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Development and preliminary evaluation of the am akbidmanna mobile application for pregnancy education and monitoring in Darat Sawah Village, South Bengkulu

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ABSTRACT

Maternal mortality in Indonesia remains above the global target, while pregnant women in rural areas may experience limitations in access to pregnancy information and continuous monitoring. Although previous studies have reported potential benefits of mobile health applications for pregnancy-related knowledge and independence, evidence regarding locally developed applications that integrate pregnancy education, monitoring, and danger-sign information for pregnant women in rural Indonesian communities remains limited. This study aimed to develop the AM AkbidManna mobile application for pregnancy education and monitoring in Darat Sawah Village, South Bengkulu, and to preliminarily evaluate its content feasibility, media feasibility, usability, and changes in pregnant women's self-reliance scores. An application development study followed by a pre-experimental one-group pretest–posttest evaluation was conducted among 10 pregnant women selected through total sampling. User needs were identified through interviews with pregnant women, midwives, and community health volunteers, followed by application development, content and media validation, usability testing using the System Usability Scale (SUS), observation of application-use tasks, and measurement of self-reliance before and after application use. Content feasibility was 84.50% (very feasible), media feasibility was 78.00% (feasible), and the mean SUS score was 73.75 (acceptable). The mean self-reliance score increased from 69.80 to 78.10, with a mean difference of 8.30 points and an N-Gain of 0.275 (low category; p = 0.002). All participants could open the application independently, but only seven of ten could independently identify pregnancy danger-sign information. These findings indicate that AM AkbidManna was feasible and usable as a complementary pregnancy education and monitoring medium, while the observed improvement in self-reliance should be interpreted cautiously because of the small sample, short evaluation period, and absence of a control group. Further comparative studies with larger samples are needed to determine its effectiveness and potential contribution to antenatal care outcomes.

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INTRODUCTION

Maternal mortality remains a global public health problem. In 2023, an estimated 260,000 maternal deaths occurred worldwide, with a global maternal mortality ratio (MMR) of 197 per 100,000 live births, nearly three times the Sustainable Development Goals (SDGs) target of fewer than 70 per 100,000 live births by 2030 (World Health Organization, UNICEF, UNFPA, World Bank Group, 2025). In Indonesia, the 2025 Intercensal Population Survey (SUPAS) recorded an MMR of 144 per 100,000 live births, down from 189 in the 2020 Population Census Long Form but still above that target (Badan Pusat Statistik, 2026).

Maternal deaths are closely related to delays in deciding to seek care, reaching a health facility, and receiving adequate treatment. The decision to seek care is influenced, among other things, by how mothers and families perceive the severity of a condition, while distance, cost, and quality of care are more prominent barriers in resource-limited settings. Knowledge of pregnancy danger signs among pregnant women and their families is therefore an important part of early detection (Tofure et al., 2026), (Thaddeus & Maine, 1994).

WHO (2016) recommends a minimum of eight antenatal contacts and positions education and communication as components of quality care. In Indonesia, antenatal care follows the national guidelines (Kementerian Kesehatan Republik Indonesia, 2020). In practice, rural pregnant women may face constraints of distance, time, cost, and availability of health workers, so information and monitoring between visits are often limited.

In Darat Sawah Village, the needs assessment identified several practical challenges related to pregnancy care, particularly the need for accessible information on pregnancy development, recognition of pregnancy danger signs, nutrition, and antenatal examinations. Pregnant women, midwives, and community health volunteers also identified the need for reminders, repeated access to information, simple navigation, and easier communication with midwives. These needs indicate that pregnant women require a complementary information and monitoring medium that can be accessed between face-to-face antenatal visits. Therefore, a locally adapted mobile application was considered relevant to support existing midwifery services rather than replace direct examination and professional care.

Mobile technology can potentially complement face-to-face care by providing information that can be accessed repeatedly. Evidence on its effectiveness is mixed: a systematic review of mobile app interventions during pregnancy concluded that firm conclusions could not be drawn because of the limited number of studies and the heterogeneity of interventions and outcomes (Daly, Horey, Middleton, Boyle, & Flenady, 2018), whereas a meta-analysis of randomized controlled trials of social media and mHealth app interventions reported a large effect on pregnancy-related knowledge (Chan & Chen, 2019). In Indonesia, a quasi-experimental study of the Ebumil application reported greater improvement in knowledge and independence among pregnant women than with leaflets (K. Kartini, F. Farming, 2025), and the M.D-Risti application was evaluated as an alternative for independent early detection of pregnancy risk (Suarayasa, Bangkele, Sumarni, Harun, & Bohari, 2021). WHO also provides a Digital Adaptation Kit for antenatal care as a reference for aligning digital systems with clinical recommendations (World Health Organization, 2021)

Despite the growing use of mobile health interventions during pregnancy, an important research gap remains. Previous studies have examined mobile applications primarily in relation to pregnancy knowledge, independence, or risk detection, while systematic reviews have reported heterogeneous interventions and insufficient evidence for firm conclusions. Limited evidence is available on locally developed applications that integrate pregnancy education, simple pregnancy monitoring, antenatal visit scheduling, examination records, danger-sign information, and

communication with midwives in a rural Indonesian community. Furthermore, the feasibility and usability of such an integrated application, together with its potential to support pregnant women's independent access to safety-related information, require further evaluation in specific local contexts. This study addresses this gap by developing and conducting a preliminary evaluation of AM AkbidManna among pregnant women in Darat Sawah Village.

