Usability assessment using m-Health app usability questionnaire on the iPosyandu application in Central Sulawesi

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ABSTRACT

The iPosyandu mobile application is one of the android-based smartphone applications that contains information about the growth and development of babies/toddlers and about pregnancy as an effort to reduce maternal mortality rate (MMR). This study's objective is to evaluate the usability of the iPosyandu mobile application and offer modifications to increase its reusability. The study was conducted on 88 pregnant women at the Lere Health Center and Kinovaro Health Center which were divided into 44 people from signaling areas and 44 people from signal-difficult areas using mixed method research with an explanatory sequential design. The m-Health app usability questionnaire (MAUQ) is employed in the quantitative stage, whereas the focus group discussions (FGD) approach is used in the qualitative stage. The calculation of the MAUQ score in this study showed that each statement item contained in 3 variables or aspects in the MAUQ questionnaire got a good score with a total average scale of 6.26 (89.41%) in the signaled area and 6.29 (89.81%) in the signal-difficult area where the score was >4. There are still some barriers to using the program, thus enhancements must be done to increase user comfort.

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1. INTRODUCTION

The development of digital communication technology has an impact on various sectors of life [1]. The World Health Organization (WHO) states that the use of digital technology, has become a prominent area of practice to meet health needs [2]. The results of the survey conducted by the Association of Indonesian Internet Service Providers (APJII), internet users in Indoniyesia in 2019-2020 amounted to 196.71 million people, equivalent to 73.7% of the total Indonesian people at that time. Pregnancy in a mother is a process of special concern, so it is essential for every pregnant woman to have knowledge about pregnancy [3]. Maternal mortality rate (MMR) due to complications of pregnancy and childbirth can be prevented through antenatal care (ANC) [4].

Several pregnant women in Indonesia have utilized ANC services inconsistently with the guidelines. The coverage of antenatal visits is below the minimum standard, indicating that pregnant women do not adhere to the recommended guidelines [5]. Nationally, the indicator for antenatal visit coverage has reached its target, however 17 provinces, including Central Sulawesi, have not reached it. The coverage of antenatal care K4 pregnant women visits from the Family Health Section in 2021 decreased by 78.2% compared to the 90.5% coverage in 2020, according to the data. Several factors contribute to the low number of antenatal care K4 visits, including the fact that not all pregnant women visit Pure K1 and the suboptimal implementation of the pregnancy planning and complication prevention program (its called P4K) [5], [6].

To improve antenatal care, the use of technology permits the dissemination of information to pregnant women. Utilization of the m-Health application improves the health of mothers and babies by increasing knowledge about pregnancy care and influencing pregnant women's attitudes and behavior [7]. m-Health is a solution for the current problem of inequitable distribution of health services in Indonesia in a digital context [8]. Through m-Health, the community can receive health information and services without having to interact in-person with medical personnel, thereby minimizing limited access and costs. In fact, however, the implementation of the m-Health application is not as straightforward as anticipated and planned. It is believed that the program designed to facilitate access to public services has not been well received by the community due to a variety of obstacles and reasons [9]. The iPosyandu application is an android-based smartphone innovation developed by the Faculty of Medicine, Padjadjaran University since 2016 to increase knowledge about pregnancy care, influence attitudes, and promote behavioral changes among pregnant women [10], [11]. As a pilot project area, Purwakarta Regency has begun actively utilizing the iPosyandu application [11].

The development of an application must be carried out by paying attention to the reusability factor from the end-user side [12] [13]. However, the reusability of the iPosyandu application developed at this time is unknown from the user's perspective, especially when the application is used in unsignaled areas. Perceived ease of use influences the intention to use the application [14]. Because the iPosyandu mobile application can provide so many benefits, particularly for pregnant women, it is important to evaluate the application's usability so that it can be utilized correctly by users and its benefits can be realized effectively. The MAUQ is used to assess usability which includes ease of use, interface, satisfaction, and usability of mhealth applications [15], [16].

