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Design and Development of the Midwifery Emergency Guidelines Application in the Islands (Si-PK3) as an Alternative Management Guide Maternal Emergency for Midwives in the Archipelago Region

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A B S T R A C T

The success of maternal health programs is assessed through the main indicator Maternal Mortality Rate (MMR). Emergency treatment during the birthing process can determine the survival of the mother and baby. Currently, the referral system that has been regulated by the government at various levels cannot be implemented properly because it is hampered by geographical areas and facilities and infrastructure in the area. The referral flow via land and sea is a typical archipelagic referral flow. Therefore, technological innovation is needed that can support technical implementation in the field. The technological innovation developed in this research is an Android application called the Midwifery Emergency Guidelines Application in the Islands (si-PK3). This research aims to develop si-PK3 as a guide for midwives in handling maternal emergencies in island areas. This type of research is Research and Development (R&D) research. The results of the material expert trial obtained a score of 88.57% and for IT experts a score of 81.25% was obtained. The results of the analysis of the dimensions of respondent satisfaction with the PK3 application showed that in general, respondent satisfaction was in the very satisfied category (92.3%). This research produced a product in the form of an application for the Midwifery Emergency Guidelines in the Islands (Si-PK3)

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INTRODUCTION

The success of maternal health programs is assessed through the main indicator Maternal Mortality Rate (MMR). This indicator also assesses the level of public health, because of its sensitivity to improving health services, both in terms of accessibility and quality1. Various efforts have been made to suppress MMR. The government and society are responsible for ensuring that every mother has access to quality health services2. Handling obstetric complications is an important aspect of maternal health service efforts. In this case, emergency treatment during the birthing process can determine the survival of the mother and baby. Prevention of complications and emergency management of mothers and babies is sought through delivery in health facilities. Analysis of maternal deaths carried out in 2012 proved that maternal deaths were closely related to birth attendants and birth facilities2,3.

Any intervention to improve access to health services requires consideration of many aspects, including strengthening the referral system. Each health service facility in the district/city is expected to create a mapping of the referral flow for health services that is adjusted to the level of capacity of the health facility, the existence of a transportation network, and the geographical conditions of the area. Ensuring the implementation of effective referrals in cases of complications is one of the main programs in the action plan to accelerate the reduction of MMR. In general, there was a reduction in maternal deaths during the 1991-2015 period from 390 to 305 per 100,000 births, but this did not reach the target. The target of reducing MMR will be difficult to achieve if appropriate intervention is not provided. Currently, the referral system that has been regulated by the government at various levels cannot be implemented properly because it is hampered by geographical areas and facilities and infrastructure in the area2,4.

One effort to reduce the MMR is to have health workers who are competent in managing emergencies with all the obstacles and challenges in the islands. The referral flow via land and sea is a typical archipelagic referral flow. The condition of emergency patients also adds to the complexity of referrals. Therefore, a technological innovation is needed that can support the technical implementation in the field of this vision. The technological innovation developed in this research is an Android application called the Midwifery Emergency Guidelines Application in the Islands (si-PK3). Si-PK3 is designed to assist midwives in managing obstetric emergencies. This research aims to develop si-PK3 as a guide for midwives in handling maternal emergencies in island areas.

LITERATURE REVIEW

Obstetric emergencies are life-threatening health conditions that occur in pregnancy or during and after labor and birth. There are many diseases and disorders in pregnancy that threaten the safety of the mother and baby. Maternal emergencies can occur at any time during pregnancy, childbirth or the postpartum period5.

In general, there are various cases that fall into the category of maternal emergencies during stages I - IV of labor and the clinical manifestations of these emergency cases vary over a fairly wide range. Maternal emergencies during the I-IV stages of labor include cases that often or may occur, namely: amniotic fluid embolism, shoulder dystocia, birth with abnormal position (breech), prolonged labor, preeclampsia, uterine atony, retained placenta, birth canal tear, post partum hemorrhage (primary), and obstetric shock5.

Some of the management of emergency cases that often occur during labor are described as follows 5:

1. Breech delivery

When entering the delivery room, it is necessary to quickly and carefully assess the condition of the amniotic membranes, the phase of labor, the condition of the fetus and the general condition of the mother; make careful observations on the FHR and quality of his delivery and progress of labor; preparation of birth attendants and assistants; spontaneous vaginal delivery (Bracht).

