

Developing and Testing PREDHIS (Pregnant Dental Health Information System): A Self-Detection Tool for Oral Disease Risk Factors in Pregnant Women

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Abstract:- During pregnancy, gum sensitivity and the possibility of gum bleeding increases. The dental and oral examination program during pregnancy can be carried out in conjunction with the pregnancy check-up program schedule and suggests the use of the Pregnant Women's Healthy Dental Card (KASIH) for dental and oral disease risk assessment since early pregnancy which is then referred to the Dental Clinic. However, the implementation has not been maximized due to the lack of cooperation of the party in charge of health services, as well as the insignificant number of visits of pregnant women referred to the dental clinic from the MCH clinic due to the mother's perception of the need for a healthy oral cavity. This study aims to produce a detection tool application that is feasible according to experts and acceptable to pregnant women as a tool that is able to detect risk factors for oral and dental disease in pregnant women independently. This study was Research and Development with a sample of 15 pregnant women as a test sample for acceptance of the development model. the result is PREDHIS as self-detection tool which android-based mobile apps, said to be very feasible according to the assessment of information technology experts, dental health experts and maternal and child health experts, and has a good level of user acceptance in providing usefulness and convenience based on the assessment of pregnant women. Hence, this study shown that a system can be built, namely the PREDHIS which is able to detect risk factors for oral and dental disease in pregnant women independently which is feasible and acceptable according to needs assessment.

Keywords:- Dental and Oral Health; Pregnant Woman; Risk Factor; Detection Tool.

I. INTRODUCTION

There is no health condition without paying attention to oral health including periodontal tissue health, but oral health in Indonesia has not been the main focus while the real threat states that the rate of periodontal disease continues to increase with a prevalence of 74.1%. [1] The increase in oral and dental disease can basically be experienced by every individual and is influenced by several factors. Biological factors that causes oral diseases include the composition and flow of saliva [2], the thickness of biofilm on the tooth surface [3], the presence of a large number of cariogenic bacteria [4] and the lack of fluorine components in the teeth can be one of the risk factors for oral diseases [4], health care needs [5], previous history of oral diseases and genetic factors. Other risk factors include poverty, social status, education level, motivation and individual awareness in maintaining dental health [6].

Pregnant women are one of the groups vulnerable to dental diseases such as caries, gingivitis, and periodontitis due to hormonal changes that cause nausea and vomiting [7]. This risk is exacerbated by poor behaviour in maintaining oral hygiene during pregnancy [8]. In addition, gingivitis during pregnancy tends to get worse as the mother's gestational age increases [9]. Gingivitis in pregnant women increases the risk of premature birth and low birth weight. Prevention through regular dental care and control of risk factors is essential during pregnancy [10]. However, many pregnant women lack information about dental care during pregnancy, increasing the risk of oral health problems [11]. Basically, the key to preventing oral and dental diseases is to treat problematic teeth to prevent further damage and break the chain of bacterial development in the oral cavity, by controlling risk factors [10]. The risk factors for oral and dental disease for each individual can vary over time because there are several risk factors that can be corrected or changed to reduce the level of risk.

Risk level assessment as an effort to detect risk factors in early pregnancy has proven to be efficient in the prevention of oral diseases such as periodontal disease and dental caries. However, many pregnant women have not received information about their oral health and how to maintain it. This statement is evidenced by previous research which shows that many pregnant women experience oral health complaints due to lack of knowledge about how to maintain oral health during pregnancy[11]

Lack of exposure of pregnant women to dental health information, can increase the risk of dental and oral diseases. Therefore, it is necessary to develop a system that allows mothers to independently detect risk factors for oral and dental diseases that can be utilized as early as possible as a form of education and *early warning* that notifies the onset of an oral and dental disease.

Based on previous research, increasing knowledge of oral health care in pregnant women is significantly effective in preventing oral problems in pregnant women[12]. One of the prevention efforts that has been suggested by the Indonesian government is the use of a healthy dental card for pregnant women (KASIH), which is a card filled out by health workers to identify signs and symptoms of dental and oral diseases. but its implementation is not optimal. Previous research has examined the implementation of the early detection and education program for the prevention of dental disease in pregnant women, found that the obstacles reported by health workers include the lack of health workers implementing dental health education outside and inside the community health center building and the lack of motivation of pregnant women in conducting examinations. This is one of the obstacles reported from health care facilities, but has not explored information on the needs and constraints experienced by pregnant women so that the dental health prevention program is not implemented.

