APPLICATION OF CALM PREGNANCY BASED ON ARTIFICIAL INTELLIGENCE AS AN EARLY ANXIETY DETECTION AND RECOMMENDATIONS FOR PREGNANT WOMEN

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ABSTRACT

This research aims to develop and test the Calm Pregnant application for early detection and recommendations for anxiety. The method used in this research uses two stages. The first stage is research and development (R&D), which aims to develop products whose quality will be tested. The trial results show that the Calm Pregnancy Application is relevant as a medium in speeding up early detection of anxiety by a difference of 172.65 seconds, speeding up the provision of recommendations to pregnant women by a difference of 250.79 seconds, and being able to get feedback from midwives directly. The Calm Pregnancy application has been proven to be effective for use by pregnant women, with an effectiveness rate of 90.5% (very high). The conclusion resulted in a product in the form of the Calm Pregnancy media application, which was proven to be effective in carrying out early detection and providing recommendations to pregnant women, as well as the Calm Pregnancy application, which has advanced features based on artificial intelligence. The difference in speed of time and provision of recommendations in early detection of anxiety is statistically significant.

Keywords: Early Detection, Human in the Loop, Anxiety

INTRODUCTION

Pregnancy, postpartum and childbirth are physiological things, but in the process pregnant women also face physical and psychological changes. Hormonal changes in pregnant women also often cause body and mind to become unstable, making pregnant women more easily panicked and anxious, irritable, more sensitive, irritable, irrational. During pregnancy there are significant changes that can contribute to increased anxiety (Harahap, 2018; Aghnia, 2019).

The prevalence of anxiety disorders in pregnant women in the world, especially in Portugal (18.2%), Sweden (24%), Bangladesh (29%), Hong Kong (54%), and in Pakistan (70%). The prevalence of anxiety according to WHO of 280 women in ASEAN in the third trimester found 193 (68.9%) women experiencing anxiety while in Indonesia out of 162 women there were 97 (59.8%) women who were found to experience anxiety (Aghnia, 2018; *The Authorss Journal Compilationn [a] RCOG*, 2015).

The prevalence of anxiety in a study in Indonesia in pregnant women was as much as (60.6%) experienced mild to moderate anxiety, and up to (33.3%) experienced severe anxiety. 4 Anxiety data in West Java, namely as many as 27% of pregnant women experienced anxiety before delivery, data from the Preliminary Study in Tasikmalaya City were (36.7%) pregnant women experiencing mild anxiety, and (68.3%) experiencing moderate anxiety (Durankuş & Aksu, 2020).

The prevalence of anxiety is high, but the level of treatment for anxiety is still low. Early detection is the best way to identify anxiety. With routine and standardized early detection in community-based services at health facilities, disease identification will be faster. As well as recommendations for interventions that are appropriate according to the level of anxiety experienced by pregnant women (Kingston et al., 2017; Simamora, 2017).

According to the National Health Service (NHS) in England, the assessment of the psychological health of pregnant women in midwifery clinics is usually carried out using verbal and paper-based questionnaires. Almost all midwives (96%) carry out anxiety assessments using paper media. Thus the detection of anxiety with a manual system both verbally and using paper media still does not help the success of early detection of anxiety in pregnant women (Doherty et al., 2018).

There are several obstacles in handling anxiety in pregnant women including the lack of health workers to recognize and often health workers lack confidence and are less trained in recognizing and providing appropriate care in efforts to deal with anxiety in pregnant women, anxiety detection is not included in routine pregnancy checks, and there are still few midwives who provide questionnaires for early detection of anxiety in pregnant women. Martínez-Borba et al., (2018) although there are still using manual filling methods both verbally and paper-based questionnaires. Lack of time, cost, geographic distance of health services and transportation to get to Health service place (NHS, 2015).

Another study is detecting anxiety in children aged 5-12 years with an Android-based application. The level of anxiety was assessed using the Zung Self Rating Anxiety Scale (SAS) questionnaire (Prasetyo et al., 2018). However, in previousearch there was no comprehensive application that pregnant women need at this time, an appropriate design is needed for early detection of anxiety in pregnant women along with the completion of appropriate recommendations for pregnant women so that increase the potential for greater understanding and management of anxiety in pregnant women and support available to pregnant women who need it (Doherty et al., 2018). In the world of health, the application of Artificial Intelligence can overcome various obstacles that arise in the health service system, be able to share the latest information in preparing future health care guidelines (National Academy of Medicine., 2022).

