Primagravida System Usability for Pregnancy and Child Growth Monitoring in Rural Areas

Wiwin Lismidiati[1*], Happy Indah Kusumawati[2], Akhmadi[3], Lutfan Lazuardi[4], Dimas SEW Sumunar[5], Mia Purnama[6]

[1]Department of Pediatric and Maternity Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

[2]Department of Basic and Emergency Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

[3]Department of Psychiatric and Community Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

[4]Department of Health Policy and Management, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

[5]Health Informatics Programme, Karolinska Institutet, Sweden

[6]School of Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

*Corresponding author's email: wiwien_lismidati@ugm.ac.id

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ABSTRACT

Over the past few decades, medicine and healthcare have significantly improved and decentralized, offering high-quality yet accessible care to individuals. Despite mHealth's substantial role in postpartum and maternity care, the adoption rate in rural and remote areas remains limited in Indonesia. mHealth apps for tracking and monitoring during and after pregnancy can potentially improve both the mother and child's quality of life. Primagravida is a web-based application introduced for maternal and childcare in a municipality at Kulon Progo Regency, Yogyakarta, Indonesia. A collaborative approach with two primary health care and the local government facilitates expert teams to reach out to pregnant women and parents at risk for health complications. Field supervision sessions were organized to coach targeted populations and voluntary health workers. At the end of the sessions, a System Usability Scale (SUS) questionnaire was distributed to capture users' experiences. Generally, a SUS score over 68 is considered good [3]. Primagravida application was acceptable and easy to learn among the users. However, the SUS questionnaire was intended as a quick and dirty assessment tool for shallow evaluation. The questions are aimed at identifying possible inconsistencies in the system rapidly. The future study must address more detailed identification with rigorous and comprehensive methods. The study's overall finding is that Primagravida was valued as satisfactory by the targeted audience of users. However, the app's usability is expected to improve through an iterative approach continuously. The findings of this study highlight the connection between efficient health apps and how their layout may foster patient engagement in care delivery. Therefore, developing health apps is essential to introduce an interdisciplinary strategy with early target group participation.

Keywords: Applications, Growth Monitoring, Pregnant Women, Primagravida, Usability.

1 Introduction

In this era of advanced technology, parallel to any other field, the healthcare sector has undergone significant changes over the last few decades. As a result, current healthcare systems have become more accessible to people through different channels. Beyond traditional delivery systems, telemedicine, mobile health, and remote health services are growing rapidly [1]–[3].

A statistical report shows Indonesia's population reached 280 million in 2022, with 202.6 million active internet users [4], [5]. Around 98.2% of internet users in the age group 16-64 use smartphones[4]. These

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figures indicate that the Indonesian population is moving towards smart living. The need for mobile applications for disease prevention, care management, self-monitoring and emergency services is rising in this context.

Maternity health care and the postpartum period are domains in which mHealth plays a significant role in Indonesia. According to the World Health Organization, birth complications are one of the leading causes of infant mortality. This can be prevented by ensuring proper availability and access to skilled health professionals during pregnancy[6]. Ranges of health strategies have been implemented in Indonesia to reduce maternal neonatal and child mortality rates. However, the strategies were not entirely successful.

Global Observatory for eHealth (GOe) defines Mobile health (mHealth) as medical and public health practices supported by mobile devices, such as cell phones, patient monitoring devices, Personal Digital Assistants (PDAs), and other wireless devices [7]. mHealth also includes "the use of any mobile device including mobile phones, smartphones, mobile sensors or cell phones to provide and receive health services such as disease monitoring, diagnosis, management, and prediction" [8]. Device components, including a microphone, camera, GPS, and accelerometer, represent the essential sensors for delivering care via smartphone.

Since the Indonesian population is diverse in terms of educational background and level of competence, the development of health applications with higher usability features (i.e., ease of understanding, ease of use, and fostering ability to work efficiently) is essential to support users and meet their needs [9], [10]. In addition, given the picture of health services as a whole and the lack of education among women in particular, applications with higher usage compliance can play a dynamic role in creating mass awareness during pregnancy among mothers and parental support during childhood in provisioning effective health management.