2.   RESEARCH METHOD

This study uses a mixed method research with sequential explanatory essay, which is a combination research method that begins with the collection of quantifiable data and then continues with the collection of quality data [17]. The research has received approval from the Health Ethics Committee of the Faculty of Medicine, Padjadjaran University with ethics number 817/UN6. KEP/EC/2022 and a license from the Central Sulawesi Provincial Health Office. The research site was carried out in Palu Barat District for the signaled area and Kinovaro District for the unsignaled area. West Palu Subdistrict is a working area of Puskesmas Lere consisting of three villages, namely Silae Village, Kabonena Village and Lere Village. Kinovaro Subdistrict is the working area of the Kinovaro Health Center including Porame Village, Balane Village, Uwemanje, Rondingo Village, Pobolobia Village, Kayumpia Village, Doda Village, Daenggune Village, Kalora Village, and Kanuna Village. This research was conducted from August 22 to September 5, 2022.

Respondents consisted of 12 pregnant women for the focus group discussion (FGD) and 88 pregnant women for the survey, 44 pregnant women each living in signaled and unsignaled areas using purposive sampling. In each FGD, the number of subjects consisted of 6 people with the consideration that there was representation from each MAUQ score, whether high, medium, or low. Qualified informants will then be selected based on the location of residence closest to the FGD location by looking at the informant biodata that has previously been filled in. The criteria for quantitative stage respondents are pregnant women recorded in the registration of Puskesmas Lere for signaled areas and Kinovaro Health Center for unsignaled areas, willing to be a respondent by filling in informed consent, being able to read and write, and having and being able to operate a smartphone that does not support with applications were excluded from the research. Furthermore, at the qualitative stage, the inclusion criteria were pregnant women who have filled out the MAUQ questionnaire with predetermined value acquisition criteria and can communicate well, while pregnant mothers who are not willing to participate in focus group discussions (FGD) were excluded.

Pregnant women use the iPosyandu application for seven days. Then the application usability was assessed using the Indonesian version of the MAUQ questionnaire which had an alpha cronbach reability of 0.855. The questionnaire consists of 3 subscales, namely ease of use (5 items), display and satisfaction (7 items), and usability (6 items). The answer to each statement uses a likert scale with 7 levels of assessment results i.e., 1 strongly disagree, 2 disagree, 3 somewhat disagree 4 neutral, 5 somewhat agree, 6 agree, and 7

strongly agree [18]. In the qualitative method, the project is determined by a purposive sampling system based on the MAUQ questionnaire category, which is selected from pregnant women who get high, medium, and low MAUQ scores in each area (signaled and unsignaled) for further FGD. This FGD method uses open-ended questions with interview guidelines as a guide.

Quantitative data processing and analysis in this study used descriptive statistics and inferential statics with Microsoft Excell software version 2021 and SPSS Version 28. The data normality test was performed to determine whether the data obtained from the normally distributed population or not were calculated using the Kolmogorov-Smirnov test on SPSS v.28.0. If the data are normally distributed, then this hypothesis test is carried out using the formula "Z-test", because the sample is >30 with α=0.05 (CI 95%). However, if it is known that the data is not normally distributed, the hypothesis test will be carried out using a nonparametric k test, namely the Mann Whitney test. p<0.05 indicates a significant difference. The qualitative data analysis technique used is thematic analysis which includes the process of identifying, coding, and categorizing data. This quality research uses a phenomenological approach, which tends to look at data thematically to extract the essence and essence of participants meanings [19]. These analytical steps are carried out by identifying important statements, creating units of meaning, grouping themes, advancing texture and structural descriptions, and ending with a combined description of the texture and structural descriptions with a complete description of the important structures (or essences) of the experience, providing clearly articulated procedures for organizing the report [20].

3.   RESULTS AND DISCUSSION
3.1. Exploratory step 1 with questionnaire

Step 1 exploratory data as demographic data. The usability rate of the iPosyandu application was assessed with the Indonesian version of the MAUQ questionnaire. The demographics data is shown in Table 1.