2. Uterine Atony

Management of uterine atony is carried out with Active Management Stage III. Mothers who experience this type of post-partum hemorrhage are treated with:

a. Giving oxytocin injections

b. Umbilical Cord Stretching

c. Removing the Placenta :

1) If the umbilical cord is getting longer but has not yet been born, bring the clamp ± 5-10 cm from the vulva.
2) If the placenta has not separated, within 15 minutes do a repeat injection of 10 IU oxytocin IM, check the bladder, wait 15 minutes, if it has not yet been delivered, do manual placental procedures.

d. Uterine Massage

1) Immediately after the placenta is born, massage the fundus of the uterus by rubbing the fundus in circles using the palmar part of the left hand for 4 hours until the uterus contracts well.

2) Check for possible postpartum bleeding, completeness of the placenta and amniotic fluid, uterine contractions, and birth canal injuries.

3. Uterine Rupture.

Management of uterine rupture is done with manual placenta and expulsion of placental contents.

4. Torn birth canal.

Treatment of tears depends on the extent of the tear. Grade I perineal tear: with catgut or figure of eight sutures. Grade II perineal tear: If you find the edge of the tear is uneven or jagged, it must be smoothed first. The left and right edges of the tear are clamped with clamps and then cut. The muscles are sutured with catgut,

the vaginal mucous membrane with catgut intermittently. The suture of the vaginal mucosa starts from the top of the tear, until the perineal skin is sutured with catgut thread in a long line. Grade III-IV perineal tears are under the doctor's authority.

Maternal emergencies can be handled from basic to comprehensive services. Basic Neonatal Emergency Obstetric Services (PONED) is an inpatient health center that is capable of providing emergency or complication obstetric and neonatal services. In the event that the Community Health Center which functions as an intermediate referral center is unable to provide medical referral services for obstetric and neonatal cases, the patient must be referred to a referral hospital (PONEK) which is stabilized first by the PONED Community Health Center. A 24-hour PONEK hospital is a hospital that provides comprehensive and integrated maternal and neonatal emergency services. 24-hour PONEK hospitals have staff with the capability and adequate supporting facilities and infrastructure to provide basic and comprehensive obstetric and neonatal emergency aid services6. PONEK referral hospitals must be accessible to the public in less than one hour, so they can provide emergency measures according to standards.

Referral is the transfer of responsibility from one health service to another health service. The health service referral system is the implementation of health services that regulates the reciprocal delegation of duties and responsibilities for health services, both vertically and horizontally, which must be implemented by participants in health insurance or social health insurance, and all health facilities. Individual health services consist of 3 (three) levels, namely 7: 1. First level health services; 2. Second level health services; and 3. Third level health services.

The flow of referrals by land and sea is a characteristic of the archipelago. A process that requires the readiness of an ambulance, complete equipment, companions, and medicines to support the patient's journey to the referral hospital safely. Regional Government has a very important role in supporting health services. To improve referral services, the Lingga Regency Government, Riau Islands has issued policy efforts to improve the referral system. The policies issued by the government are from the demand side (treatment costs) and the supply side (systems that support health services) 8. The results of an evaluation conducted by Zaenab (2012) on the referral system in the Riau Islands stated that the problems and challenges of Community Health Centers and Regional Hospitals in supporting the maternal referral system were limited resources (facilities and equipment), lack of team collaboration between referral levels, incomplete referral SOPs, weak information system and by-pass referral flow9.
To overcome the limitations of the referral system in island areas, technological innovation is needed to guide midwives in managing maternal emergencies. The technology that is popularly used today is smartphones with Android OS.

Android is a Linux-based mobile device operating system that includes an operating system, middleware and applications. Android is an open platform that allows developers to create their applications10. The advantages of Android applications include:

1. Speed factor

Application efficiency in providing data precisely according to user wishes. Mobile applications are made simple for specific needs and not as complex as applications for PCs, so that midwives can easily and quickly access the data they need.

2. Productivity aspect

The variety of applications marketed makes it easier for users to overcome daily problems, including health problems faced by midwives in their service activities.

3. Design creativity

The design offered is user friendly. Developers also make various user adjustments based on age, education and class so that users have more freedom in carrying out mobile activities. This makes it easier for developers to create applications that can be adapted to the characteristics of midwives.

4. Flexibility and reliability

Each application is only intended for specific purposes. This specification supports the uniqueness of the si-PK3 application which is designed specifically for midwives in the islands.