Currently, there is no development and alternative problem solving regarding the sustainability of the dental and oral health program for pregnant women, especially in prevention efforts through early detection because the existence of the KASIH Card has not been matched by supportive implementation management. However, other efforts can be made with the use of technology to deliver dental health information to pregnant women according to the needs of pregnant women. similar things about the use of technology in early detection efforts have been carried out in previous studies, namely the use of the KESTURI application as an increase in health education in early cancer detection which provides an increase in knowledge of up to 89.5% [13]. the implementation of appropriate early detection in the sense

that it is easy to understand, accept and according to user needs will have a positive impact on disease prevention behaviour. this corresponds to previous research on the importance of an early detection activity of a disease which is a prevention strategy and knowledge improvement. [14]

This study conducted an in-depth assessment and analysis in identifying constraints, needs and potential problem solving in the implementation of dental and oral health programs for pregnant women which include educational efforts and early detection based on the perceptions of those responsible for dental health services for pregnant women and the perceived needs of pregnant women. So that it can be the first step in developing strategies and educational program plans for preventing oral and dental diseases in pregnant women in the future.

II. METHODS

The method in the research to be carried out is the *Research and Development* method with 5 stages including: 1) data collection; 2) Model design; 3) Expert validation and revision; 4) Model trials and 5) product results[15]. At the model trial stage, researchers used a *pre-experimental one shotcase study* design[16].

This study was conducted with the aim of developing a dental health information system for pregnant women needed according to the assessment of information systems experts, experts in maternal and child health and oral health, then the development of this tool will be tested for acceptance with the *Technology Acceptance Model (TAM)* assessment. The targets in this study were pregnant women and those responsible for dental and oral health for the system trial assessment. The sampling used is purposive sampling technique so that the number of samples obtained is 15 people.

III. RESULT

The research results are divided into five stages, namely: information observation, product/model design, expert validation and revision, product/model testing, and product/model results. In the information observation stage, interviews were conducted related to promotive and preventive programs for oral and dental diseases in pregnant women. Interviews were conducted with the Head of the Subdivision of Health Services of the Pekalongan District Health Office, Head of Public Health Centre, Dentist, Midwife MCH coordinator and Dental and Oral Therapist. The conclusions from the respondents' answers are described as follows tabel 1.

Table 1 Results of Information Observation

Question	Answer Summary
What is the government's policy on oral health programs for pregnantwomen, especially at community health centres in Pekalongandistrict?	The oral health program for pregnant women conducted at the Community health center in the PekalonganDistrict Health Office working area has not been monitored as a priority program because there isno specific policy for the implementation of oral health services outside the building. Work program development is developed at each health centre.
How is the implementation of the KASIH card as a prevention of oral and dental disease among pregnant women at the Pekalongan District Health Office's health centres?	The use of the KASIH card can help prevent dental and oral diseases of pregnant women at the Pekalongan District Health Office's regional health centres but has not been implemented thoroughly due to various factors, namely there is no policy touse the KASIH card, unclear procedures for its use, and no special reporting for oral health of pregnantwomen. There needs to be co-operation between those in charge of policy, dental health workers, midwives and also awareness.
Are there any obstacles encountered in the field in an effort to provide oral health education and preventionof dental disease in pregnant?	There are barriers to oral health education for pregnant women, namely that the program is notyet a priority, the program will be implementedif there is cooperation between the health office and health care center.
What efforts have been made to raise awareness among pregnantwomen to prevent oral diseases?	Efforts have been made so far using leaflets or flyers from the dental clinic to be distributed topregnant women at the integrated health care center (maternal health program).
What is needed to improve the oral health care program for pregnantwomen at community health center in the Pekalongan district health officearea?	The oral health care program for pregnant women needs to be improved in theimplementation of education and monitoring with efforts to procure dental health workers, develop dental health program and develop existing program.
What dental diseases are often complained about or experienced bypregnant women, especially at Community health center in the Health Office working area and need prevention?	Dental and oral diseases that pregnant women oftencomplain about are loose teeth, tartar and bleeding gums.

