Primagravida application usability and user satisfaction as a digital health initiative for pregnancy educational media and remote rural monitoring

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ABSTRACT

Introduction: Nutritional status during pregnancy is one of the critical factors in determining maternal and fetal development, affecting birth weight, perinatal mortality, and infant growth. Regular monitoring of pregnant women's health is crucial as preventive measures and promotive approaches for both mother and fetus. Primagravida, a web-based system, was developed to assist pregnant women in rural areas in monitoring their health, especially during the COVID-19 pandemic. This study aimed to evaluate usability and user satisfaction in using Primagravida.

Method: Quantitative descriptive research with a cross-sectional design was employed. The study was conducted in the Kalibawang Primary Health Center (PHC) service area between June - October 2021. Seventy-nine pregnant women participated in this study. Pregnant women were registered and observed for their pregnancy profile through a web-based service integrated with PHC maternal and child health care. In evaluating the system usability, the current study utilized System Usability Scale (SUS), while a modified users' satisfaction questionnaire was employed to capture participants' perceptions.

Results: Results indicated that most participants were satisfied with the benefits, information relevance, content adequacy and clarity, platform availability, and up-to-the-minute curated knowledge provided by the system. Utilization of this system reduced the number of visits to PHC since health monitoring could be performed virtually. Regarding system usability, respondents reported a score of 70, and the average score of respondents was 66.

Conclusion: Pregnant women have adopted the Primagravida application to monitor their health and fetal status in Kalibawang District, Kulon Progo. Feature development is required to accommodate the upcoming demands of holistic maternal and perinatal care.

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INTRODUCTION

Pregnant women's nutritional status is a contributing factor to fetal development. Malnutrition during pregnancy poses risks for low birth weight, perinatal mortality, and delayed child growth and development. Globally, the maternal mortality rate remains high, especially in low- and middle-income countries such as Indonesia.[1] Despite care facilities and health professionals being equally distributed in the Special Region of Yogyakarta (DIY), the low birth weight prevalence in Kulon Progo regency experienced fluctuations between 2017-2021 by an average of 7,026%.[2]

Due to the COVID-19 pandemic, the World Health Organization (WHO) and the Ministry of Health published policies to limit direct contact to prevent case transmission.[3,4] The COVID-19 pandemic affects the activities of pregnant women in Kalibawang District, Kulon Progo. Declining number of antenatal care (ANC) visits reported during March 2020. Pregnant women community outreach was abolished to reduce the risk of COVID-19 transmission, care assistance for pregnant women was not intensively carried out, and the stereotype was given for patients visiting the Primary Health Care (PHC/ Puskesmas) terrifying pregnant women to get periodic pregnancy examination. A novel approach is required to improve pregnant women and infants' health amid current disease outbreaks. One of the initiatives is introducing technology-based solutions for care delivery systems.

The health sector's development of virtual care services for patients in the community remains limited. In the other area of healthcare, the utilization of IT-based applications has been massively carried out. Amid this pandemic, patients and families prefer to be engaged in digital services. Digital services in the health and education sectors have increased significantly.[5–7] Implementing fast, reliable, and appropriate technology potential to support care delivery service. Primigravida, a web-based pregnancy monitoring system, is one of the IT-based solutions aimed at supporting maternal

and fetal care delivery. This system is integrated closely with PHC services. Using Primagravida, pregnant women can record and display their health history, receive feedback from midwives, and access educational content in text articles or videos. The study aimed to evaluate the usability and user satisfaction of using Primagravida.

METHODS

This research is a descriptive quantitative study with a cross-sectional design. The research was carried out between June - October 2021 in the working area of Kalibawang PHC, Kulon Progo. System usability and user satisfaction were measured in this study. The study received an ethical clearance letter from the Medical and Health Research Ethics Committee, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, with the letter KE/FK/1033/EC/2021.

Research participants were recruited using total sampling with inclusion criteria: pregnant women registered for antenatal care in Kalibawang PHC, willing to participate and have a personal smartphone with an Android operating system. Participants were recruited through public announcements from the PHC and midwives. Prior to participating in this research, research participants received a research procedure explanation and provision of informed consent. Once the participant's consent was retrieved, midwives and field assistants guided pregnant women through the registration and system feature introduction.

Midwives and field assistants facilitate discussions about the system utilization and pregnancy health topics through the WhatsApp group to maintain participant engagement. Since August 2021, as the government restriction was lifted, midwives and field assistants visited community centers to introduce Primagravida to research participants. Activities carried out during the visit were training on the use of the application and a general discussion session. Asynchronous assistance continued to be provided for the participants until the research's end.

System usability and user satisfaction questionnaire were distributed to the research participants. Both digital and printed versions of the questionnaire were provided for the evaluation. During the virtual supervision session, research participants access the evaluation directly from the Primagravida application. The paper-based evaluation was given to attending community center participants, guided by midwives and research assistants.

