



Innovation Article

Family-centered maternity care mobile application to increase the readiness of pregnant women in facing a high-risk childbirth

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ABSTRACT

Background: Pregnant women with high risk need education and information along with the pregnancy. Information support helps them to feel ready and confident to go through the delivery. Sources of information that can be accessed during pregnancy include websites regarding pregnancy, smartphone applications, magazines, and books. One of the efforts to increase pregnant women's readiness to face childbirth is by providing Family Centered Maternity Care (FCMC) education through Mobile Applications.

Objective: This study aims to develop and test the FCMC mobile application's effectiveness to help pregnant women's readiness with a high risk of childbirth.

Method: This study employed Research & Development consisting of 4 stages, namely Literature Study, Development Stage, Validity Expert, and Trial.

Results: FCMC Mobile application has been created with nine features, starting from pregnancy features to delivery preparation. The trial results showed that the application effectively increased pregnant women's readiness to face childbirth ($p < 0.001$).

Conclusion: The FCMC is a form of midwifery technology that makes it easier for health workers to educate pregnant mothers, especially mothers with high-risk pregnancies. By applying the apps, pregnant women can prepare for the process before childbirth in physical preparation, psychological preparation, financial preparation, cultural preparation, home preparation, and delivery preparation.

INTRODUCTION

A high-risk pregnancy is a pregnancy that will cause harm and complications to the mother and the fetus. It may cause pain, disability, and even death. Its incidence can be influenced by antenatal, intrapartum, obstetric, neonatal factors, general factors, and education. Other factors include genetics (heredity) and environment (education and socioeconomic) and high-risk factors for those who work in the periods of pregnancy, childbirth, or/and neonates¹.

High-risk pregnancies can affect the mother, partner, and family's physiological, psychological, social, and emotional conditions. This will result in more harm and complications to both the mother and her fetus. In turn, it may lead to death, illness, disability, discomfort, and dissatisfaction. One of the efforts to reduce anxiety and complications in

high-risk pregnant women can be realized through nursing interventions in health education. Pregnant women at high risk need education and information. This helps them to feel more ready and confident to go through. To fulfill their information needs, they usually ask others like parents, relatives, friends, or health workers. Nowadays, it is easy to get it from online sources. They can be accessed on websites, smartphone applications, magazines, and books. With easy access to the information they need, the mothers will increase their confidence to get along with their pregnancy².

The Indonesian government has developed various methods and programs to detect the complications of pregnancy and childbirth early. They include: monitoring closely the Maternal and Child Health (abbreviated in Indonesian as PWS KIA program), Maternal Grouping, Implementation of Maternity Planning Program (abbreviated

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in Indonesian as P4K), and distributing MCH Handbook. Unfortunately, they do not work very well. It is a simple and effective tool for information, education, and communication. According to the 2013 National Basic Health Research, 80.8% of mothers have had the book, but it is shown that only 40.4% of them can prove it. It means its ownership is still far below the standard service target, 100%³. Current technological advances allow everyone to maximize their smartphone's function with applications that facilitate information access for them⁴. Current technological advances allow everyone to maximize their smartphone's function with applications that facilitate information access for them. The Android Operating System, an open-source, can be used by developers to create a mobile application that can help pregnant women, especially those who have a high level of activity and are too busy to seek information about their pregnancy⁵.

FCCM (Family-Centered Maternity Care) can be modified using digital technology, namely using the Mobile FCCM model as a medium to help the preparedness of those with a high risk of childbirth. Direct educational methods have become commonplace for health workers. This will be more effective if the media support it like leaflets or other props. This conventional way sometimes creates a misunderstanding in the audience. Through the FCCM approach, the role of the family is recognized and valued for their involvement. The family is encouraged to recognize and build its strengths and make the best decisions in the care of high-risk pregnancy by creating a normal lifestyle⁶. FCCM appreciates the diversity of family structures, cultural backgrounds, preferences, strengths, weaknesses, and needs. Its implementation will make the families more independent and confident in taking care of mothers with a high-risk pregnancy⁷. The care prioritizes the support, participation, and choice of the family⁸.