Based on the interview results regarding the oral health service program for pregnant women in the Pekalongan District Health Office working area, it can be seen that there is no dental health program for pregnant women that must be implemented by the Community health center. As for the previous year, the implementation of education using leaflets in pregnant women's classes and the use of the KASIH Card had been carried out, but the implementation was not optimal because it was not monitored as a priority program, there was no recording and reporting of the program, there was no optimal cooperation from the Health Office, Head of Community health center, Dental Therapist and Midwife in an effort to build a dental health program for pregnant women. This is the basis for the need for innovation in dental and oral health services for pregnant women, especially in efforts to prevent oral and dental diseases independently, because based on reports from health workers at the Karanganyar Community health center dental clinic, that pregnant women referred from the MCH clinic generally complain of sore teeth and gums, then found poor *oral hygiene*, bleeding

gums, and swollen gums. With this information, it is necessary to conduct a more in-depth assessment related to oral and dental diseases experienced by pregnant women and their prevention. But also as an alternative to solving the problem of pregnant women who tend to rarely do independent dental examinations before complaints of pain.

Based on the data that has been obtained from collecting information with 4 informants as well as reviewing scientific articles and literature related to the factors that cause gingivitis that can be identified independently by pregnant women as an early prevention effort, an application model design was developed that can help identify factors at risk of periodontal disease using system development SDLC (*System Development Life Cycle*), namely *requirements, design, implementation, verification, and maintenance*. The use of the database designed in the application is data on risk factors for oral and dental disease and information on pregnancy conditions with the design of the use of the application model in Figure 1.