The usability of the Primagravida application in this study was evaluated using the Indonesian version of the System Usability Scale (SUS).[8] SUS comprises 10 statement items with a Likert scale (5 strongly agree - 1 strongly disagree). The adapted SUS version has passed the cross-cultural adaptation and reliability test. The Cronbach's Alpha of the adapted version of SUS was 0.841[6]. According to various studies, SUS is valid and reliable.[9,10] Evaluation of user satisfaction in this research was adapted from End User Computing Satisfaction (EUCS). EUCS instrument has been validated and widely used to evaluate systems in various fields.[11,12] The instrument has five dimensions: content, accuracy, format, ease of use, and timeliness.

Univariate analysis was conducted to summarize demographic data such as age, gender, education level, occupation, number of childbirth, and pregnancy status. The system Usability Scale (SUS) consists of 10 items (5 items each for favorable and unfavorable). The user satisfaction instrument consists of five domains: content, accuracy, format, ease of use, and timeliness. Those variables were also presented and analyzed using frequency distribution tables.

RESULT

Seventy-nine respondents participated in this research. Based on Table 1, the study discovered that the average age of the research participant was 29,02 years old. The majority of the research participants are high school graduates and unemployed. Pregnancy status varies among the participants, from the first time to the sixth time of pregnancy. Maximum of four childbirth identified from the

participant. A detailed demographic profile of the research participants is provided in Table 1.

The average System Usability Scale score from this research was 73. The highest recorded SUS score was 100, while the lowest reported scale was 45 (Table 2). Thirty-six research participants acknowledged that the system's usability was above the average score (Table 3).

Based on the End-User Computing Satisfaction (EUCS) evaluation, study participants were highly satisfied with the dimension of application content, followed by ease of use and timeliness (Table 4). Least satisfactory experience was discovered from the format of the application.

DISCUSSION

The majority of the respondents reported high system usability and user satisfaction. Features of the application support pregnant women in tracking their pregnancy health during the pandemic. The remote monitoring system allows participants to keep in touch with primary

Table 1. Research participant's demographic profile (n=79)

Attribute	n
Age	
Mean (SD)	29,02(5,87)
Min	19
Max	45
Education	
Undergraduate	13
High School	54
Secondary School	11
Elementary School	1
Occupation	
Civil Servant	1
Farmer/ Labor	6
Entrepreneur	13
Others	16
Unemployed	43
Number of Childbirth	
Min	0
Max	4
Status of Pregnancy	
Min	1
Max	6

Table 2. SUS Evaluation Result (n=79)

	Mean (SD)	Min	Max
SUS Score	73 (11,14)	45	100

Table 3. SUS Item Analysis (n=79)

SUS Item No	Mean	Min	Max
I1	3,51	1	5
I2*	2,52	0	4
I3	3,56	2	5
I4*	2,27	0	4
I5	3,44	1	5
I6*	2,56	0	4
I7	3,27	1	5
I8*	2,53	0	4
I9	3,32	1	5
I10*	2,2	0	5

*Items 2, 4, 6, 8 and 10 are unfavorable.

Table 4. Users' Satisfaction based on EUCS domains (n=79)

Domain	SD	D	N	A	SA
Content	0 (0%)	0 (0%)	1 (1,27%)	50 (63,29%)	28 (35,44%)
Accuracy	1 (1,27%)	0 (0%)	2 (2,53%)	52 (65,82%)	24 (30,38%)
Format	0 (0%)	0 (0%)	6 (7,59%)	54 (68,35%)	19 (24,05%)
Ease of Use	0 (0%)	0 (0%)	2 (2,53%)	55 (69,62%)	22 (27,84%)
Timeliness	1 (1,27%)	0 (0%)	2 (2,53%)	57 (72,15%)	19 (24,05%)

SD: strongly disagree, D: disagree, N: neutral, A: agree, SA: strongly agree

health care maternal services while limiting the risk of exposure to the virus. In this regard, participants were empowered to take an active role in promoting their health and wellness.

Usability is defined as the proficiency of a system to facilitate users in achieving desired goals in a specific context.[13,14] Average score from the evaluation was 73. A score above 68 is considered highly usable. The SUS item analysis discovered that system complexity, technical support, inconsistency, and simplicity need to be improved.

User satisfaction with an application is defined as the disclosure between expectations and experience provided by an individual.[11] Users' satisfaction may also be expressed as a response and feedback from clients after using the information system.[15,16] In terms of system development, user satisfaction is acknowledged as one of the success barometers of an application. Experience and services provided by an application affect users' satisfaction with the information system.