A web-based application development research has been conducted to make a pregnancy risk detection tool as a recording and reporting system for midwives. It also tested the application⁹. There are many guide applications for pregnant women, but the information provided is still fragmented¹⁰. The new function introduced in the current study's application is its target users, which cover pregnant women and pregnant women's families. It contains information about pregnancy, high-risk pregnancies, and preparation for childbirth.

This study aims to make an application that makes it easier for users, especially high-risk pregnant women, to learn information and advice about pregnancy through a mobile application. This app is a means to obtain information and contains suggestion features, like the delivery preparation, the fetus development, the inconveniences of pregnancy, fulfillment of maternal and fetal nutrition, danger signs in pregnancy, and high-risk pregnancies calculating gestational age and preparation for childbirth. Those can

increase their users' knowledge about pregnancy and labor preparation. Thus, it is hoped that the apps can help the mothers in getting through their pregnancy.

METHOD

The development model used in the research consists of Literature Study, Development Stage, Validity Expert, and Trials¹¹.

Stage 1 Literature Study

The first stage is the initial stage of preparation for development by conducting a literature review in preparing material for the FCCM mobile application. The researchers collected material and reference sources for the application's contents, including FCCM, pregnancy, high-risk pregnancies, and labor preparation, which were then arranged in several sub-contents.

Stage II Application Development

At this stage, the researchers created features that are easy to understand and relevant to the mothers' needs with a high-risk pregnancy. In doing this, the team was assisted by an information system expert or application developer. The application development used software with Windows as the Operating System, Navicat Premium as RDBMS Server, and Google Chrome as a Web Browser Tool. The team arranged the images to fit the features and checked the material and images' placement on all the features.

Stage III Expert Validity

After the application was completed, experts in midwifery, the lecturers' midwives, midwives/practitioners, and information technology experts carried out a legibility test. Each expert assessed the application operation system, the suitability of content, display, and language. The team made observations and took note of the essential things, such as deficiencies, weaknesses, and mistakes. These were to determine the weaknesses and strengths of the application.

Stage IV Application Testing

The testing employed the pre and post design approach. The population was 40 mothers with a high-risk pregnancy and was divided into two groups. The first group has given an intervention by providing information media us the FCCM Mobile Application, while the second group was given leaflets. This was conducted in each respondent's house and the midwife clinics as they visited her. The variable assessed was their preparedness in anticipating childbirth. The instrument was a questionnaire with a structured statement. At this stage, monitoring of the mobile application use was carried out. It included the obstacles in accessing the application for four weeks by discussing the materials in each feature. The data analysis used

a paired t-test analysis. The research was conducted from January to July 2020 in the Independent Midwife Practice, Malang City.

RESULTS

Result of the Literature Review

Based on the FCMC mobile application literature review, pregnant women's assessment was done using the Poedji Rochyati Score Card to determine the high-risk score for pregnancy¹². Furthermore, the materials of high-risk pregnancy and preparation for childbirth are adapted to the needs of information during pregnancy, from the physical preparation, psychological preparation, financial preparation, cultural preparation, home preparation to maternity preparation, which refers to the books of Asuhan Kebidanan Persalinan dan Bayi Baru Lahir (Maternity Care for Childbirth and Newborns)^{13,14} and Buku Kesehatan Ibu dan Anak (Maternal and Child Health)¹⁵.