The AM AkbidManna mobile application was designed for pregnant women in Darat Sawah Village, Seginim District, South Bengkulu Regency, combining pregnancy education materials with simple monitoring functions in a single application (Hernawati, 2025), (Aminah & Widyastuti, 2018). Its features include pregnant woman data, an antenatal visit schedule, examination records, pregnancy education, danger sign information, and access to a midwife's contact through WhatsApp. The application is positioned as a supporting medium, not a replacement for examination by health workers. This development is aligned with SDG 3 (good health and well-being). The effect of the application on antenatal visit adherence, complications, or maternal and infant outcomes was not measured in this study.

Because AM AkbidManna includes pregnant women's personal information and examination records, data confidentiality and privacy are important considerations in its implementation. In this study, confidentiality of participant information was maintained during data collection and research activities, while the application was intended as a complementary medium rather than a replacement for formal clinical records and professional assessment. The application should apply data minimization and restrict access to personal and examination information to authorized users. However, specific technical security mechanisms, including encryption, authentication, access control, and audit trails, were not evaluated in this preliminary study. Therefore, these security measures should be explicitly addressed and evaluated before wider implementation to ensure that personal and pregnancy-related health information is adequately protected.

This study aimed to develop the AM AkbidManna mobile application and to assess its content feasibility, media feasibility, usability, and changes in pregnant women's self-reliance scores after using the application.

RESEARCH METHOD

Study Design and Setting

This study comprised the development of a mobile application followed by feasibility and usability testing, and measurement of self-reliance using a pre-experimental one-group pretest–posttest design (Notoatmodjo, 2018). This design describes the change in scores within the same group before and after use of the application. The study was conducted in Darat Sawah Village, Seginim District, South Bengkulu Regency, on 8–23 September 2026

Population and Sample

The population was all pregnant women in Darat Sawah Village during the study period. The sample was selected by total sampling (Sugiyono, 2016) and comprised 10 pregnant women.: inclusion and exclusion criteria, e.g., gestational age, ownership of and ability to operate a smartphone, willingness to participate. Respondent characteristics (age, parity/gravidity, trimester, education). Content and media validation were performed by number and expertise of validators.

Application Development

The development stages comprised identification of user needs, preparation of education and monitoring materials, interface development, content validation, media validation, revision, and a usage test. User needs were explored through interviews with pregnant women, midwives, and community health volunteers (cadres) (10 informants). The materials covered pregnancy

development, danger signs, nutrition, antenatal examination, and care during pregnancy, with reference to materials from the Indonesian Ministry of Health and WHO.

Instruments

The instruments were (1) a content validation sheet and a media validation sheet, each with 10 aspects and a maximum score of 20 per aspect; (2) the 10-item System Usability Scale (SUS) (Brooke, 1996); (3) an observation sheet for five application usage tasks; and (4) a pretest–posttest questionnaire on pregnant women's self-reliance number of items, scale, source/adaptation, and validity and reliability results, e.g., Cronbach's alpha.

Data Analysis

Content and media feasibility were calculated as the percentage of the obtained score relative to the maximum score and categorized as very feasible (81–100%), feasible (61–80%), fairly feasible (41–60%), less feasible (21–40%), and not feasible (≤20%) cite the source of this categorization. SUS scores were calculated using the standard formula (range 0–100) and interpreted with reference to (Bangor, Kortum, & Miller, 2008) and (Tullis, T., & Albert, 2013). Change in self-reliance was analyzed as the difference between posttest and pretest means and as a mean-based N-Gain, i.e., (posttest mean − pretest mean)/(100 − pretest mean), with categories low (<0.30), moderate (0.30–0.70), and high (>0.70) (Hake, 1998). Normality of the score differences was tested with the Shapiro–Wilk test; the paired t-test was used if the data were normally distributed and the Wilcoxon signed-rank test if not, with a significance level of 0.05, using SPSS version 25.

Research Ethics

The study obtained ethical approval the number 020/203/IP/KPTSP/VIII/2026 appears to be a one-stop integrated service (KPTSP) permit; Sinta journals usually require an ethical clearance letter from a Health Research Ethics Committee — state the issuing committee and its number]. All respondents gave written informed consent before participating, and data confidentiality was maintained

RESULTS AND DISCUSSIONS

User Needs and Application Features

Interviews with pregnant women, midwives, and cadres showed a need for information on pregnancy development, danger signs, nutrition, and antenatal examination, as well as reminders, repeatable access to information, and easy navigation. Based on these needs, AM AkbidManna includes features for pregnant woman data, an antenatal visit schedule, examination records, pregnancy education, danger sign information, and a midwife contact through WhatsApp.