Therefore researchers need to make an Android application based on Artificial Intelligence which can make it easier for pregnant women to detect anxiety early on and get recommendations from experts or midwives. in pregnant women. This study aims to develop and test the Calm Pregnancy application for early detection and recommendation of anxiety. This research is important because this android-based application is a fast and accurate application and the use of information systems in this study has important potential for remote detection, providing care according to the level of anxiety, being able to monitor maternal anxiety during pregnancy, expanding the range of care in underprivileged populations. served, enabling timely recommendations and interventions, reducing the error rate in diagnosing. The use of information systems can be used easily so as to allow minimal use of human resources (Budiyati et al., 2022; PROSA-HI., 2022; Martínez-Borba et al., 2018; NHS, 2015).

RESEARCH METHOD

This research went through two stages. The first stage is research and development or Research and Development (R&D) which aims to develop products that will be tested for quality. The second stage is the testing phase of the tool with a field trial design using the Quasy Experimental method with a posttest only Non-equivalent Control Group Design design. Of the ten steps of research and development of the Borg & Gall model above,

researchers limit the steps used in research which are in line with Emzir's opinion consisting of literature studies, application development stages, expert validation, and trials.

Stage 1 Literature Study

All this stage, the researcher conducted a literature study and collected information data by interciewing the department of health and maternal and child health section and midwives to obtain potential data and problems in the field as application materials.

Stage 2 Application Development

The results of the initial stages will be used to design a Calm Pregnancy application model, adjusted to the needs of the land then design an application using an Artificial Intelligence system. The specification requirements and model design are described in the form of a system design in the application shown in :
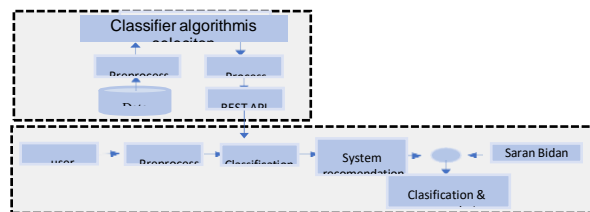
Stage 3 Expert Validity

Conduct expert validation tests to test the feasibility of the Calm Pregnancy application which is made before it is used by the public, especially by pregnant women. The finished design was then validated through expert judgment by 3 experts. Application testing is planned to be carried out by Hypnobitrhing experts, Maternal Mental Health psychologists and Information Technology (IT) experts. Data collection techniques by sending IT expert questionnaire measurement instruments with questionnaires.

The results of the validity test of the Calm Pregnancy Application obtained the Midwifery Lecturer validation results of 98.8%, hypno expert validation of 94.40%, Information and Technology (IT) media experts gave a validation score of 94.40% and Maternal Mental Health psychologists gave a validation score of 97.7%, the average value of the Calm Pregnancy Application feasibility test is 96.3% with a very high category. These results indicate that the application that has been built can be stated by experts as feasible for research trials. In addition to application validation that is assessed by experts, this application is calculated for the accuracy of the system as follows:

Table. 1
Early Detection System Accuracy

	Accurcy	Precision	Recall	Specificity	F1 Score
Score	100 %	100 %	100%	0 %	100%

Table. 2
Recommendation System Accuracy

	Accurcy	Precision	Recall	Specificity	F1 Score
Score	98 %	92 %	98%	5 %	97%

Stage 4 Application Testing

After the product is declared valid and feasible to be tested, the application can then be tested. The Calm Pregnancy application was carried out by product trials by 6 pregnant women outside the research sample to assess the effectiveness of the product before being used in the research sample. Products that have been declared effective are then tested using a Quasy Experimental design with a posttest only design with a non-equivalent control group. This study used two groups with a total of 34 respondents, namely 17 respondents per group including the treatment group and the control group where the assessment would be carried out after being given treatment and the results were compared without randomization.