Based on the age, it was shown that respondents in this study were dominated by mothers with an age range of 20-35 years in each group, namely the signaling area of 32 people (72.73%) and the difficult area of signal 32 people (72.3%). Furthermore, in the last category of education, respondents with high school education had the most number in the two groups. Each group consisted of 21 people (47.3%) in the signaling region and 20 people (45.4%) in the signal-hard region. The occupational category is dominated by housewife with 29 people (65.91%) in the signaled area group and 22 people (50.00%) in the unsignaled area group. The highest number of children was 0-2 children consisting of 33 people (75.00%) in signaled areas and 29 people (65.91%) in unsignaled areas. The religions adopted in both groups were dominated by respondents who were Muslim, namely 35 people (79.55%) in signaled and 22 people (50.00%) in unsignaled areas. The values of the m-Health app usability questionnaire (MAUQ) questionnaire are shown in Table 2.

Table 1. Demographics data

Characteristic	Group				Total	
	Signaled area		Unsignaled area			
	n=44	%	n=44	%	n=88	%
Age group						
<20	3	6.82	4	9.09	7	7.95
20–35	32	72.73	32	72.73	64	72.73
>35	9	20.45	8	18.18	17	19.32
Final education						
Elementary school	2	4.55	9	20.45	11	12.50
Junior	8	18.18	12	27.27	20	22.73
Senior high school	21	47.73	20	45.45	41	46.59
College	13	29.55	3	6.82	16	18.18
Work						
Housewife	29	65.91	22	50.00	51	57.95
Civil servants	5	11.36	0	0.00	5	5.68
Self employed	3	6.82	1	2.27	4	4.55
Private employees	4	9.09	3	6.82	7	7.95
Laborer	2	4.55	4	9.09	6	6.82
Farmer	1	2.27	14	31.82	15	17.05
Number of children						
0-2	33	75.00	29	65.91	62	70.45
3-5	11	25.00	13	29.55	24	27.27
>5	0	0.00	2	4.55	2	2.27
Religion						
Islam	35	79.55	22	50.00	57	64.77
Christian	7	15.91	21	47.73	28	31.82
Hindu	2	4.55	1	2.27	3	3.41

Table 2. MAUQ score calculation

Statement	Signaling region			Difficult signal regions		
	Average scale	%	Category	Average scale	%	Category
Ease of use variables	6.17	88.12	Keep	5.78	82.53	Keep
1 The app is easy to use	6.11	87.38	Keep	5.45	77.92	Keep
2 Easy for me to learn how to use the app	6.16	87.99	Keep	5.82	83.12	Keep
3 The instructions in the application make it easier for me to switch pages	6.16	87.99	Keep	5.52	78.90	Keep
4 All parts in the application I can use (such as entering information, responding to reminders, viewing information)	6.20	88.64	Keep	5.59	79.87	Keep
5 When I use the wrong application, I can easily restore it to its original state	6.20	88.64	Keep	6.50	92.86	Keep
Display and satisfaction variables	6.22	88.82	Keep	6.64	94.86	Keep
6 I liked the look of the app	6.45	92.21	Keep	6.80	97.08	Keep
7 The information that is applied is well arranged so that it makes it easier for me to get the information I need	6.25	89.29	Keep	6.73	96.10	Keep
8 The application provides adequate information about the progress of my actions	6.00	85.71	Keep	6.25	89.29	Keep
9 I feel comfortable using this app everyday	6.11	87.34	Keep	6.59	94.16	Keep
10 The amount of time it takes to use this app is already appropriate for me	6.02	86.04	Keep	6.73	96.10	Keep
11 I want to use this app again	6.32	90.26	Keep	6.75	96.43	Keep
12 Overall, I am satisfied using this app	6.36	90.91	Keep	6.41	91.56	Keep
Usability variables	6.39	91.29	Keep	6.44	92.05	Keep
13 This app will be useful for my health and well-being.	6.55	93.51	Keep	6.64	94.81	Keep
14 This app improved my access to healthcare	6.30	89.94	Keep	6.66	95.13	Keep
15 This app helps me in managing health efficiently	6.32	90.26	Keep	6.57	93.83	Keep
16 The app has all the functions and capabilities I expected	6.41	91.56	Keep	6.27	89.61	Keep
17 I can use the app even if there is no internet network	6.32	90.26	Keep	5.89	84.09	Keep
18 This application provides an easy way to receive health services, obtain health education, monitor my skills and conduct assessments independently	6.45	92.21	Keep	6.64	94.81	Keep
Total	6.26	89.41	Keep	6.29	89.81	Keep