In this study, the following aspects are attributable to a lower score of unfavorable items compared to the favorable items: (1) It was the absolute first-time experience of the participants in using the application, (2) The majority of the participants were graduated from senior high school that

might influence the result due to their prior knowledge, (3) The participants living from rural areas with limited access to healthcare, (4) low digital literacy and troubleshooting abilities led to poor app utilization.

Content evaluation of an application appraises the system by analyzing functions and modules used by users, including information generated by the system.[17] The level of conformity of the information for the users needs to be validated. A total of 98.73% of the research participants were satisfied with this dimension. Research participants appreciated Primagravida system acceptability, ease of use, and feature integration. Users also indicated that to be confident using this system requires little effort for adaptation and no prior knowledge.

The accuracy dimension measures satisfaction regarding the system's precision in receiving input, analyzing the data, and generating results.[18] Error episodes and frequency in the data processing indicate system accuracy. Features of the Primagravida application that rely on system accuracy include body weight recording, dietary intake, and supplement consumption documentation. 52 of 79 research participants agreed on the accuracy, while 24 of the total sample strongly agreed with this dimension.

An application that displays accurate information indicates a high-quality system and positively contributes to general satisfaction.[15,16]

As user interface (UI) and user experience (UX) became fundamental aspects of user satisfaction, optimizing the system is important for the interactivity and perception of utility. Evaluation of UI and UX in EUCS included in format dimension. Format measures appearance and system interface in fulfilling users' needs.[19,20] Despite 92.40% of research participants reporting satisfactory experience, the Primagravida format needs to be enhanced. Positive experiences may engage users closely and allow developers to define tailored customer journeys by leveraging the quality of the information system.

Another dimension associated with user satisfaction with information systems is the ease of use. The dimension includes ease of learning, ease of operation, and user's independence.[17,21] Around 97.4 of the research participants reported high satisfaction from this dimension. The application's ease of use significantly influences the general user experience and enhances user satisfaction.[22,23]

Timeliness measures user satisfaction in terms of the response time of a system in presenting required data and information.[24,25] Users were predominantly unaware of the interaction between text, graphics, animation, network connection, and device performance. End-users demand just-in-time responses from the system, neglecting other factors that may alter the application's robustness. In this dimension, 76 of 79 research participants were satisfied with the Primagravida timeliness. Major problems experienced by users associated with the application response related to network coverage. As Kalibawang district is situated in a hills area, bandwidth and the internet speed depend on the distance to the signal transmitter.

The results of this study have limited transferability and generalizability because it was conducted in one remote location. Despite the Primagravida application being perceived as acceptable and easy to learn among users, a more in-depth evaluation is further recommended.

The SUS was originally developed as a simplified instrument for quick and shallow evaluation. Further study is recommended to employ rigorous and comprehensive system evaluation methods.

The current study has discovered that the end users appreciated Primagravida. The intended audience perceived that the system was instrumental in pregnancy monitoring. Nevertheless, usability problems were the major barrier identified in this study. Continuous system development, with users centered approach, is necessary. It was demonstrated that workable solutions for remote healthcare services potentially encourage users to improve their health.

CONCLUSION

This research evaluated a remote pregnancy monitoring application's usability and user satisfaction. Primagravida is highly usable based on the System Usability Scale, while application users reported satisfaction with content, accuracy, format, ease of use, and timeliness. Continuous system development is essential in expanding the application benefit for the greater population.

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CONFLICT OF INTERESTS

There is no conflict of interest, such as any financial, professional, or personal relationships that are relevant to the submitted work.

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REFERENCES

1. Moller A, Patten JH, Hanson C, et al. Monitoring maternal and newborn health outcomes globally: a brief history of key events and initiatives. Tropical Medicine & International Health 2019; 24: 1342–1368. https://doi.org/10.1111/tmi.13313

2. Dinas Kesehatan Provinsi DIY. Profil Kesehatan Daerah Istimewa Yogyakarta Tahun 2021. 2021.

3. World Health Organization. Indonesia: WHO Coronavirus Disease (COVID-19). Website, https://covid19.who.int/region/searo/country/id (2022, accessed 2 October 2021).

4. Direktorat Jenderal Pencegahan dan Pengendalian Penyakit. PEDOMAN PENCEGAHAN DAN PENGENDALIAN CORONAVIRUS DISEASE (COVID-19). 4th ed. Jakarta: Kementerian Kesehatan RI, 2020.