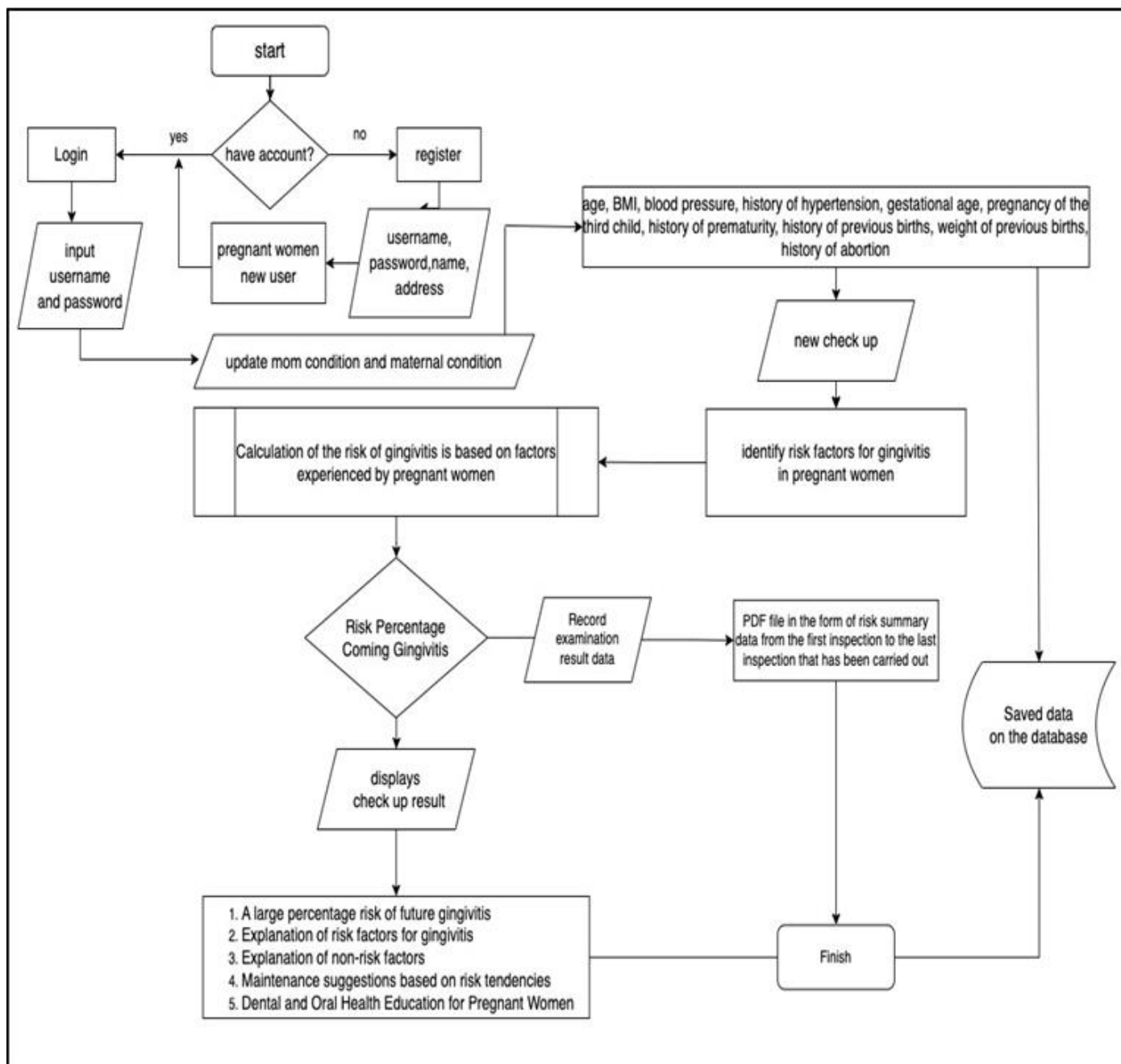


Fig 1 Flowchart of Application Model for Self-Detection of Dental and Oral Disease Risk Factor During Pregnancy

The design of the detection application model is then compiled into an operable application and an expert validation test is carried out to determine the feasibility value of the developed detection application. application feasibility assessment based on the substance of software development

standards by 2 informatics engineering experts, while the feasibility of material substance is assessed based on the opinions of 2 dental health experts and 2 maternal and child health experts. Testing was carried out by distributing questionnaires to assess the suitability of the application built.

Tabel 2. Feasibility Test by Expert Judgement

Validator	Score	(%)	Mean	r
Dental and Oral Health Expert 1	33	82,5%	88,75%	0,833
Dental and Oral Health Expert 2	38	95%		
Maternal and Child Expert 1	32	80%	87,5%	0,792
Maternal and Child Expert 1	38	95%		
IT Expert 1	36	90%	87,5%	0,556
IT Expert 2	34	85%		

The oral health expert's assessment of the detection application obtained an average value of 88.75% with a category that is very feasible. The results of the assessment of the two experts showed an *r* value of 0.833 > 0.60 with the measurement consistency criteria of the two observers, namely strong consistency. So it can be said that the PREDHIS application as a system for identifying oral and dental disease factors and oral health education independently, is very feasible in accordance with the substance of dental and oral health material for pregnant women.

The maternal and child health expert's assessment of the detection application obtained an average value of 86.25% was obtained with a very feasible category. The results of the validity of the two experts show that the *r* value is 0.792 with the measurement consistency criteria of the two observers, namely strong consistency. So it can be said that the detection application developed as a system for identifying oral and dental disease factors and oral health education on an independent basis, is very feasible in accordance with the substance of dental and oral health material for pregnant women. IT Expert assessment of the detection application, obtained a value of 87.5% with a very feasible category. The validity results of the assessment of the two experts show that the *r* value is 0.556 which means that the application developed

is very feasible in accordance with the substance of the information system development standards.