Result of Application Development

In the FCMC mobile application, there are nine features available. After downloading it, the main homepage of the application will appear (Figure 1). Furthermore, to access features, the user presses the 3-line mark in the right corner of the display, then the nine features will appear in the application (Figure 2). In feature 1 (Figure 3), users find material about pregnancy with sub-contents on Definition, Pregnancy Period, Signs and Symptoms, and Nutrition needed by pregnant women. Feature 2 (Figure 4) contains Fetal Development material divided into three sub-contents, including Fetal Development for 1-12 weeks, Fetal Development for 13-28 weeks, and Fetal Development for 29-40 weeks. To calculate the pregnancy risk score, the user can open feature 3 (Figure 5) containing the pregnancy score check. The user can calculate the pregnancy

score in this feature, including pregnancies with high risk or very high-risk pregnancies. Pregnant women can fill in the risk factors that the mother experienced and then add up the filled scores according to the instructions in the feature.

Feature 4 (Figure 6) contains High-Risk Pregnancy with sub-contents, including definition, factors that affect high-risk pregnancy, signs of high-risk pregnancy, how to handle, and how to prevent high-risk pregnancies. Feature 5 (Figure 7) contains Pregnancy Hazard Signs material discussed in each trimester in sub-content, namely in Trimester I (0-12 weeks), Trimester II (13-28 weeks), and Trimester III (29-42 weeks). Feature 6 (Figure 8) contains Discomforts during pregnancy and how to deal with it. This sub-content discusses discomfort in each semester, namely in the first trimester (0-12 weeks), second trimester (13-28 weeks), and third trimester (29-42 weeks).

Feature 7 (Figure 9) contains Preparation for Childbirth with 11 sub-contents including definition, physical preparation, psychological preparation, financial preparation, cultural preparation, preparation at home, preparation for delivery, essential lists, lists of maternal supplies, lists of baby supplies, and additional information. Feature 8 (Figure 10) contains the FCMC during pregnancy and the puerperium. Feature 9 (Figure 11) contains a pregnancy score check. In this feature, pregnant women only need to enter First Day of Last Menstruation (FDLM) to calculate the estimated gestational age of pregnant women at this time and the estimated delivery.

The application can be used in the android system by downloading its link at <http://bit.ly/sim-fcmchrg> or <http://www.mediafire.com/file/1u6xrftwtv55g8i/cimosoft.wvapps.sim.fcmchrg-dupmf.apk/file>.



