

# Web-based Community Health Monitoring Information System (SIP-UKGM) for Pregnant Women

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**Abstract:-** Efforts to improve health are supported by optimal dental and oral health. A significantly high number of pregnant women, around 85%, experience dental cavities, while only about 15% remain cavity-free. The government's program is to carry out dental and oral health efforts which are activities that are carried out in an integrated, integrated, and sustainable manner that are able to maintain and improve dental health, one of which is UKGM. A website-based health information system that utilizes technology can support the processing of information, data and health indicators. The purpose of this study is to produce a feasible and effective Community Dental Health Monitoring Information System to improve the quality of Dental and Oral Health Services for Pregnant Women in Community Health Centers. This research uses the Research and Development (R&D) method and product testing using Pre-Examination Design with a pre-post one group design. The results of the expert validation test on the SIP-UKGM model obtained a V-Hit value of >0.8 with a very feasible category. The overall quality of SIP-UKGM services increased significantly after treatment compared to before ( $p < 0.05$ ). Statistical analyses showed a significant improvement in the overall quality of dental and oral health services after implementing the SIP-UKGM model.

**Keywords:-** Dental Health, Service Quality, user Satisfaction, Dental Hygiene Tools and Materials.

## I. INTRODUCTION

Development in the health sector is expected to increase the will, ability, and awareness of each individual to be healthy in order to achieve an optimal degree of public health. Based on Law Number 17 of 2023 concerning Health, health is a person's state of health, both physically, mentally, and socially, and is not just free from disease to enable him to live a productive life [1]. This meaning of health can be improved through improved health efforts [2].

Efforts to improve health are supported by optimal dental and oral health. This is regulated in the Regulation of the Minister of Health Number 89 of 2015 concerning Dental and Oral Health Efforts to establish a Dental Examination Program

for pregnant women which aims to prevent complications during pregnancy and become a means of early detection [3].

Pregnant women have a high risk of developing dental cavities, with over 84% experiencing this issue. The average number of decayed, missing, and filled teeth (DMF-T) among pregnant women is 4.34. This breakdown includes an average of 3.03 decayed teeth, 1.08 missing teeth, and 0.05 filled teeth. Interestingly, the severity of dental caries tends to increase throughout pregnancy, with the highest DMF-T value found in the second trimester [4].

Pregnancy can involve physical and hormonal changes in every organ system including the oral cavity that make pregnant women susceptible to oral infections and periodontal disease [5]. One of the dental and oral diseases that most affect pregnant women is dental caries. Caries or cavities is a disease in the oral cavity caused by the destruction of bacteria to the hard tissues of the teeth (enamel, dentin, and cement). The cause of dental caries is plaque that accumulates on the surface of the teeth. Plaque is created from food debris, feces, and bacteria in the oral cavity. The process of eroding enamel is called enamel erosion. Gradually, this erosion process can cause small holes in tooth enamel [6].

Dental caries is a chronic condition that progresses over time, often persisting throughout an individual's life. Left untreated, it can lead to pain, tooth loss, and infection. Pregnant women are particularly susceptible to the adverse effects of dental caries. The associated pain can reduce dietary intake, potentially resulting in low birth weight infants due to maternal malnutrition. Additionally, dental caries can elevate blood pressure, increasing the risk of preeclampsia. Furthermore, the condition may stimulate hormone release, which can induce uterine contractions and consequently threaten premature birth or miscarriage. Overall, dental caries poses a significant risk to the overall health and well-being of pregnant women [7].

The oral health status of pregnant women is significantly associated with the development of early childhood caries, which can have profound and lasting consequences for children's health. Effective prevention of dental infections during pregnancy necessitates comprehensive dental and oral

health education, including self-care guidance. Research has consistently demonstrated that pregnant women possess limited knowledge and awareness of oral health issues. Furthermore, studies indicate a substantial proportion of pregnant women do not receive adequate dental or oral healthcare services during this critical period [8].