In the next stage, the model was tested to determine the level of acceptance of the use of the application system in small-scale and wider-scale groups of pregnant women. This study was conducted in a class of pregnant women and Integrated health care center under the guidance of Community health center in the working area of Pekalongan District Health Office using the *pre-experiment design* method with a *one shot case study* design. The PREDHIS android based apps was tested on a small group consisting of 5 people in charge of dental health services and pregnant women's health who were informants in the identification of problems and needs at the research site and 10 pregnant women in Tanjungsari Village and Tanjung Kulon Village as *users*, while this number has met the minimum number of trials of a system [17]. The purpose of this small-scale trial is to confirm whether the resulting application can be used and accepted by those responsible for dental health services as an alternative to detecting risk factors for oral and dental disease in pregnant women. The user acceptance test of the developed detection application uses the *Technology acceptance model* questionnaire where there are 5 aspects studied, namely aspects of perceived ease, perceived usefulness, acceptance attitudes, intention to use and actual use [18].

Table 3 User Acceptance Test of Self-Detection Tool Using Technology Acceptance Model (TAM)

No.	Respondents	Score	Mean	<i>r</i> *
1	Head of Sub-division. Health Services of the Health Office	78		
2	Head of Community health center	58		
3	MCH midwife	60		
4	Community health center Dentist	60		
5	Health Centre Dental Therapist	58		
6	Pregnant women 1	47		
7	Pregnant women 2	62		
8	Pregnant women 3	69	62,7	0,940
9	Pregnant women 4	71		
10	Pregnant women 5	58		
11	Pregnant women 6	80		
12	Pregnant women 7	40		
13	Pregnant women 8	60		
14	Pregnant women 9	80		
15	Pregnant women 10	60		

*Interclass-Correlation

Based on product trials conducted on 15 users, an average score of 62.7 was obtained with a high category of acceptance of use according to the technology acceptance model assessment guidelines. The results of the *r* value of 0.940 > 0.60 which means that the PREDHIS (Pregnant Dental Health Information system) apps has a value of ease and usefulness for users with a good level of acceptance of use. Thus, the result of this development research is that an Android-based self-detection system model has been developed that is feasible and acceptable for use by pregnant women to detect risk factors for dental and oral disease during pregnancy called the PREDHIS android based app

The PREDHIS application adopts 25% of the KASIH question items. So that in the PREDHIS application there are 15 questions that refer to factors that can cause gingivitis and can be identified independently by pregnant women, including identification of dental conditions, history of nausea and vomiting, habits of maintaining oral hygiene during pregnancy, dental and oral hygiene conditions, history of comorbidities that affect oral conditions, history of smoking habits, history of dental examinations during pregnancy, history of previous periodontal disease complaints, and vitamin D and C nutrition during pregnancy.