METHODOLOGY

The research stages are depicted in the following scheme:

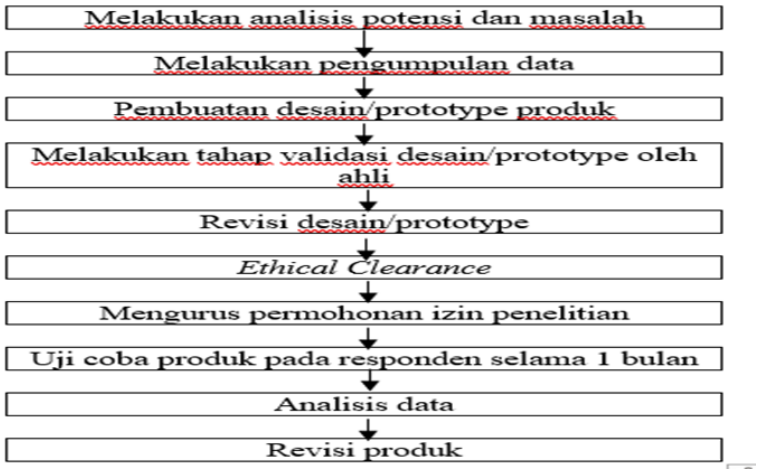


Figure 1. Research Flow Chart

This type of research is Research and Development (R&D) research. R&D research is a research method to discover, develop, improve and produce products, then test them until a standardized product is produced12.

The following is a description of the procedural steps that will be carried out:

1. Potential and Problems

At this stage the researcher carried out an analysis by collecting information about existing potential, namely the availability of guidelines for managing

obstetric emergency cases and the media used to present these guidelines. This potential can be used to guide midwives in managing emergency cases correctly and improve the performance of midwives in services. Apart from that, an analysis of problems related to the emergency management guidelines was also carried out. Regarding the potential for technological development, information was collected regarding the use of smartphones with Android OS by midwives as a means of daily communication as well as problems in using this technology in island areas.

2. Data Collection

Data collection was carried out using structured interviews with midwives working on the island to obtain precise and appropriate data as a basis for designing and building applications that are practical, flexible and according to needs.

3. Product Design

Product design is the final result of a series of initial research in the form of a prototype. The design is also made based on an assessment of existing products, so that weaknesses in the system can be found.

4. Validate Product Design

In this step, an assessment will be carried out on the product design in the form of a prototype by inviting experienced experts to assess, both substance/material experts and media experts.

5. Revision of Product Design

Weaknesses found during discussions with experts or experts will be reduced by improving the prototype.

6. Product Trial

In this step, trials are carried out on experts and respondents. Experts assess products using the ISO/IEC 9126 questionnaire. The characteristics of application quality assessment in ISO/IEC 9126 consist of the items: functionality, reliability, usability, efficiency, maintainability and portability. The product trials on respondents were carried out by comparing the conditions before and after using the product.

7. Product Revision

If the results of the product trial still reveal things that need to be improved, then revisions will be made.

The research design for product trials was carried out using quasi-experimental design with a one-group posttest-only design. Testing begins by providing the PK3 application for midwives to use for one month. After one month, respondents were given a questionnaire about the PK3 application, to assess several dimensions such as tangible, reliability, responsiveness, assurance, and empathy13.

The population in this study are all midwives who actively practice at Community Health Centers and Independent Midwife Practices (PMB) in

Tanjungpinang City, Riau Islands Province. Meanwhile, the research sample was midwives who met the following inclusion criteria:
1. Willing to be a respondent and cooperative
2. Active as a midwife who provides services both independently and as a Community Health Center midwife in Riau Islands Province
3. Have practiced as a midwife for at least 1 year
4. Have and be able to use an Android smartphone
5. The Android smartphone used is at least version 5
Drop Out: Respondents do not use all the features provided in the application.