RESULT

Result of The Literature Review

This application is designed to facilitate midwives and pa-tients in the early detection of Anxiety. The references in-cluded in this application are related to the early detection of anxiety application for children based on android, *Feasibility of perinatal Mood Screening and text messaging on patients personal smartphones, Anxiety Diagnosis Application Using Web-Based Forward Chaining Method with PHP and MYSQL, A mobile App for the Self-Report of Psychological well-Being during Pregnancy BrightSelf , The Effect Of Android Audio Visual Health Education On Anxiety.*

Results of Application Development

The Calm Pregnancy application has five available features. After downloading, user can face the intro (Figure 1) and then a login page will appear to enter the application (Figure 2). (Figure 3) is the initial registration menu for creating an account so that users can log in. Feature 1 (Figure 4) Home is the main menu which contains material about anxiety in pregnancy and in this Home feature pregnant women can see several other features contained in the Calm Pregnancy application. Then feature 2 (Figure 5) is an early detection feature of anxiety, pregnant women can carry out early detection of anxiety independently. This menu contains a questionnaire that can be filled in for early detection. After the pregnant woman has filled in all the questions, the screen will display the results of early detection along with recommendations from the midwife (Figure 5). Furthermore, feature 3 (Figure 6) is an audio relaxation feature for pregnant women to overcome anxiety in pregnancy. Feature 4 (Figure 7) is a chat feature among users of the Calm Pregnancy application so that fellow pregnant women can share and in this feature also pregnant women and in this feature pregnant women can connect with maternal mental health experts. Feature 5 (Figure 8) contains a Profile Page consisting of 4 menu tabs namely anxiety or anxiety status, history of recommendations, midwife advice and therapy sessions. Each tab has its own function, including the anxiety tab containing the anxiety history of pregnant women, the recommendations tab are recommendations issued by the application system, the midwife's suggestions tab is data from feedback or Human In The Loop from midwives.

Figure 1. Intro	**Figure 2.** Login	**Figure 3.** Registration	**Figure 4.** Home
Figure 5. Screening	**Figure 6.** Calm Me	**Figure 7.** Find Friends	**Figure 8.** Profil

Results of Trial

The trial result found that this application is more effective than the manual system. The trials include detection speed, diagnostic speed and recommendation speed, and the system's effectiveness. The test results found that the use of this application is more effective in terms of usability, speed, suitability, convenience, accuracy, and trustworthiness. In addition, this application has been proven faster in detecting, and diagnosing anxiety, and give recommendation than the manual system.

Differences in Detection and Recommendation Time

The information system for early detection of Anxiety using Android can automatically detect Anxiety based on the re-sults of the examinations in detail. Table 1 shows that all respondents in the intervention group detected Anxiety with an average examination time of 435.46 seconds. Mean-while, the control group (respondents who received a man-ual system inspection) with an average time required of 608.11 seconds. The results showed that respondents in the intervention group experienced a faster examination time than the manual system, which was 172.65 seconds faster. All respondents in the intervention group recommendation anxiety with an average duration of diagnosis of 444.46 seconds. Mean-while, in the manual group, the average time required of 695.25 seconds. The results showed that respondents in the intervention group experienced a faster examination time than the manual system, which was 250.79 seconds faster. Based on the interpretation of the data, it can be concluded that at the time of detection and recommendation, the intervention group was better than the manual group.

Table. 3
Detection Speed

Group	N	Mean (seconds)	Standar Deviasi	p-value
Intervention	34	435.46	25.809	0.001
Control	34	608.11	62.756	

Table. 4
Recommendation Speed

Group	N	Mean (Seconds)	Standar Deviasi	p-value
Intervention	34	444.46	25.809	0.000
Control	34	695.25	62.756	

Expert System Effectiveness

All respondents in the intervention group who used the Calm Pregnancy application were asked to fill out a questionnaire provided by the researcher. The questionnaire can be filled in after the respondent makes early detection of anxiety with the Calm Pregnancy application. This questionnaire aims to assess whether the Calm Pregnancy application is effective for use by pregnant women as an early detection and recommendation of anxiety. The results of the respondents' assessment of the Calm Pregnancy application can be seen in Table 4.10.
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Table 5.
Effectiveness of the Application System

No	Parameter	N	Persentase
1	Utility	34	91.4 %
2	Speed	34	90 %
3	Suitability	34	91.4 %
4	Convenience	34	88.6%
5	Accuracy	34	90%
6	Trust	34	91.4 %
	Average		90.5%

Based on Table 5, the highest score data on the effective-ness of information systems in terms of utility, suitability and Trust is (91.4%), while the lowest score in terms of convenience is (88.6 %). The average score of information system effectiveness is (90.5%) in terms of usability, speed, suitability, convenience, accuracy, and trust worthi-ness. So it can be concluded that the information system for early detection of Anxiety in pregnant women is very effective.