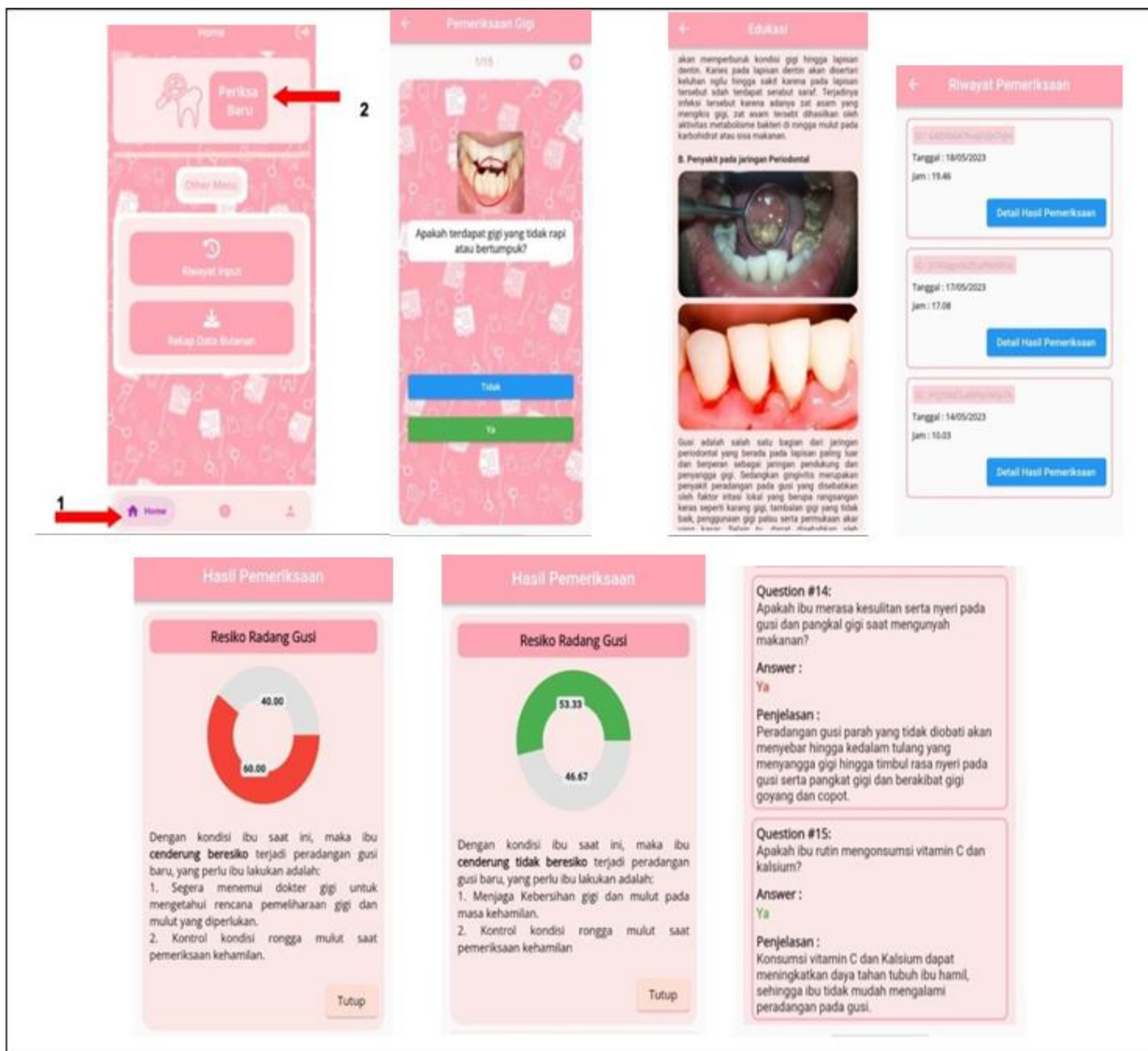


Fig 2 PREDHIS Apps View

IV. DISCUSSION

In system development research, after a system model is produced, it must be tested for suitability to the needs. The feasibility assessment of the application is assessed from the validation results of several experts regarding the substance of the feasibility of system performance and the feasibility of the application content built before being implemented in the community. Measurement of the feasibility of the detection application system developed in this study was carried out using a questionnaire developed based on ISO 9126 guidelines covering 6 characteristics, namely *usability*, *reliability*, *functionality*, *efficiency*, *maintainability*, and *portability*[19]. The benefit of assessing each ISO 9126 characteristic of a software is to facilitate the determination of maintenance priorities that help progress the development of software systems[20].

Based on the feasibility analysis of the 6 characteristics that make up ISO 9126, the detection application developed has a very feasible level of feasibility as a detection tool for factors causing oral and dental disease in pregnant women according to the perceptions of informatics experts, maternal and child health experts and oral and dental health experts so that this application can be an alternative problem solving in oral and dental health education in pregnant women using technology. Similar efforts were also made by previous research on the use of technology as a strategy to increase oral and dental clinic visits in pregnant women during ANC at the Sangkapura health centre through SWOT analysis with a problem-solving strategy, namely the use of technology as an effort to deliver dental health information that can be disseminated and reach out precisely and practically[21]. In addition, education is needed that integrates studies from psychological aspects so that the health information

produced can be an innovation to increase the motivation of pregnant women. This is supported by statements from previous researchers regarding the Antenatal Care Innovative program, that pregnant women must have motivation and a sense of responsibility for their own dental health, with efforts to include them to understand the condition of their oral cavity, it will build awareness of the importance of maintaining independent dental health and responsibility for their own health[22]. This corresponds to the purpose of developing applications in this study, namely making efforts to solve problems in the form of developing applications for detecting dental and oral disease factors in pregnant women that can be used independently called the PREDHIS Application or *Pregnant Dental Health Information System*.