RESULTS

The following is a description of the results of the research that has been carried out:
1. Potential and Problems
At this stage the researcher carried out an analysis by collecting information about existing potential, namely the availability of guidelines for managing obstetric emergency cases and the media used to present these guidelines. This potential can be used to guide midwives in managing emergency cases correctly and improve the performance of midwives in services. Apart from that, an analysis of problems related to the emergency management guidelines was also carried out. At this stage the problem was discovered that there were no SOPs or guidelines that midwives could use in the Riau Islands Province. Regarding the potential for technological development, information was collected regarding the use of smartphones with Android OS by midwives as a means of daily communication as well as problems in using this technology in island areas. The main problem related to smartphone use in island areas is the difficulty in getting a signal. In other words, the main problem is related to inadequate infrastructure. Apart from that, a literature study was carried out to collect data regarding the Maternal Mortality Rate in the Riau Islands province (Kepri) as well as material regarding maternal emergencies.
2. Data Collection
Data collection was carried out using structured interviews with midwives working in the Riau Islands to obtain precise and appropriate data as a basis for designing and building applications that are practical, flexible and according to needs. At this stage, Focus Group Discussion activities were carried out with midwives, both those who practice independently and at Community Health Centers, regarding the need for application of midwifery emergency guidelines.
3. Product Design
Product design is the final result of a series of initial research in the form of a prototype. The design is also made based on an assessment of existing products, so that weaknesses in the system can be found. At this stage, a prototype design is prepared in the Canva application to be discussed with the IT team.

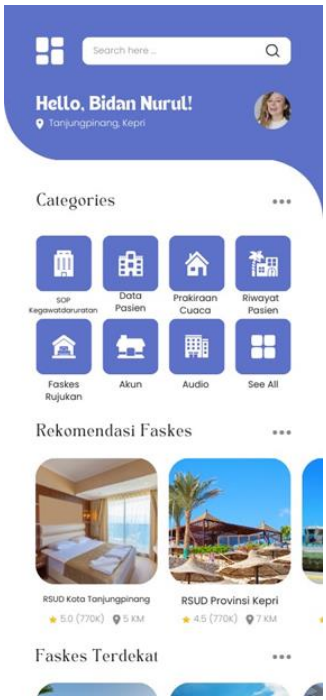


Figure 2. Prototype Drawing

4. Validate Product Design

In this step, an assessment is carried out on the application product design in the form of app-release.apk by inviting experienced experts to assess, namely midwives who assess the substance of the material and programmers/IT who assess the programming and UI/UX aspects. Validation was carried out through discussions between the research team and experts.

5. Revision of Product Design

Weaknesses found when discussing with experts or experts will be reduced by improving the application. The following are the menus contained in the PK3 application after being revised based on expert input:

- App download view

Figure 2. App Download View

- Home page display

Figure 3. Home Page Display

- Display registration page

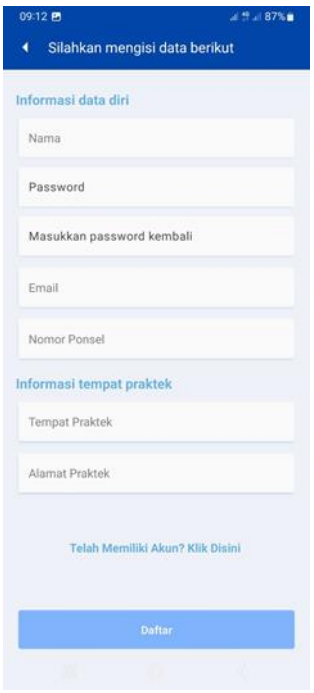


Figure 4. Display registration page

- Home page display after logging in

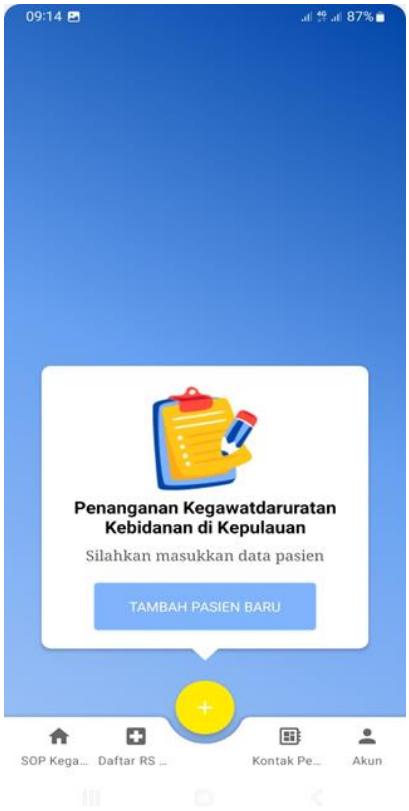


Figure 5. Home Page Display After Logging in

There are 5 menus on the home page, namely the Emergency SOP menu which contains a preview of materials that can be studied by midwives, a referral hospital list menu, a patient data entry menu, a developer contact menu so that users can communicate with developers regarding applications and a user account menu that can be personalized as desired. user.