2 Research Methodology

A cross-sectional quantitative descriptive study was conducted in June-August 2022. Pregnant mothers and parents were invited to this study. Prior to evaluation, participants received an explanation about the purpose of the study, risks, and compensation. In addition, a two-hour training session was scheduled for delivering materials related to pregnancy and stunting prevention. Practical guidance on how to use the system was delivered to the participants before the SUS evaluation.

Participants were recruited from two municipalities in rural areas of the Special Region of Yogyakarta. Primary care staff facilitated the prioritization of participating subjects. This study involved pregnant women with a high risk of chronic energy deficiency and parents with severely stunted children. The training sessions were organized at the local community center to ensure the participant's accessibility to the location as highlands mainly surround the areas.

Usability questionnaires based on SUS were distributed to the study's participants. There are 10 SUS questions adapted and validated in the Indonesian language [11]–[13]. The item analysis for the SUS questionnaire's initial version is shown in Table 2. Participants were required to choose a Likert scale of 1-5 for each item. For favorable items, the score contribution is the scale minus 1; for unfavorable items, the score contribution is five minus the scale. The sum of the item score contributions is multiplied by 2.5 to produce the overall SUS score, which ranges from 0 to 100[12]. If a system's overall SUS score is 68 or higher, it is said to have good usability [12]. After the usability evaluation was retrieved, the data was processed using quantitative analysis. Additional profiles of the participants were also collected in this study, including their educational background, age, and employment status. This will be shown in Figure 1.

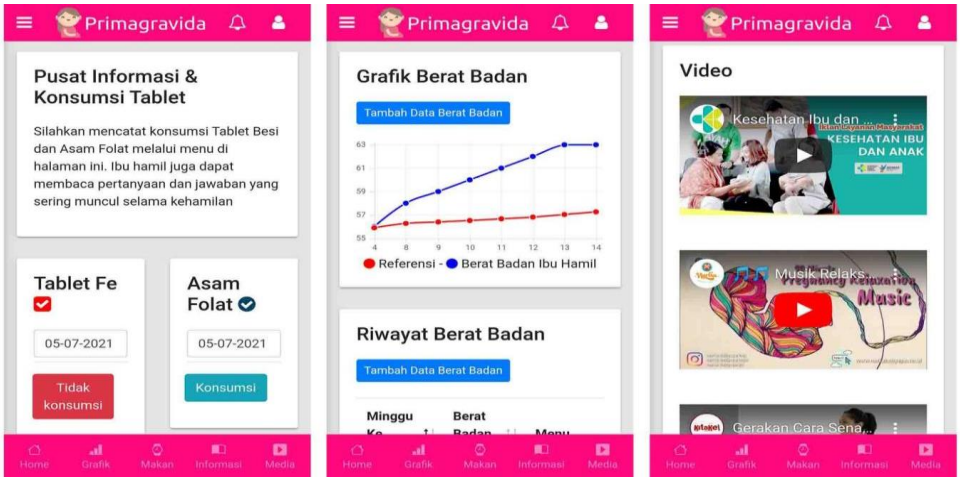

Figure 1: *Primagravida App provides holistic services, from Fe supplement intake monitoring to weight recording and educational content.*

3 Theory and Calculation

Usability is a critical aspect that ensures the quality of software or applications [14]. The absence of usability leads to low adoption rates [10], [15]. This study is categorized under Human-Computer Interaction (HCI) to comprehend key usability components. The information collected from this study helps health informaticians and system developers create user-friendly, effective, and efficient applications to guarantee customer satisfaction. This study's ultimate goal was to enhance the usability and accessibility of the system to as many people as possible. The design, deployment, and assessment of the interactive Primagravida system took place in the context of users' tasks and responsibilities according to frameworks. Numerous factors potentially affect a system's design, development, implementation, and evaluation due to the integration of computer science, sociology, and information science with psychology and other cognitive sciences.