The group that had a high MAUQ score category in respondents living in the signaled area was 9 people (18.2%) while in the unsignaled the signal was only 1 person (2.3%). For the moderate score category, there was 29 people (65.9%) in signaled area and 38 people (86.4%) in unsignaled area. The low score category in the signaled area was 7 people (15.9%) while in the unsignaled area was 5 people (11.4%). If calculating the overall average score in both signaled and unsignaled area, the most scores are in the moderate category, which is 6.26 (89.41%) for signaled area and 6.29 (89.81%) for unsignaled area.

3.2. Explanation of application usability

Based on the output of T test group statistics, it was determined that the total number of signaled areas was 44 and the number of unsignaled area was 44. The average signaled area acquisition was 112.57, and the average unsignaled area was 113.23. According to the outcomes results, there is a difference between the average value of the signaled area and the unsignaled area groups. For additional information, please refer to the Table 3. The information obtained from the interview results through the FGD is then transcribed and continued the coding process, categories as well as determining the theme and recommendations for improvement in Table 4 and Figure 1 (see in Appendix).

The potential for innovation in the field of digital technology in the health sector is very large. Mobile health is an innovation and advancement in electronic medical technology that is expected to affect all levels of society [21]. The use of information media is very influential on the delivery of health messages. Previous research results suggest that mobile phones will be an approach to providing support to pregnant women from low socioeconomic levels in middle-income countries, as most women interviewed said it was easier to access communication via mobile phones [22].

The iPosyandu application is an innovation in the health sector in the form of mobile technology that provides an easy way to receive health services, obtain health education, monitor the growth and development of toddlers, and conduct independent assessments. During pregnancy and in preparation for motherhood, many women seek information and try to implement a healthy lifestyle by utilizing digital resources. Collectively, pregnancy apps have been downloaded hundreds of millions of times and are an integral source of information for many expectant mothers [23].

Table 3. Comparison of iPosyandu application usability in signaled and unsignaled areas

		Independent samples test						
		Levene's test for equality of variances		T-test for equality of means				
		F	Sig.	t	df	Sig. two Sided-p	Mean difference	Std. error difference
Results of the MAUQ questionnaire	Equal variances assumed	1.369	.245	.405	86	.687	-.659	1.628
	Equal variances not assumed			.405	85.003	.687	-.659	1.628

Table 4. Thematic distibution

Theme	Category	Coding
Ease of use		
	Registration	Registration difficulties
		Registration repeats itself
		Fill in the registration data
	Use	Easy to use
		Not convoluted
		Time is already efficient
	Bugs in the application	Chat repeats itself
		Frequent errors
		Less responsiveness
	Assisting with emergencies	Midnight complaint
		Explanation of the complaint
	Interaction with midwives	Direct contact with midwives
		Explanation of information from the midwife
Display and satisfaction	Theme customization	Attractive view
		Can change the background
		Light color
	Additional features	Incomplete features
		Features not working
		Educational Image and Video Features
		Audio Features
		App chat features
Uses	Health service information	Types of checks
		Examination time
		Complaints of pregnant women
	Maternal health education	Recognizing the signs of childbirth
		Food recommendations
		Can be used online
		Can be used offline
	Network connectivity	No data plan
		Difficult signals
		Using wifi

Usability is an important aspect in assessing the quality of an interface that will be used by users about how one can use a product as a tool to perform, simplify and support everyday tasks. Zhou *et al*. developed and validated a more precise MAUQ, which is intended specifically for m-Health applications. This MAUQ can assess the ease of use, interface, satisfaction, and usability of the m-Health application to the end user (either patient or healthcare provider) and the type of interaction between the patient and the healthcare provider (standalone or interactive) [15], [16].