Knowledge deficits can influence human behavior, including health-related actions. Health education is instrumental in shaping positive behaviors. However, dental and oral health behaviors require significant improvement. A comprehensive approach encompassing promotive, preventive, curative, and rehabilitative interventions is necessary to address this public health challenge [9].

The still high prevalence rate of dental caries coupled with other pregnancy disorders shows that the health status of pregnant women is still low. According to Hendrick L Blum (1983) stated that public health is influenced by 4 (four) factors, namely the environment, behavior, health services and genetics [10].

Health services constitute a critical third factor influencing the overall state of public health. The presence of adequate healthcare infrastructure is instrumental in providing essential services for disease prevention, treatment, care, and recovery within both population groups and communities [10].

In order to get maximum results, health services must be of high quality. Superior service quality is directly linked to increased customer satisfaction. Customers assess service quality based on how well it aligns with their expectations. To exceed customer expectations and foster loyalty, service delivery should consistently surpass customer standards. The SERVQUAL model, developed by Parasuraman, Zethaml, and Berry, is a common method for measuring service quality. This model compares customers' perceptions of the actual service with their expectations of what the service should be, as these expectations represent the desired service level from the company [11].

To enhance healthcare quality, we can utilize five key dimensions identified by Parasuraman: tangibles (physical environment), reliability (consistency), responsiveness (timeliness), assurance (trustworthiness), and empathy (care). Improving service quality requires several strategic actions: pinpointing key quality determinants, managing patient expectations, showcasing service quality, educating patients about services, fostering a quality-oriented culture, automating quality processes, and following up on service delivery [12].

The result of improving service quality is customer satisfaction which is a feeling of happiness or disappointment of a person that comes from a comparison between his impression of the performance of a product and his expectations, so that it can give birth to customer loyalty. Loyal customers have a very important role because they can improve and maintain their existence in improving the quality of health [11].

The government has implemented a comprehensive and ongoing dental and oral health program aimed at enhancing and preserving the overall oral health of the population. This program encompasses activities focused on promoting oral health, preventing oral diseases, and providing treatment and restorative care [13]. Community Dental Health Efforts (UKGM) involve dental health activities organized and implemented by the community with guidance from community health centers. The goal is to empower individuals to take proactive steps in managing their dental and oral health issues [14]. The success of Community Dental Health Efforts (UKGM) hinges on active community participation and the support of healthcare professionals. These efforts aim to provide optimal dental and oral healthcare services. The primary goal of UKGM is to improve the oral health of specific groups: children under five, elementary school students, pregnant and breastfeeding women, and the elderly [15].

The effectiveness of Community Dental Health Efforts can be evaluated based on factors such as the surrounding environment, community knowledge about oral health, educational programs, public awareness, and the delivery of both preventive and treatment services. Preventive measures against dental and oral health problems need to be taken so that there are no disturbances in function, activity, and decreased productivity that will affect the quality of life of the community [16]. To enhance community oral health, comprehensive and ongoing health initiatives are implemented. These efforts encompass maintenance, promotion, prevention, treatment, and rehabilitation services to improve overall oral well-being [17].

The implementation of Community Dental Health Efforts often experiences obstacles, this is due to the limitations of facilities, manpower, funds, and facilities of community health centers. Other obstacles that cause the implementation of the Community Dental Health Facility are hampered, namely: 1) The knowledge and ability of health workers in dental and oral health efforts in organizing, planning, monitoring and implementing promotive and preventive dental health efforts as a whole across sectors has not been maximized, 2) The unavailability of the right dental health coaching platform, the absence of a dental health program policy at the Health Office local government resulting in the non-implementation of monitoring and evaluation, 3) the unavailability of operational costs to implement the UKGM program [18].

The current manual system for recording and reporting dental health data in public health centers is inefficient. This system, which combines dental and general health reports on a single form and is completed annually, hinders the ability to effectively monitor and evaluate the progress of community dental health programs [19]. Evaluation and monitoring are essential tools for tracking the progress of health programs against their established goals. By regularly assessing program performance, it's possible to identify and address shortcomings effectively [18].