One of the efforts to maintain the implementation and further development of the PREDHIS application is to measure the level of acceptance of the application on a small scale consisting of the party in charge of health services with the aim of getting support and feedback related to the application developed whether it has been able to become an alternative problem solving or needs to be improved before it is finally implemented widely. In addition, trials were also conducted on pregnant women as the target of PREDHIS application implementation. The same thing was also done by previous researchers on the procurement of innovations related to oral health programs in pregnant women, stating that strong support from the health department and health workers was an initial factor in the success of health innovations and was likely to be included in the policy for implementing innovations in pregnant women's dental health programs that must be carried out at ANC examinations[22].

Acceptance of the use of the PREDHIS application system used by pregnant women in Pekalongan Regency was measured using the *Technology Acceptance Model (TAM)* questionnaire on the level of acceptance of the use of the PREDHIS application as a tool for independent detection of dental and oral disease factors in pregnant women. The TAM questionnaire was administered when mothers had used the PREDHIS application as a tool for self-detection of dental disease risk factors in pregnant women. The ability to self-detect has an important role in disease prevention management. The benefits of self-detection as an early detection effort are useful for preventing new diseases and preventing more serious damage to a disease. PREDHIS application was developed as a tool to improve the ability of pregnant women to carry out self-detection or the ability to detect and understand the signs and symptoms and causative factors of an oral cavity disease during pregnancy. This is very important for the health and well-being of mothers during their pregnancy.

Some other benefits of self-detection skills for pregnant women are primarily as a preventive effort, by being able to detect signs and symptoms and causative factors of oral dental disease early, pregnant women will take preventive action early. Pregnant women can exercise self-control or control over their oral health and allow for commitment to behaviour change in maintaining oral conditions. The ability to self-detect provides the benefit of reducing the cost of

treatment required if oral problems are left without immediate treatment in the future. The current self-detection efforts have many variations, one of which is the use of self-detection and independent health monitoring applications developed through *smartphones*[19].

In the development of the PREDHIS Application as a tool for detecting factors that cause oral and dental disease in pregnant women independently, it is very important to consider the factors that influence the acceptance of application use so that the actual application can be useful, easy to understand and easy to use. So it is necessary to test the acceptance of the use of the application with the aim of ensuring that the PREDHIS application developed has met the expectations of pregnant women as users to get easy access to information that supports dental health maintenance and meets the expectations of those responsible for dental health services for pregnant women who get easy oral health education for pregnant women.

The assessment of the acceptance of the PREDHIS application in the pregnant women group has a high acceptance category. High acceptance can increase the likelihood of changes in oral health maintenance behaviour of pregnant women due to easy access to dental health information to pregnant women, although it may not necessarily have a direct impact on improving oral health status. This is in accordance with similar research on *oral health monitoring mobile* applications targeting pregnant women in the Surabaya area, it is said that the android-based mobile application contains material about oral health, especially related to pregnancy, good food for dental health, recording the condition of pregnant women, and suggestions for pregnancy check-up visits to the health centre so that with the compatibility of the mobile application, pregnant women can access a lot of information anytime and anywhere according to their health conditions and it is said that if the information displayed is much easier to learn and accept by pregnant women, it can increase the effectiveness of education as an effort to increase the knowledge and perceptions of pregnant women about the importance of oral health during pregnancy.[23]

V. SUMMARY

Based on the needs of those responsible for dental and oral health services for pregnant women for tools that convey oral health information that can be used by pregnant women, the PREDHIS Application has been developed which can be accepted as an application that is able to detect risk factors for oral and dental disease in pregnant women. This is evidenced by the results of the assessment of the level of acceptance of the PREDHIS application, obtained good acceptance criteria by those responsible for health services and by groups of pregnant women.

Future researchers can complete a novelty that is more than this research such as *bridging the* PREDHIS application system with the existing pregnant women's health system, it is necessary to conduct a diagnostic test to determine the suitability of the application's prediction results with the

actual conditions or cases of gingivitis experienced by pregnant women, research can be conducted on the direct benefits of using the PREDHIS application on the motivation of maintaining dental health of pregnant women and the dental health status of pregnant women.

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