Table 1: *Participants' Characteristics (n=59)*

Characteristics	**Frequency (n)**	**Percentage (%)**
Level of Education		
Bachelor's degree	2	3.38%
High school	45	76.26%
Junior high school	10	5.90%
Elementary	1	1.69
Employment		
Housewife	48	81.36%
Private employees	3	5.08%
Farmers	1	1.69%
Unemployed	5	8.47%
Others	3	5.08%

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4 Results and Discussion

Eleven pregnant women and 48 parents participated in this study, making up 100% of female respondents. Based on demographic data, the average age of respondents was nearly 30 years old (29.94), with a standard deviation of 5.94. Most respondents graduated from Senior High School (76.26%) and were employed as housewives (81.36%)—detailed profile of the study participants is presented in Table 1.

A quantitative descriptive analysis was performed to explore the statistical features of the SUS score. Fifty-nine records of completed responses were retrieved from the participants. Item evaluation results of the SUS items are provided in Table 2.

Table 2: *Item Analysis of the System Usability Scale (SUS) (n=59)*

No	Item	Mean (SD)	Minimum	Maximum
1	I believe I'll be using this system frequently.	4.03 (0.41)	3	5
2	The system seemed overly complicated to me.	3.63 (0.75)	1	5
3	I found the system to be simple to use.	3.98 (0.6)	2	5
4	I believe that in order to use this system, I would require the assistance of a technical person.	2.81 (1.01)	1	5
5	I found many functions in this system seemed to be properly integrated.	3.98 (0.39)	2	5
6	I believed this system to be far too inconsistent.	3.69 (0.7)	2	5
7	I imagine majority of individuals would learn to use this system fairly fast.	3.73 (0.73)	1	5
8	The system was really difficult for me to utilize.	3.71 (0.69)	2	5
9	I had no trouble using the system.	3.74 (0.68)	2	5
10	I had a lot to learn before I could began using this system.	2.14 (0.75)	1	4

Odd numbers of the SUS represent unfavorable items. Participants gave the system a 4.03 average out of 5 on a Likert scale, indicating that they intended to use it regularly. Ease of use, well-integrated system functions, and confident interaction were admitted positively. However, some improvements should be made, especially regarding prior knowledge and competence. Various studies reported similar findings, which conducted SUS evaluation for electronic health records, learning systems, and communication apps [15]. In addition, the user's level of knowledge and previous experience in using mobile applications contribute to system usability [16]. The SUS Evaluation results will be explained in Table 3.

Table 3: *System Usability Scale (SUS) Evaluation Results (n=59)*

	Mean (SD)	Minimum	1st Quartile	3rd Quartile	Maximum
SUS Score	70.16 (8.04)	52	66	76	88

Primagravida application was acceptable and perceived as easy to learn among the users. Generally, an average SUS score over 68 is considered acceptable [11], [12]. A meta-analysis reported that the mean score of SUS apps in health care and health information were 71.30 and 69.45, respectively [15]. Our study results, with an average of 70.16, fell among those criteria. The highest SUS score retrieved from a health-related

system was recorded from a physical activity application, averaging 83.28 and 12.39 SD. Several factors have related to this aspect, including how the system provider involves a user-centered approach in developing the app, popularity, and gamification features [15].

5 Conclusion

The study's overall finding validated that Primagravida was perceived as satisfactory by the targeted user's audience. However, the app's usability is expected to improve through iterative approaches continuously. The findings of this study highlighted the connections between well-developed health apps and how their layouts may foster patient engagement in care delivery. Therefore, future development of health apps is essential to introduce an interdisciplinary strategy with a user-centered framework to enhance system usability and customer satisfaction.

6 Declarations

6.1 Study Limitations

Participants in this study had limited time to explore the app's functionalities. An immediate evaluation was organized for the participants upon completing the 2-hour training session. Assessing users' experience with sufficient time is essential to capture users' perspectives better. In addition, the SUS questionnaire was intended as a quick and dirty assessment tool for a shallow evaluation. The questions were aimed at identifying possible inconsistencies in the system rapidly. Future studies must address more detailed usability aspects with rigorous and comprehensive methods.

6.2 Acknowledgments

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6.3 Funding Source

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6.4 Competing Interests

The authors declare no competing interest in association with this publication.

6.5 Informed Consent

Prior to data collection, participants were provided with a detailed description and purpose of the study. Informed consent was retrieved from the targeted population willing to participate in this study.

6.6 Publisher's Note

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