- Emergency SOP Menu Display

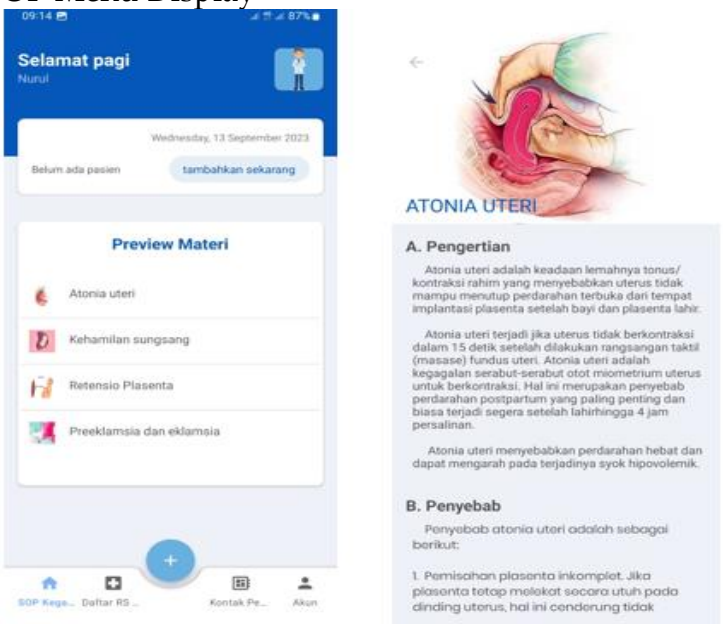


Figure 6. Emergency SOP Menu Display

- Referral hospital list menu display

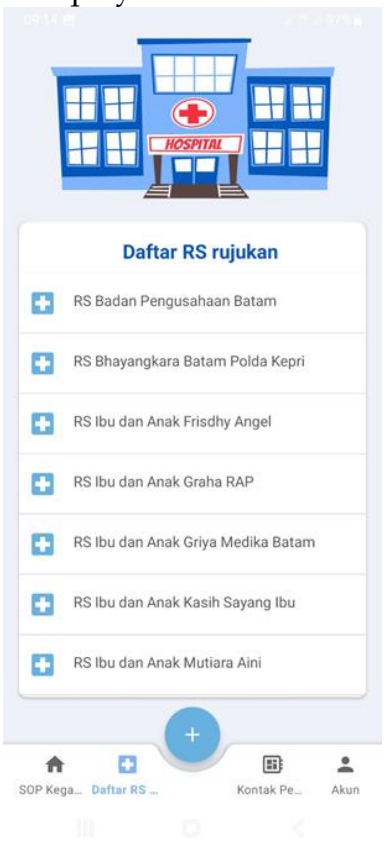


Figure 7. Referral Hospital List Menu Display

In this menu there is a list of referral hospitals in the Riau Islands, containing the addresses and telephone numbers of the hospitals.

- Developer contact menu display

Figure 8. Developer Contact Menu Display

- Account menu display

Figure 9. Account Menu Display

The image above is a user account display that can be adjusted according to user needs.