5. Sierpina VS. The impact of COVID-19 on medical education. Explore 2020; 000: 8307. https://doi.org/10.1016/j.explore.2020.06.009

6. van den Broucke S. Why health promotion matters to the COVID-19 pandemic, and vice versa. Health promotion international 2020; 35: 181–186. https://doi.org/10.1093/heapro/daaa042

7. Nakayama A, Takayama N, Kobayashi M, et al. Remote cardiac rehabilitation is a good alternative of outpatient cardiac rehabilitation in the COVID-19 era. Environ Health Prev Med 2020; 25: 4–9. https://doi.org/10.1186/s12199-020-00885-2

8. Sharfina Z, Santoso HB. An Indonesian adaptation of the System Usability Scale (SUS). 2016 International Conference on Advanced Computer Science and Information Systems, ICACSIS 2016 2017; 145–148. https://doi.org/10.1109/ICACSIS.2016.7872776

9. Peres SC, Pham T, Phillips R. Validation of the system usability scale (sus): Sus in the wild. In: Proceedings of the Human Factors and Ergonomics Society. 2013, pp. 192–196. https://doi.org/10.1177/1541931213571043

10. del Rocio Sevilla-Gonzalez M, Loaeza LM, Lazaro-Carrera LS, et al. Spanish version of the system usability scale for the assessment of electronic tools: Development and validation. JMIR Hum Factors; 7. Epub ahead of print 1 October 2020. DOI: https://doi.org/10.2196/21161

11. Doll WJ, Deng X, Raghunathan TS, et al. The Meaning and Measurement of User Satisfaction: A Multigroup Invariance Analysis of the End-User Computing Satisfaction Instrument. http://dx.doi.org/101080/07421222200411045789 2014; 21: 227–262.

12. Aggelidis VP, Chatzoglou PD. Hospital information systems: Measuring end user computing satisfaction (EUCS). J Biomed Inform 2012; 45: 566–579. https://doi.org/10.1016/j.jbi.2012.02.009

13. U.S General Services Administration. System Usability Scale (SUS) | Usability.gov, https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html (2021, accessed 2 January 2022).

14. Cayola L, Macías JA. Systematic guidance on usability methods in user-centered software development. Inf Softw Technol 2018; 97: 163–175. https://doi.org/10.1016/J.INFSOF.2018.01.010

15. Hartson R, Pyla PS, Johnson J, et al. User Satisfaction - an overview | ScienceDirect Topics, https://www.sciencedirect.com/topics/computer-science/user-satisfaction (2021, accessed 2 November 2021).

16. Vaezi R. User Satisfaction with Information Systems: A Comprehensive Model of Attribute Satisfaction. 2013. http://hdl.handle.net/10657/407

17. Tarricone R, Petracca F, Ciani O, et al. Distinguishing features in the assessment of mHealth apps. Expert Rev Pharmacoecon Outcomes Res 2021; 21: 521–526. https://doi.org/10.1080/14737167.2021.1891883

18. Jake-Schoffman DE, Silfee VJ, Waring ME, et al. Methods for evaluating the content, usability, and efficacy of commercial mobile health apps. JMIR Mhealth Uhealth; 5. Epub ahead of print 1 December 2017. DOI: 10.2196/mhealth.8758. https://doi.org/10.2196/mhealth.8758

19. Fitriantoro MJ, Husnah N. The Implementation of the End-User Computing Satisfaction Model into SCeLE: A Study of the Undergraduate Program of the Accounting Department in Universitas Indonesia. 2018. https://doi.org/10.2991/iac-17.2018.27

20. Prastyo E, Budiyanto CW, Yuana RA. Measuring mobile applications user's satisfaction: A closer look into the appropriate information systems user's satisfaction. IOP Conf Ser Mater Sci Eng 2021; 1098: 042002. https://doi.org/10.1088/1757-899x/1098/4/042002

21. Anggara R, Budiyanto CW, Hatta P. Comparison between TAM, EUCS, TTF analysis to evaluate user acceptance for conference management system. In: AIP Conference Proceedings. American Institute of Physics Inc., 2019. Epub ahead of print 18 December 2019. DOI: https://doi.org/10.1063/1.5139737

22. Garg S, Sharma S. User Satisfaction and Continuance Intention for Using E-Training: A Structural Equation Model. Vision 2020; 24: 441–451. https://doi.org/10.1177/0972262920926827

23. Xu F, Du JT. Factors influencing users' satisfaction and loyalty to digital libraries in Chinese universities. Comput Human Behav 2018; 83: 64–72. https://doi.org/10.1016/j.chb.2018.01.029

24. Amin M, Rezaei S, Abolghasemi M. User satisfaction with mobile websites: the impact of perceived usefulness (PU), perceived ease of use (PEOU) and trust. Nankai Business Review International 2014; 5: 258–274. https://doi.org/10.1108/NBRI-01-2014-0005

25. Ghanifia A, Amalia R, Nugroho A, et al. The Relationship Between Perceived Ease of Use, Perceived Usefulness and Perceived Loss of Control with User Satisfaction in Mandatory Setting. 2021. https://doi.org/10.2991/aebmr.k.210928.034