DISCUSSION

The features of this application are the feature of early detection of anxiety independently and features of early detection, recommendation anxiety, health articles, Audio Hypnobirthing, Features chatting with others mom, health consultations, and user biodata. The essence of this application is the menu for early detection of anxiety that can be done independentlyanxiety user. After the mother gets information from the application about her health condition, it is hoped that it can change her behavior to pay more attention to her

health. The user is looking at the menu for early detection of anxiety, which is expected to anxiety anxietyl screening when the mother has health problems related to behavioral factors.

This early detection can be done at home. There are also educational facilities in the form of health articles that mothers can use to find health information, especially about anxiety. If the early detection results are health problems, the mother can contact the midwife in charge the consultation menu. The menus in the application are designed in such a way as to make it easier for mothers to receive education and conduct examinations from a distance.

Expert test or feasibility testing is an activity to assess the model's design by presenting several experts such as IT experts, material experts, and health workers (specialist doctors and midwives). This is done so that the results are reliable. Currently, no application can be used to perform early detection of anxiety with diagnose, recommendation of anxiety and human in the loop. The existing application only provides health information related to anxiety and diagnose anxiety without recommendation anxiety and without human in the loop From expert advice (Ciesielski et al., 2015).

The Calm Pregnancy application can make it easier for midwives to carry out comprehensive midwifery care who are difficult to reach due to limited geographical distance, for pregnant women to connect directly with midwives to get advice or feedback related to their anxiety status and the next steps that pregnant women must take, to get relaxed to deal with their anxiety, especially in the field where not all Community Health Centre provide questionnaires to measure anxiety levels in pregnant women even though early detection of anxiety is needed by pregnant women to help reduce the long-term impact that can be felt to pregnant women. And then make it easy for pregnant women to share with other pregnant women regarding their pregnancy, sharing discomfort and make it easy for pregnant women to see developments in anxiety status, system recommendations and feedback history from midwives (Dayyana et al., 2017).

The statistical test results mean the speed of anxiety detection time in the intervention group (Calm Pregnancy application) is 435.32 seconds with a standard deviation of 25,219 and the mean value in the control group is 608.11 seconds with a standard deviation of 65,872. Based on these data, it can be interpreted that the time for early detection of anxiety using the Calm Pregnancy application is 172.79 seconds faster when compared to the manual system. The difference in early detection time using the Calm Pregnancy application was statistically significant. Timely and accurate early detection of anxiety can improve better outcomes compared to people who know their condition when they are already suffering from depression. This shows that early detection of anxiety is very important for pregnant women so that it is not too late and faster in handling it (Shrestha & Pun, 2018).

The Calm Pregnancy application is a system that is able to issue recommendations directly based on the results of the diagnosis. Development in providing recommendations is carried out based on previous journals and minimum service standards for pregnant women in conducting Antenatal Care (ANC) based on the Ministry of Health. The mean statistical test results in the intervention group (Calm Pregnancy application) were 444,46 seconds with a standard deviation of 25,809 and the mean value in the control group was 250.79 seconds better than the control group . The difference in the time of giving recommendations using the calm pregnancy application was statistically significant.

The output in the form of recommendations on the application is considered to make it easier for health workers, especially midwives, to provide proper care for pregnant women. In addition, the recommendations contained in the application can minimize errors by health workers in making a diagnosis. Simbolon stated in his research that the use of the system in the application to produce output in the form of recommendations is necessary so that the

results issued at this stage are consistent with the data and diagnoses of pregnant women inputted into the system. So as to produce an accurate recommendation system. The use of a recommendation system prevents errors in determining the actions to be taken and is more effective in making the right decisions (Simbolon et al., 2020; Ulfa, 2017).

The information system is a solution to the many problems that exist in health services, such as the lack of available resources, the length of the reporting process, the length of the administrativeprocess, the incompleteness of the existing data, the delay in establishing a diagnosis and providing treatment, the long distance to go to the health service, the high-cost transportation to health services (Maulida & Wahyuni, 2020).

CONCLUSIONS

An application for an early detection system for anxiety in pregnant women based on artificial intelligence has been made. This application can accurately detect anxiety along with anxiety recommendations. As a promotive effort going forward, this application will be socialized to pregnant women with cross-sector collaboration for early detection of anxiety independently.

SUGGESTIONS

With this application, it is hoped that it can be input into midwifery services as an alternative choice in speeding up detection and getting recommendations so as to minimize delays in treatment which is at 3x the risk of experiencing depression.

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