It is necessary to make efforts to improve the quality of dental and oral health of the community, especially the quality of management which includes planning, implementation, monitoring, and evaluation in the implementation of UKGM. Leveraging the latest technological advancements can replace manual monitoring processes through the implementation of an information system [20]. To align with Industry 4.0 standards and improve individual health outcomes, public health centers must prioritize the quality of their workforce and data management. A comprehensive, integrated information system is essential for effectively managing and enhancing the quality of recording and reporting activities [21].

A website-based health information system that utilizes technology can support the processing of information, data and health indicators. This can be used as a switch from manual monitoring activities to a computer information system. Health information systems in public health centers can ensure the availability of faster, more accurate, up-to-date, sustainable and accountable information. A health information system serves as a comprehensive management tool that guides decision-making and actions related to data, processes, technology, performance metrics, and personnel within the healthcare sector [22].

The goal is to leverage user-friendly technology to improve community dental health services through a health information system. This system will outline service standards, key performance indicators, and evaluation metrics for community dental health programs. Previous research indicates that such a system can enhance monitoring, system efficiency, data accuracy, and overall service quality within community health centers [18].

This study aims to develop and evaluate the Community Dental Health Efforts Monitoring Information System (SIP-UKGM) to enhance dental care for pregnant women, particularly those under maternal and child health programs.

## II. RESEARCH METHODS AND SAMPLE

The method of research to be carried out is the *Research and Development* (R&D) method. Research *Research and Development* It is a mix-method, meaning that this method

combines qualitative and quantitative approaches. In testing the effectiveness of products using analytical methods, and in producing products using descriptive methods while in testing product effectiveness using analytical methods [23]. There are five steps in the research *Research and Development*, including: collecting data and information, design, expert validation, product trials, and product results.

### ➤ Information Collection

Information collection was carried out by means of interviews with the Health Office, the Head of the Public Health Center, Dentists and Dental Therapists. In addition, it is supported by literature studies from journals and books related to information systems, dental health and pregnant women's health.

### ➤ Design and Build Models

The model design method uses the *Rapid Application Development method* where the development consists of the requirements analysis phase, modeling analysis phase, modeling design phase, and construction phase.

### ➤ Expert Validity Test

The expert validation process is carried out by three experts, namely dental and oral health management experts, health promotion experts, and information systems experts. The test was carried out using an assessment questionnaire and then revised the use of the Community Dental Health Efforts Monitoring Information System (SIP-UKGM) to improve the quality of health services for pregnant women. Then the results obtained from each expert are analyzed with Aiken V for the Validity test and using *Interclass Correlation (ICC)* as the Reliability test.

### ➤ Product Test

This study employed a pre-test, post-test design to evaluate the effectiveness of the SIP-UKGM system in enhancing the quality of community dental health services provided by community health centers. The study participants were dental and oral therapists working in these centers.

### ➤ Product Results

The product results are in the form of a SIP-UKGM Monitoring Information System at the Public Health Center.

## III. RESULTS AND DISCUSSION

### ➤ Information Collection Stage

Data was collected through interviews with key personnel, including the head of the health office, the dental and oral health coordinator, the health center head, dentists, and dental therapists.

Table 1 Conclusions of Respondents' Answers

Dimension	Answer
Implementation of Community Dental Health Activities that are currently underway	"... The activities of Usaka Community Dental Health are running well including preschoolers, the elderly, pregnant women, and toddlers are monitored through RUK and activity reports sent from the Community Health Center to the Bulukumba Regency Health Office. The drawback is that there is no exact format for sending reports every year.