- Account display adds patient menu

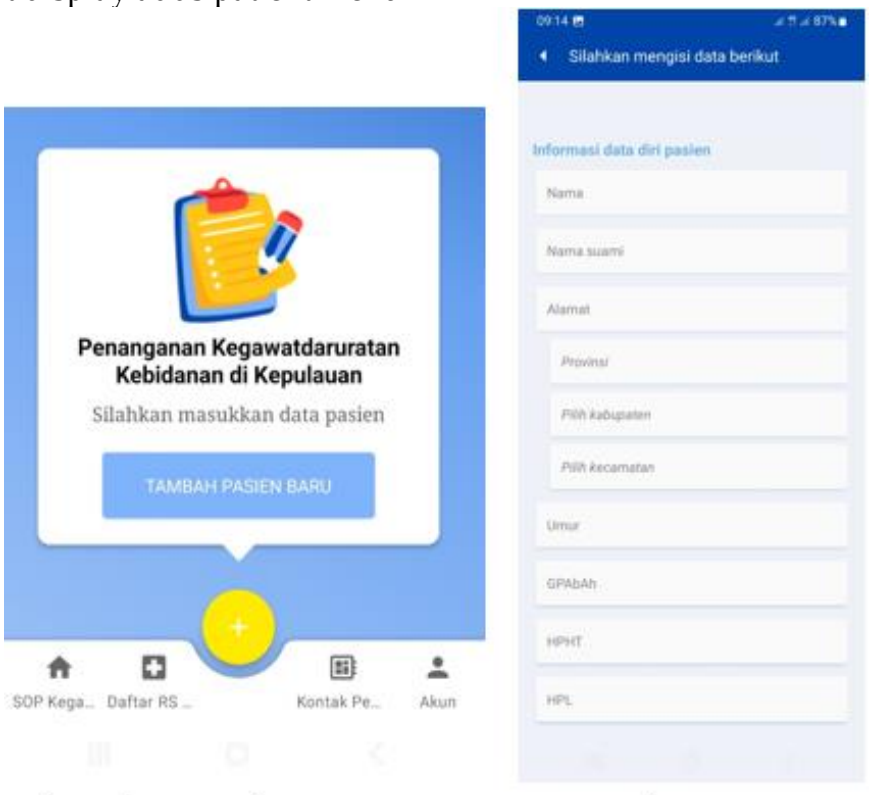


Figure 10. Account Display Adds Patient Menu

- Display of maternal emergency management flow

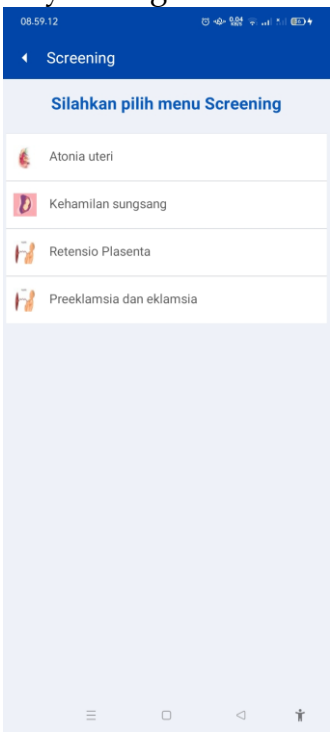


Figure 11. Display of Maternal Emergency Management Flow

After entering patient data, the user is directed to select the screening menu for one of the emergencies.

Figure 12. Screening Menu for One of the Emergencies

There is a short description if the user is not sure which emergency menu to choose.

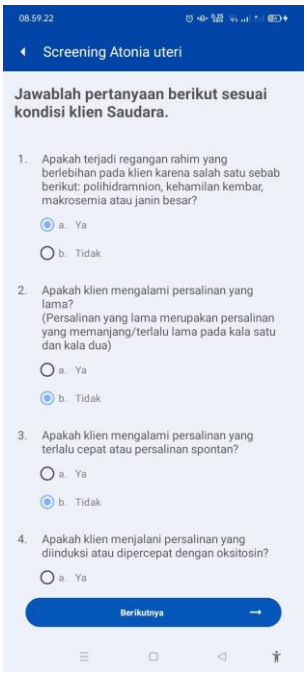
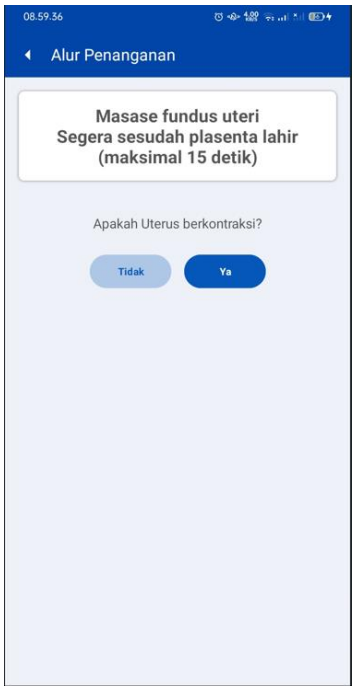
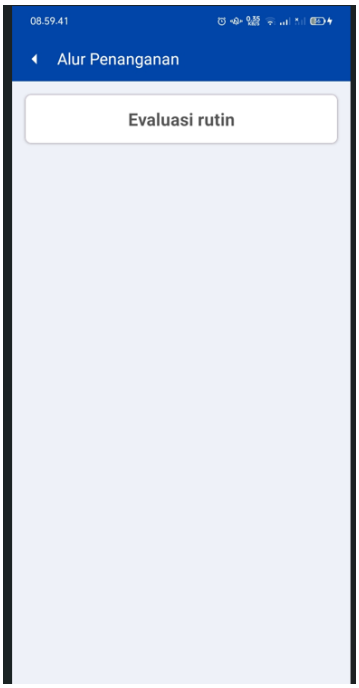
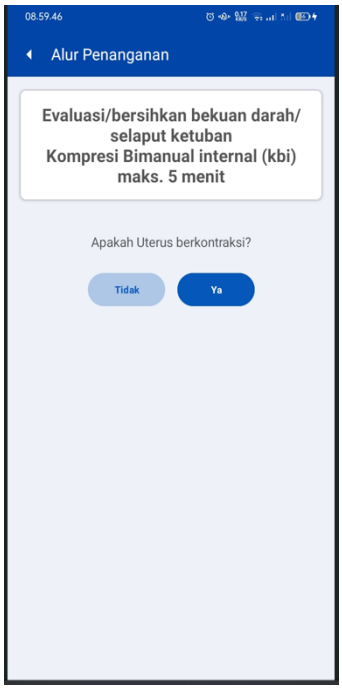