Figure 1. Appearance and Home

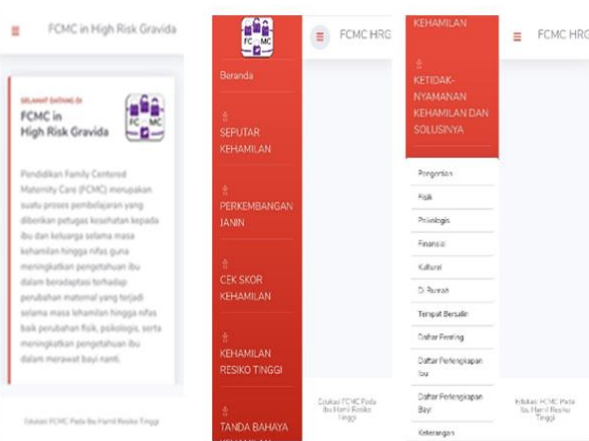


Figure 2. Menu Application

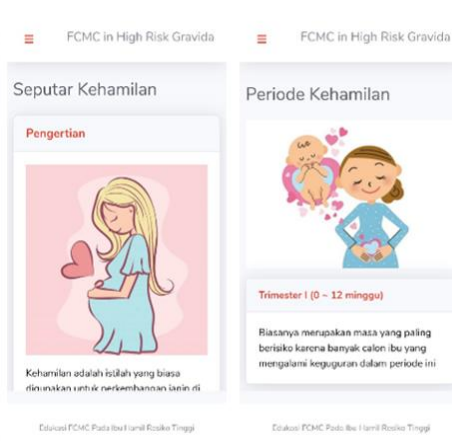


Figure 3. Feature 1 Pregnancy in General

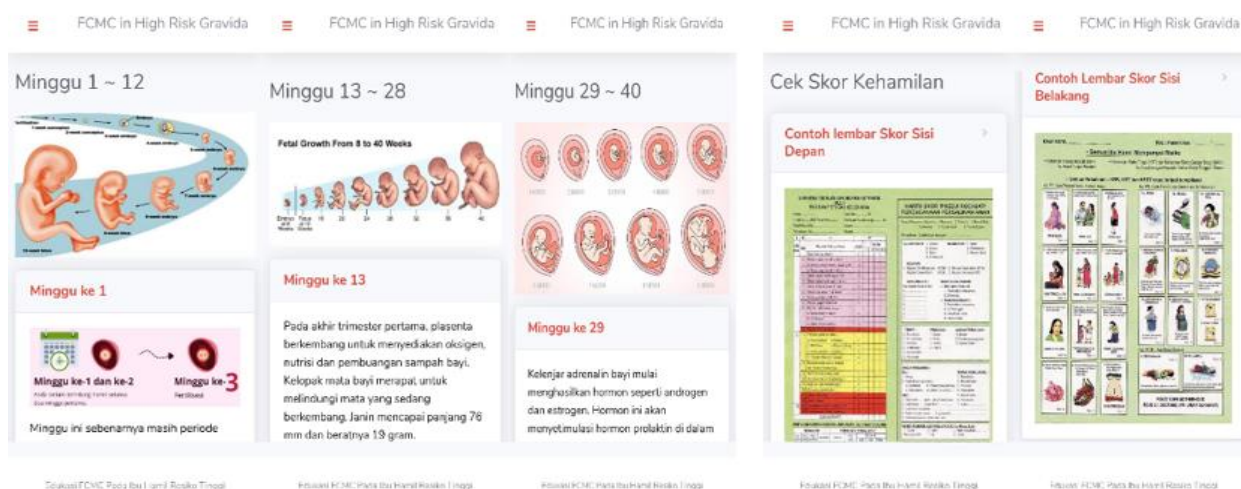


Figure 4. Feature 2 Fetus Development



Figure 5. Feature 3 Check Pregnancy Score

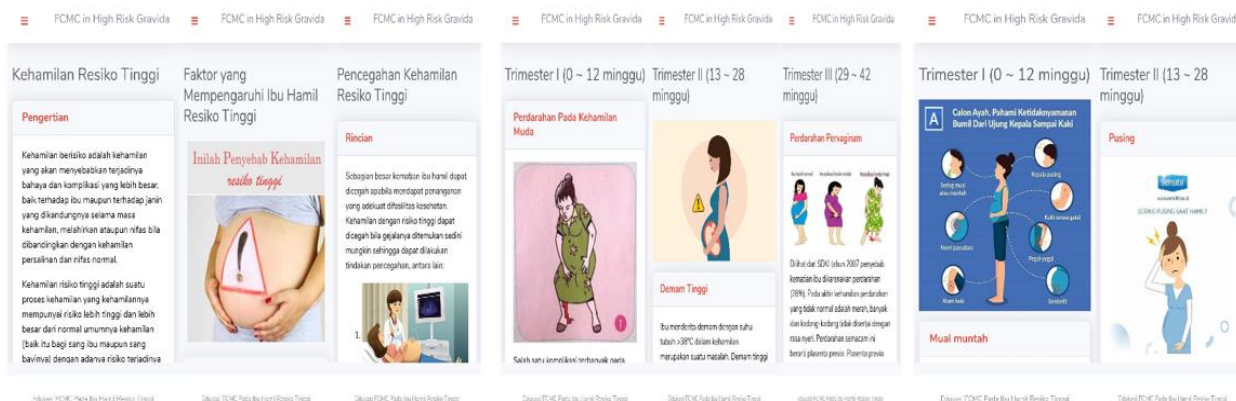


Figure 6. Feature 4 High-Risk Pregnancy

Figure 7. Feature 5 Alerts of Pregnancy

Figure 8. Feature 6 Pregnancy Discomfort

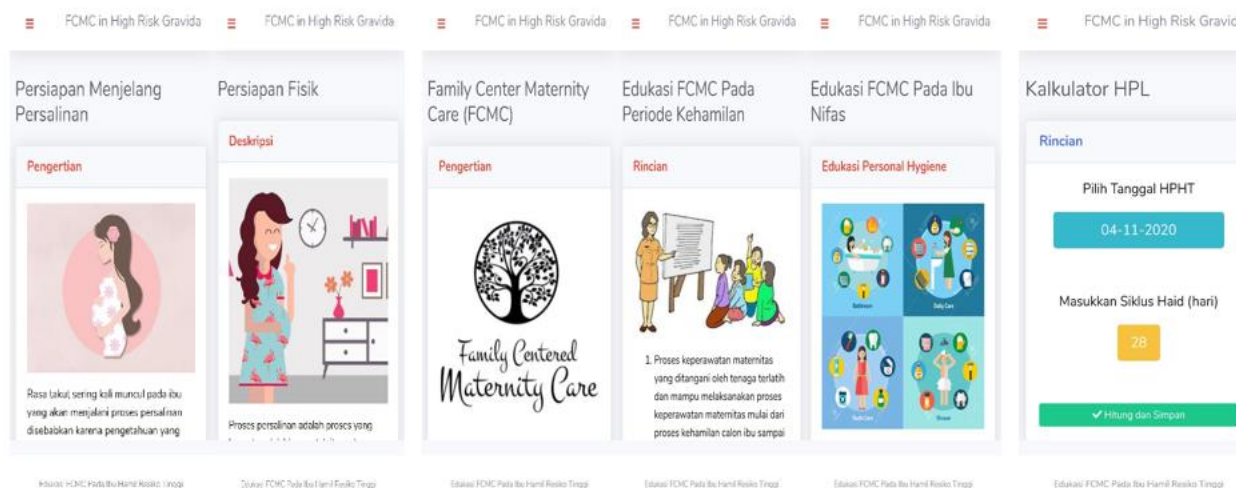


Figure 9. Feature 7 Childbirth Preparation

Figure 10. Feature 8 Family Centered Maternity Care (FCMC)

Figure 11. Feature 9 Calculator of Delivery Day

Results of Trial

The use of Mobile FCMC as an information media for high-risk pregnant women can increase their readiness in facing the delivery process for the treatment group compared to the control group using leaflet media. Table 1 showed that the p-value was 0.002 ($p < 0.001$), indicating that the application significantly affected changes in pregnant women's readiness level in facing childbirth. Based on the analysis, it is found out that the average increase in the experimental group is 10.52, while the increase in the control class is 4.24. The increase of pregnant women's readiness score to face childbirth in the treatment group is 6.28 more than the control group. The application is proved to be very useful in promoting their preparedness for childbirth (effect size d Cohen's > 0.8)¹⁶.

Table 1. Readiness in Facing Childbirth

Group	Mean	t	p-value	Effect size	
Experiment (Mobile Application group)	Pre	45.56	3.533	0.002	1.17
	Post	56.08			
Control (leaflet group)	Pre	44.80			
	Post	49.04			

DISCUSSION

The education model with the FCMC approach is one of the educational methods to increase knowledge for high-risk pregnant women by involving family as social support in early detection of problems in pregnancy to reduce morbidity and mortality in pregnant women¹⁷. Recommendations or interventions by families and medical staff through providing education through this application are expected to strengthen the mother's motivation to safely and comfortably have her pregnancy safely and comfortably¹⁸. A wrong direction will fail in achieving the goals expected by the family with the prevailing norms¹⁹.