Ease of use is an aspect of technology that combines with other aspects that make up the technology. It can be said that usability is the ease of use of a technology from the point of view of the user of the technology [24]. The iPosyandu application provides an easy way to receive health services, obtain health education, monitor activities, and conduct assessments independently [25]. In addition, the ease of use aspect is important in influencing the user's intention to continue using the application, this has been explained in previous studies where there was a direct and significant influence on the perception of ease of use on the intention to use the application. Usefulness can be interpreted as the extent to which a person believes that using a certain system will improve his ability or performance means that the perception of benefits is a step where users believe that using a technological system can improve performance and work performance [26].
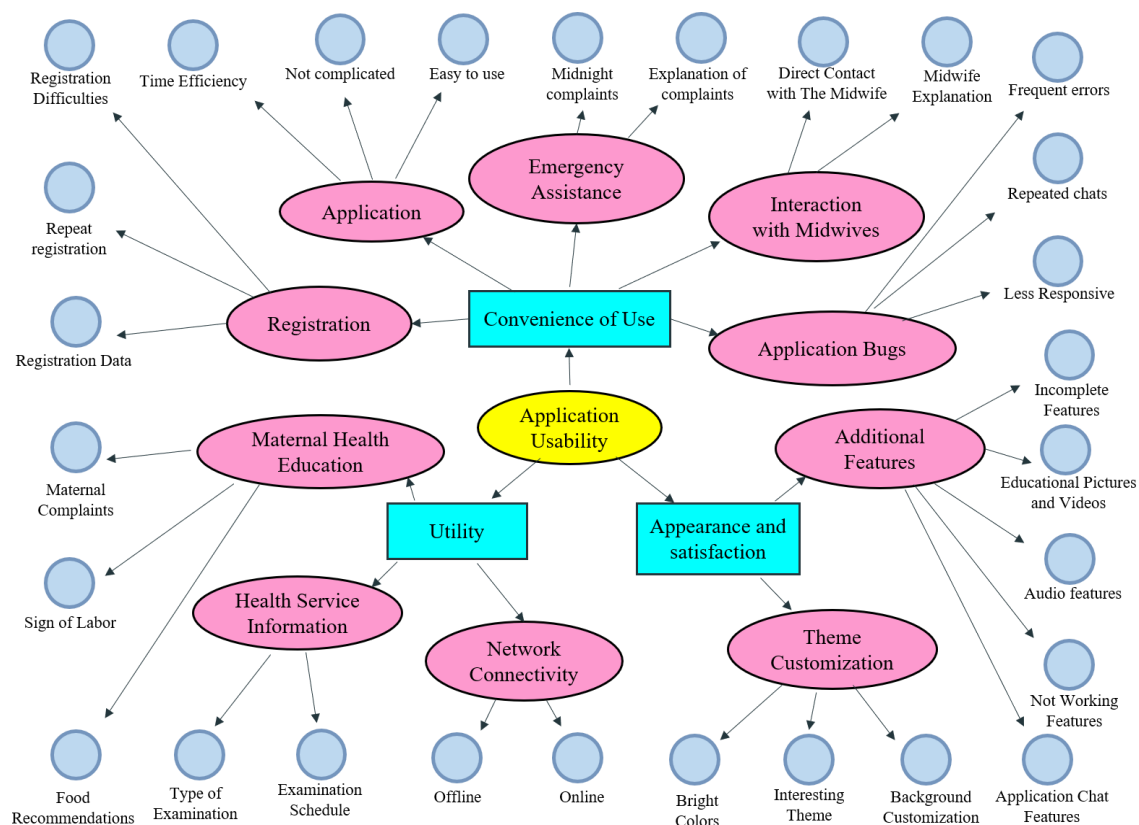
Figure 1. Concept framework for improvement recommendations