Figure 13. Emergency Menu to Choose

If the patient's condition has the risk factors in question, the user will be directed to the diagnosis form. If a patient is found diagnosed according to the emergency in question, the user will be directed to the patient management flow as follows:







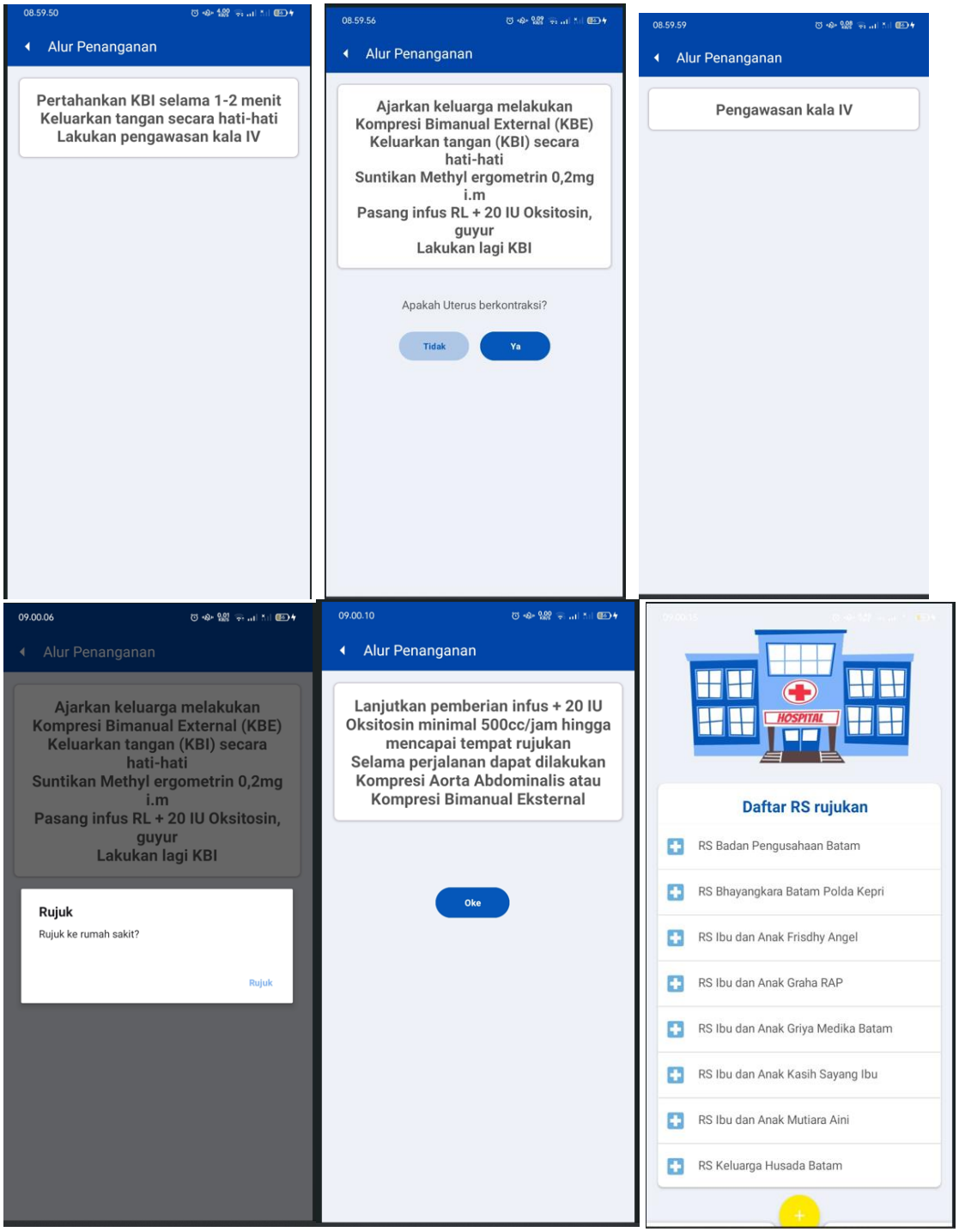


Figure 14. Patient Management Flow

When the patient is referred, the user will be directed to the referral RS register menu.

6. Product Trial

In this step, trials are carried out on experts and respondents. Experts assess products using the ISO/IEC 9126 questionnaire. The characteristics of application quality assessment in ISO/IEC 9126 consist of the items: functionality, reliability, usability, efficiency, maintainability and portability. The product trial on respondents is carried out by comparing the conditions before and after using the product through a satisfaction questionnaire which

respondents will fill out after using the application for one month, namely from September to October 2023. The application has also been given to IT experts to be assessed using the ISO/October questionnaire. IEC 9126.
The results of the material expert trials obtained a score of 88.57%, which means it is very feasible, and the results of the trials with IT experts obtained a score of 81.25%, which means it is very feasible. Midwife respondents were tested by assessing the dimensions of application satisfaction. The results of the analysis of the dimensions of respondents' satisfaction with the PK3 application showed that each dimension of satisfaction was in the very satisfied category, with the following details: tangible dimension 91%; reliability 91.3%; responsiveness 92%; assurance 88.3%; and empathy 86.0%. In general, respondent satisfaction was in the very satisfied category (92.3%).
7. Product Revision
Revisions were made with necessary improvements to several menus that experienced errors when clicked by respondents.

DISCUSSION

Experts and all respondents used all available application features during the R and D research. The features available in the application are designed in such a way as to meet the needs of respondents. The results of the material expert trials obtained a score of 88%, which means it is very feasible, and the results of the trials with IT experts obtained a score of 85%, which means it is very feasible. It can be concluded that in terms of material, the PK3 application is in accordance with the needs of midwives in handling emergencies for women giving birth. Meanwhile, in terms of media, the ePoK application has met the quality aspects of functionality, reliability, usability, efficiency, maintainability and portability so that it is suitable to continue with the next research process.