The application contains information about pregnancy specifically for high-risk pregnancies. In the application feature, there is information on preparations that mothers need to prepare before childbirth, starting from physical preparation, psychological preparation, financial preparation, cultural preparation, preparation at home, and preparation for the delivery. By accessing this feature, mothers and their families are more ready to anticipate childbirth. The purpose of making this application using family-focused maternity nursing is to ensure the safe delivery of quality health services. It explores, focuses, and is adapted to the needs of mothers, babies, and families²⁰. The result supports other research in which there is a significant relationship between social support and labor readiness²¹, and there is a relationship between the husband's support and labor readiness²².

The results showed that the change in the average pretest-posttest score in the treatment group was 45.56 to 56.08, while in the control class, the change in score was 44.80 to 49.04 (Table 1). From these data, it is clear that the mean difference between the pretest and posttest results between the two groups. The effect size value is 86%, categorized as giving a significant effect. It means the application is very useful in increasing the readiness of high-risk pregnant women to face childbirth. The respondents think it is beneficial for both them and their families (husbands) to prepare for childbirth because it is detailed and easy to understand. They get guidance on labor preparation early so that preparation can be done in stages. Besides, it can be accessed at any time and is very easy to operate. This application also provides FCMC education during the puerperium. Postnatal education is the right choice for health workers to prepare postnatal mothers in adapting to carry out developmental tasks that will be carried out²³.

The most critical point of this application is to involve the role of the family as social support. The family can participate in providing care for any discomforts and inconveniences in pregnant women. It also provides essential information about further management or referral. The mother and her family can access and use a health service model to reduce complaints or problems encountered during pregnancy and prepare for delivery via a smartphone. The majority of women use mobile applications to get information about health during pregnancy. Information about childbirth is not given enough attention. Applications that contain postpartum information should be developed and available for free. The appearance of the application's content should be relevant and age-appropriate and provide users with the ability to link to a validated external website for more detailed information on a particular topic of interest. Given the high level of need for information about breastfeeding, mobile applications should provide practical simulations so that mothers can easily understand².

The systematic results on the impact of health information technology on the quality, efficiency, and cost of medical care conclude that health information technology can improve the quality and efficiency of health services²⁴. The use of the mobile application (ASIH) was also applied to research on pregnant women with three significant benefits, increasing midwife compliance with antenatal care standards (47.2%) and the satisfaction of mothers (43.8%). The proportion of antenatal care with good quality in the treatment group was 84% , and in the control group, 37%. Antenatal services that do not use ASIH risk midwife non-compliance with antenatal care standards of 3.93 times and dissatisfaction of pregnant women by 4.4 times. The quality of antenatal services is worse by 3.93 times compared to antenatal services using ASIH²⁵.

Health workers' efforts to provide education about pregnancy to prepare for delivery can be carried out using midwifery technology by developing a homecare-based technology education model²⁶. It makes it easier to provide education and can be easily accessed by the target. Currently, it is undeniable that technological developments have been speedy. The effectiveness of android smartphones, its multimedia capabilities, high portability, and local data storage can potentially help health workers by providing information about case management and decision support applications that impact improving their service quality²⁷.

There are some limitations to this study. It only used a small number of samples because it only took the criteria for pregnant women with high-risk pregnancies. Another point is the measurement of labor readiness using a questionnaire; sometimes, the answers given do not reflect the real situation. This study used mobile applications that require an internet quota to access this application. This application needs development to make it better and easier to access because so far, the application can only be accessed via a web browser by writing an application link. It has not been available on the Play Store. The users who want to access it will need link information.

CONCLUSIONS AND RECOMMENDATION

The FCMC Mobile Application is a form of midwifery technology that makes it easier for health workers to provide education about pregnancy, especially for mothers with high-risk pregnancies. In this application, pregnant women will obtain education regarding their complaints during pregnancy to the preparations to do for childbirth. Applying these apps is guided in the preparation, covering physical preparation, psychological preparation, financial preparation, cultural preparation, home preparation, and delivery preparation. An essential thing in this application is to involve the role of the family as social support. The family is encouraged to participate in providing care for solving the complaints felt by pregnant women. This application also provides essential information if mothers need further management or referral.

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