User interface (UI) or user interface display is an important part of a system or application. The UI is part of the system used to interact directly from the user. Therefore, the design of the UI is one of the influential attractions, especially for a mobile application. Video and audio informations make it easier for users to understand them as it is a visual message that can be played back and listened to as often as the user wants. Media, such as videos, make mothers more interested in listening to information according to the problems they face [27]. This is in line with previous research, that visual power is an important thing that influences marketing strategies to attract users. Therefore, UI design must be aesthetically pleasing and keep up with visual style trends so that users get comfort, convenience, and sustainability in using mobile applications [28].

A product can be said to be useful if failures in its use can be eliminated or minimized and provide benefits and satisfaction to users [29], [30]. The iPosyandu application is currently being developed in order to provide satisfaction and benefits for its users. Information and knowledge related to pregnancy is very necessary for women who are just experiencing this phase, based on previous research that states that the use of m-Health as a health promotion strategy is expected to be able to facilitate important and accurate information, reaching healthy individuals but not regular contact to health services [31]. Based on this, the iPosyandu application can be a medium for health promotion, especially for pregnant women. This is inline with previous studies that reported on the performance of mobile applications for pregnant women have benefits related to providing knowledge, changing behavior, and can increase the number of antenatal visits, because it can serves as a reminder for medication adherence, provides treatment instructions, and answers questions commonly asked by pregnant women [31]–[33].

In terms of improving the effectiveness of services, mobile health can improve maternal and infant health in services, making it easier for health workers to reach and access patient data in real-time, faster and more efficiently and improve complication detection and timely referral to treatment facilities. Users are more comfortable using m-Health in finding health information. This is because m-Health-based apps are prioritized to improve access to health services for high-risk pregnancies to improve emergency response and to address changing patient habits and the way they seek accurate health information [34].

One of the benefits of m-Health is a medium that can be used to support remote health care between patients and medical personnel, so that its can be a solution to the problem of limitations due to geographical conditions in an area. In addition, m-Health has been shown to influence economic factors to reduce health

costs [27]. For certain regions with low connectivity issues, its can be very difficult to access application updates and sync them to the server. Currently, the iPosyandu application can be used offline so that users can obtain the necessary data and information anywhere and anytime. This has been reported in previous studies, developing an messenger version, an offline version was developed to address the problem of low connectivity in some areas while an online version to document more detailed and complex Posyandu data is underway [35].

4.   CONCLUSION

The iPosyandu mobile application is good in ease of use, appearance, and satisfaction as well as usability based on the m-Health app usability questionnaire (MAUQ) score. The most problems experienced by informants when operating the iPosyandu mobile application include informants still having difficulty in the registration process, informants also experience problems when they want to register family member data. Then there is still an error when the application is used such as repeated commands. Then the problem of displaying educational images and videos that are still lacking, as well as the absence of audio menu options on the iPosyandu application makes informants feel that this application still has shortcomings. The iPosyandu application is also not accompanied by a setting menu option for color changes in the application background.

Recommendations given to overcome problems in the iPosyandu mobile application include adding writings that show the description and differentiating the list page or creating an account by logging in to the application so that informants are not confused, reviewing the application's display design to make it more attractive accompanied by colors, images and educational videos that are easy to understand. Add audio to the app to make it easier for informants when using the app. It is necessary to make improvements to the midwife chat menu so that there are no repeated errors or commands, so that respondents are not saturated. Midwife chat should still be done in the iPosyandu application menu without having to move to whatsapp so that respondents who live in difficult signal areas or who do not have internet data can still communicate with the midwife to get information about their pregnancy.

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