. The difference and novelty of my research with previous research is that the EKA application is not only

made for medication reminders. However, it is equipped with an educational menu containing tuberculosis disease material, side effects of drugs, nutrition, physical activity, prevention of transmission accompanied by educational pictures and videos. In addition, the EKA application contains a medicine taking calendar which can be used as a monitor for taking medication for tuberculosis patients.

In this research, the results of the application feasibility test through the SUS questionnaire showed that the EKA application received an "Acceptable" score (81.5) based on the acceptability ranges menu component, a "B" value (81.5) based on the grade scale menu component, an "Excellent" score (81.5) based on the adjectives rating menu component, also a "good" value (81.5) based on the Percentiles menu component. It is in line with the research of Adu *et al.* [43]; the critical thing that needs to be done in developing media to support the treatment of diseases is application testing. The purpose of application testing is to assess the overall application usability, ease of access, and application performance. A well-managed system means it is functional with achievable goals [44].

The EKA application uses a database server that can only be accessed by certain parties, such as programmers and researchers, in response to these security issues. That way, the application security can be maintained. Following the guide CIOMS, a secure system is necessary for storing health research data because health data is personal data that needs to be considered confidential [45]. Data storage in the EKA application is stored on a server equipped with a data code that can only be accessed by entering a password to guarantee data security.

4. CONCLUSION

The implementation of health education at the Pulmonary Disease Polyclinic at Bangil Hospital, Pasuruan, has been running but has yet to be well planned. Furthermore, the media used are leaflets and posters that cannot be taken home. Meanwhile, health education is implemented when patients are queuing to get medical checkups; during the checkups time, and when patients take prescriptions for a short time.

Medication adherence for tuberculosis patients in the Pulmonary Disease Polyclinic mainly falls in the Obey category. However, some patients are still in the not obey (non-adherent category). In addition, the self-efficacy of tuberculosis patients in the Pulmonary Disease Polyclinic is mainly in the high category, but some patients are still in the medium and low classes. Thus, the EKA application was developed through literature studies, FGD, and expert consultations to produce media in providing more effective and efficient health education interventions. It is an android-based application that consists of medication reminders, physical activity reminders, education, calendars, and self-intervention. In other words, the EKA application works as a supporting tool in health promotion media and as social support for tuberculosis patients.

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BIOGRAPHIES OF AUTHORS

Lie Liana Fuadiati is a student in the Master of Nursing Program at Faculty of Nursing, Universitas Airlangga, Surabaya, East Java, with a focus on medical surgical nursing. Currently she works as a lecturer at the S1 Nursing Study Program at STIKes Kendedes Malang, East Java. She's interested in the fields of Medical Surgical Nursing, Psychiatric Nursing, Complementary Nursing, and developing Android-based health applications. To realize a career as a professional lecturer, researchers also actively participate in seminars and training activities, as well as research in this field. The researcher is also actively writing books in the hope that his work can make a positive contribution to the nation and state, especially to Nursing Education and the Nursing Profession. She can be contacted at email: lielianafuadiati@gmail.com.

Tintin Sukartini is a Professor and Lecturer in Medical Surgical Nursing, Faculty of Nursing, Airlangga University, Surabaya, East Java. She was inaugurated as a professor on July 16, 2023, with an inauguration speech entitled "Stigma dan Pemberdayaan Perempuan ODHIV". She is an expert in the field of medical surgical nursing. She is interested in identifying infectious disease research, especially tuberculosis, HIV AIDS, COVID-19 and others. She is an active researcher and author of books in the field of medical-surgical nursing. She can be contacted at email: tintin-s@fkp.unair.ac.id.

Makhfudli is a Lecturer at the Faculty of Nursing, Universitas Airlangga, Surabaya, East Java focus on medical surgical nursing. He graduated from the Universitas Airlangga Postgraduate Program: Doctoral Education Program, Faculty of Medicine whose main interests are Community Health Nursing, Family and Gerontics. Her current research interests are Family and Gerontology Nursing, Community Nursing and Tropical and Infectious Disease Nursing. She currently teaches at the D III Nursing Study Program, Faculty of Vocational and Faculty of Nursing, Universitas Airlangga. He holds a Master's degree in Tropical Disease Medicine, Faculty of Medicine, Universitas Airlangga after conducting research on Tuberculosis. He also worked as a Nursing Manager, Universitas Airlangga Hospital, Surabaya. He can be contacted at email: makhfudli@fkp.unair.ac.id.

Yulis Setiya Dewi is a Lecturer at the Faculty of Nursing, Universitas Airlangga, Surabaya East Java. She is an expert in the field of medical surgical nursing. She is interested in identifying nursing, nurse, caring, nursing education, critical care nursing, disaster nursing. She is an active researcher and author of books in the field of medical-surgical nursing. She can be contacted at email: yulis.sd@fkp.unair.ac.id.

Alfian Nur Rosyid is a Lecturer at the Faculty of Medicine, Universitas Airlangga, Surabaya, East Java. He also worked as a Doctor, Department of Pulmonology and Respiratory Medicine Doctor, Universitas Airlangga Hospital, Surabaya. He is an active researcher and author of books in the field of Pulmonology and Respiratory Medicine. He can be contacted at email: konsulparu@gmail.com.

Arina Qona'ah is a Lecturer at the Faculty of Nursing, Universitas Airlangga, Surabaya, East Java. She is an expert in the field of medical surgical nursing. She is interested in identifying medical surgical nursing, nursing management, chronicles of illness technological and health care innovationBachelor's Study Program, Department of Advanced Nursing. She is an active researcher and author of books in the field of medical-surgical nursing. She can be contacted at email: arina-qonaah@fkp.unair.ac.id.