Obstacles When the Implementation of Community Dental Health Hygiene Exam so far	"... The obstacle of Usaka Community Dental Health is the lack of implementing personnel and the implementation time is limited, in addition to the problem of funds because there is no special financing for this Usaka Community Dental Health activity from BOK., there is no sustainable action because patients referred at the posyandu do not come to the community health center for further treatment
The system used for recording and reporting the implementation of Usaka Community Dental Health so far	"... The recording and reporting system is still manual and the obstacles of this recording are sometimes reports can be scattered or tucked between other activity documents and the data is not stored neatly.
Transferring the function of recording and reporting Community Dental Health activities to the information system	"... The online-based information system is very appropriate because it makes it very easy to record and report itself

The current implementation of Community Dental Health activities has shown positive results, however, the manual system for recording and reporting data presents significant challenges. The manual process limits the effectiveness of reports and causes delays in transmitting information between the community health center and the health office. Consequently, monitoring and evaluating the progress of these activities is hindered.

The transfer of the recording and reporting function of Community Dental Health Activities to an information system can be used to improve the quality of recording and reporting Community Dental Health Activities so that the reports produced can be better and activities can be carried out optimally. The solution offered in this study is through the "SIP-UKGM" model which can be used to improve the quality of Dental and Oral Health services for pregnant women based on an information system that is expected to be carried out more practically.

Community Dental and Oral Health Efforts (UKGM) is a program implemented to improve the degree of dental and oral health of pregnant women, toddlers, preschool-age children and the elderly with promotive and preventive actions carried out comprehensively through posyandu [24].

To effectively monitor and evaluate the implementation of Community Dental Health Practices within a community health center, a specific set of reporting indicators is necessary for tracking the dental and oral health program's progress [25]. To effectively implement and evaluate Usaka Community Dental Health practices, the development of comprehensive reporting indicators is essential. These indicators will serve as benchmarks for monitoring progress within community health centers. By optimizing Community Dental Health Practices, the community can receive optimal promotive and preventive dental and oral health services tailored to the specific needs of each target population.

One of the processes that can be used to improve performance and allow various activities to be carried out quickly, precisely, and accurately so that it will increase productivity is to take advantage of technological advances. One of the impacts of information technology advances is the public's dependence on information produced by a system that is developed so that it can be more effective and efficient. In line with this, a 2020 study explains that management information systems provide accurate and timely information

needed to facilitate decision-making and problem-solving processes that enable the implementation of planning, control, and operational functions to run effectively [26].

The development of the SIP-UKGM model aims to enhance the recording and reporting processes within community health centers. By providing a more efficient system for collecting and managing data, this model can support healthcare workers in making informed decisions, particularly in monitoring and evaluating community dental health programs. The use of information systems offers numerous benefits, including increased efficiency, accuracy, and speed in data retrieval, report generation, and overall program evaluation [27].

#### ➤ *Design and Build Models*

The "SIP-UKGM" model was created as a tool in the implementation of Community Dental Health Usaka activities which was previously in manual form into a website-based information system that will make it easier for TGM to record and report UKGM activities.

Information system development uses the RAD (Rapid Application Development) method. The menu developed in this information system includes registration menus, log in, home, guides, activity agendas, evaluation menus and health worker menus. On the activity agenda menu, there is a schedule for the implementation of Community Dental Health activities that have been scheduled by health workers consisting of dates and activities that must be carried out, material on dental health education and cadre training, simple dental and oral health examination forms for pregnant women, data on dental care action plans and referral data.

The feasibility measurement of "SIP-UKGM" was carried out using a questionnaire developed based on ISO 9126 which includes 6 characteristics, namely, usability, reliability, functionality, efficiency, maintainability, and portability. The benefit of assessing each ISO 9126 characteristic of a software is that it makes it easier to prioritize maintenance that helps advance software system development.

*Usability* is a software characteristic assessment based on the ability of the software to be understood, learned, and used by users [28]. In this study, the assessment of usability characteristics is seen from "SIP-UKGM" which is easy to operate and understand by users and existing menus according to needs.



**Reliability** is a software characteristic assessment based on the software's ability to prevent unwanted access and maintain the performance of the software [28]. In this study, the reliability characteristic assessment is seen from the ability of "SIP-UKGM" to avoid intruders (hackers) and authorization in data modification, namely by restricting user access rights.