The trial of midwife respondents was carried out by assessing the dimensions of application satisfaction. Overall, the respondent satisfaction category with this application is at the very satisfied level with a percentage of 92.3%. This means that the PK3 application is considered safe and easy to use, has an attractive and simple appearance, is very useful, and suits user needs and current conditions. Based on the results of the questionnaire, respondents were interested in using this application because it was easy to understand and use, and provided complete guidance. Midwives can follow the stages of handling emergency cases, starting from screening to referring to health facilities appropriate to their domicile.

Changes in social conditions that occurred in the midst of the COVID-19 pandemic have also caused major changes in the use of digital technology. Indonesia has potential in developing digital health technology (eHealth). This technology is expected to make it easier for people to gain access to health more easily14. The increasingly rapid development of technology has made most people choose media that is simple, attractive, practical and can be accessed anytime and anywhere15,16. The PK3 application is an Android-based application which is intended to help build a "digital ecosystem" in the health sector, especially for midwives to help reduce maternal mortality. The PK3

application is also designed to approach real conditions of emergency services to make it easier for cadres to use.

CONCLUSIONS AND RECOMMENDATIONS

The conclusion of this research is that this research produces a product in the form of an application for the Midwifery Emergency Guidelines in the Islands (Si-PK3). This application can be a guide for midwives in handling maternal emergencies that occur, especially in island areas.

FURTHER STUDY

In the future, the PK3 application will be equipped with neonatal emergency cases as well as a weather forecast menu and can be connected directly with referral hospital contacts, so this PK3 application will be online/cloud based.

ACKNOWLEDGMENT

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