**Functionality** is a software characteristic assessment based on the software's ability to provide system functions according to user needs [29]. In this study, the assessment of functionality characteristics is seen from the availability of menus in "SIP-UKGM" that are in accordance with the needs of the implementation of UKGM.

**Efficiency** is a software characteristic assessment based on the software's ability to provide usability that helps user productivity [30]. In this study, the assessment of efficiency characteristics seen from the response time of "SIP-UKGM" when opened does not take long.

**Maintability** is an assessment of software characteristics based on the software's ability to update and modify according

to current and future needs[31]. In this study, the assessment of the characteristics of maintainability is seen from the ability of "SIP-UKGM" to be redeveloped in material and feature aspects.

**Portability** is an assessment of software characteristics based on the ability of software to replace or continue a pre-existing information system or product as well as the capabilities of pre-existing systems as well as the ability of the system to be easily installed and accessed on several different devices[32]. In this study, the assessment of maintainability characteristics is seen from the ability of "SIP-UKGM" to adapt easily to various hardware or OS/IOS platforms without any additional effort.

#### ➤ Expert Validation

Expert validation consists of 3 people, namely information technology experts, dental and oral health experts, and dental and oral health management experts. Feasibility is proven through calculation *Statistics* through the Aiken V test for a validity test that gets very *valid* and continued with a reality test using the ICC test (*Interclass Correlation Coefficient*).

Table 2 Aiken V Test Results

It	Test Results	Interpretation	Follow-up
1	0.58	Valid Medium	Accepted/used
2	0.83	Highly Valid	Accepted/used
3	0.83	Highly Valid	Accepted/used
4	0.83	Highly Valid	Accepted/used
5	0.5	Valid Medium	Accepted/used
6	0.58	Valid Medium	Accepted/used
7	0.83	Highly Valid	Accepted/used
8	0.75	Valid Medium	Accepted/used
9	0.41	Valid Medium	Accepted/used
10	0.75	Valid Medium	Accepted/used
11	0.75	Valid Medium	Accepted/used
12	0.91	Highly Valid	Accepted/used
13	0.66	Valid Medium	Accepted/used
14	0.83	Highly Valid	Accepted/used
15	1	Highly Valid	Accepted/used
16	0.75	Valid Medium	Accepted/used
17	0.91	Highly Valid	Accepted/used
18	0.91	Highly Valid	Accepted/used
19	0.91	Highly Valid	Accepted/used
20	0.91	Highly Valid	Accepted/used

\*Aiken V

In the table above, it can be seen that out of 20 question items, there are 9 questions with medium validity ( $V_{hit} > = 0.4-0.8$ ) and 11 questions in the state of  $V_{hit} > = 0.8$  is expressed as very *valid*. This means that the model *SIP-UKGM*

This is feasible as an effort to improve the quality of Community Dental Health services at community health centers.

Table 3 ICC Test Results

Single Measure	Interclass Correlation	Sig
Average Measures	0,568	0,000
	0,796	0,000

\*ICC

The results of the expert validation reliability test on 1 (one) expert have a value of *Intraclass Correlation*<sup>b</sup> 0.568. Because the value is >0.50, the reliability has adequate stability, and overall from 3 (three) experts have a value of *Intraclass Correlation*<sup>b</sup> 0.796 and a value of *V hit* > 0.8, it can be interpreted as having very high reliability.

This feasibility study was carried out to find out whether the "SIP-UKGM" model can be tested in a large group which is then expected to be used as a tool to improve the recording and reporting mechanism as well as the quality of data and

information of Usaka Community Dental Health in community health centers.

This aligns with a 2020 study demonstrating the feasibility and effectiveness of a digital dental health recording and reporting system for implementation in health centers [33]. Expert validation is carried out in accordance with the field being researched and mastering a certain field.

#### ➤ Model Test Results

The model trial in this study was carried out by dental and oral therapists who work in community health centers.

Table 4 Frequency Distribution of Quality of Service Pre-Post Test

No.	Variables	Dental and Oral Therapist	
		Mean	Difference
1.	Pre_Test	33,20	9,20
2.	Post_Test	42,40	

Based on the Table above pThere are test results type This small scale can be known as the average value before treatment of 33.20 and the average value after treatment is 42.40 with a

difference value of 9.20, then we can conclude that the use of the SIP-UKGM application is effective in improving the Quality of UKGM Services.

Table 5 Results of Different Tests

Variable	Mean±SD Pre test	Mean±SD Post test	p-value*
Quality of Service	33.20 ± 1,095	42.40 ± 0.894	0,000

\* Pairing Test : Paired Sample T-Test

Based on the "SIP-UKGM" model difference test on service quality in a small-scale group conducted on 5 TGM people, it is known that the results of the paired data difference test have differences in service quality before and after treatment. In the results of this small-scale difference test, it can be known that the average value before treatment is 33.20 and the average value after treatment is 42.40 with a Sig (2-tailed) value of 0.000 < 0.05, so we can conclude that there is a real difference between before and after the use of the SIP-UKGM application in community health centers.

The purpose of this small-scale trial is to confirm whether the resulting "SIP-UKGM" model is feasible and effective to be used as a tool to improve the quality of Community Dental Health services in community health centers and subsequently to conduct trials on respondents on a large scale.

Community health centers collect and compile data from both core staff and support personnel for submission to the health office. This includes documenting all activities within and outside the health center. Currently, this process is manual, involving time-consuming steps such as gathering individual reports from program heads, consolidating them, and obtaining final approval from the health center head [34].

#### ➤ Model Results

The "SIP-UKGM" model can provide ease and speed of the process or mechanism for recording and reporting UKGM activities. The ease of entering data and searching for data will help officers in shortening work in reporting the implementation of Community Dental Health Studies,

including in terms of ease of information in understanding and obtaining.

Implementing an information system for recording and reporting community dental health activities can streamline the process by connecting staff at all levels, from frontline workers to health office administrators. This integrated system can facilitate efficient data management and sharing. Supporting this approach, a 2016 study found that information systems can help district health offices effectively manage reports from community health centers, aiding in program evaluation.

The development of a web-based recording and reporting system provides more advantages of virtualization, a method that was initially manual can easily be converted into an information system. Recording and reporting that utilizes information systems has another advantage, namely being more flexible for the implementation of recording and reporting mechanisms because it can identify the needs of dental hygienists in the 65 Community Health Center.

The completeness of data and information includes all information needed by users from the information system [35]. Data completeness is paramount for the successful implementation of the E-UKGM model. Comprehensive data ensures that the system can effectively support decision-making processes. Data clarity is essential for accurate interpretation, while detail guarantees that the information is sufficiently specific to address user needs. A logical data sequence enhances usability and facilitates efficient analysis. By encompassing these qualities, data completeness empowers

the E-UKGM model to provide valuable insights and drive improvements in community dental health. [36].

Data accuracy pertains to the precision of information collected within a specified timeframe, aligning with community dental health activities. Accurate data expedites decision-making processes. The SIP-UKGM system is anticipated to provide timelier data compared to manual systems. A system's ability to process data and information efficiently is a key indicator of its overall quality.

#### IV. CONCLUSION

The "SIP-UKGM" model is feasible and effective to be used as an effort to improve the quality of dental and oral health services for pregnant women in community health centers. It is hoped that dental and oral health workers can maximize the application of the model and implement it in a sustainable manner to improve the quality of recording and reporting of Community Dental Health Institutions at community health centers. In addition, it is hoped that health workers will be able to optimize the coordination of the implementation of the Community Dental Health Usaka with the implementing officers of the Community Dental Health Usaka both across sectors and across programs, so that it can improve the degree of dental and oral health of the community.

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