Content and Media Feasibility

Content and media validation each comprised 10 aspects with a maximum score of 20 per aspect (total 200). The content score was 169 (84.50%) and the media score was 156 (78.00%) (Table 1).

Table 1. Results of content and media validation

Component	Score	Maximum	Percentage	Category
Content validation	169	200	84.50%	Very feasible
Media validation	156	200	78.00%	Feasible

Usability

Usability was assessed with the SUS among 10 respondents. The mean SUS score was 73.75, above 70, and was therefore classified as acceptable.

Observation of Application Use

All respondents were able to open the application and access nutrition information independently. Nine of ten respondents could read pregnancy development information and access iron-folic acid tablet information independently, while one required assistance. Danger sign information was identified independently by seven respondents; three required assistance (Table 2).

Table 2. Completion of application usage tasks (n = 10)

Task	Independent	With assistance	% independent
Opening the application	10	0	100
Reading pregnancy development	9	1	90
Identifying danger sign information	7	3	70
Accessing nutrition information	10	0	100
Accessing iron-folic acid tablet information	9	1	90

Change in Self-Reliance Scores

The mean self-reliance score increased from 69.80 before to 78.10 after use of the application, a difference of 8.30 points (Table 3). The mean-based N-Gain was 8.30/30.20 = 0.275, in the low category. Shapiro–Wilk result for the score differences, the test actually used (paired t-test or Wilcoxon signed-rank), and the test statistic gave p = 0.002.

Table 3. Self-reliance scores before and after use of the application

Measurement	n	Mean score	Remarks
Pretest	10	69.80	–
Posttest	10	78.10	–
Difference (posttest − pretest)	10	8.30	N-Gain 0.275 (low)

Discussion

a. Development based on user needs, the identified needs, namely danger sign information, reminders, and repeatable access to information, are consistent with the (World Health Organization, 2016) recommendations that position education and communication as part of antenatal care (Purnami et al., 2025), (Martha, Wulandari, & Pertiwi, 2025). The WHO Digital Adaptation Kit approach emphasizes mapping user needs, workflows, core data, decision support, and technical requirements. Accordingly, further development of AM AkbidManna should ensure that each feature has a clear service purpose, minimal but relevant data, and a referral mechanism when users encounter danger signs. The application is only a supporting medium; pregnant women must still have their pregnancy examined by health workers.

b. Content and media feasibility, the content score (84.50%, very feasible) and media score (78.00%, feasible) indicate that the application is acceptable for testing in the target group. The lower media score suggests room for improvement in display and navigation, which is consistent with the finding that some respondents still needed assistance with certain tasks.

c. Usability, a SUS score of 73.75 is above 70, which (Bangor et al., 2008) interpret as acceptable and approaching a "good" rating. The SUS is a brief, widely used instrument that can give fairly stable results in small samples (Tullis, T., & Albert, 2013); however, with 10 respondents from one village, this result cannot be generalized. The observation showed that identifying danger signs most often required assistance (three of ten respondents). Because this feature is most closely related to safety, simplifying the language, using icons or images, and placing the menu more prominently should be priorities for revision (Habibi et al., 2026).

d. Change in self-reliance, the 8.30-point increase in mean self-reliance score is in the same direction as the Ebumil study, which reported improved knowledge and independence among pregnant women using the application (K. Kartini, F. Farming, 2025), and as a meta-analysis reporting a large effect of mHealth and social media interventions on pregnancy knowledge (Chan & Chen, 2019). However, the Ebumil study had a comparison group and a much larger sample, and the systematic review by (Daly et al., 2018) did not find sufficient evidence for firm conclusions. In addition, the N-Gain of 0.275 is in the low category, so the magnitude of change is limited. Without a control group, randomization, and control of confounders, the score increase cannot be regarded as a causal effect of the application; prior experience, education from midwives, exposure to other information, and re-testing effects may also have influenced the scores (Denise F. Polit & Cheryl Tatano Beck, 2021). These results are best viewed as a basis for hypotheses for future research.
e. Implications for midwifery services, AM AkbidManna can be used as a complementary education medium in community midwifery services to reinforce the information provided by midwives. Implementation should be accompanied by a referral pathway for danger signs, content updates in line with national guidelines, and protection of user data. Record-keeping design should also consider the provisions on recording and reporting in the implementation of reproductive health services (Kementerian Kesehatan Republik Indonesia, 2025). For areas with unstable connectivity, functions that remain usable when the network is limited should be considered in the design (Najib, 2025).
f. Limitations, the main limitations are the small number of respondents, the one-group design without a control, the short observation period, and the self-reported measurement of self-reliance. This study also did not assess the effect on antenatal visit adherence, actual danger sign detection, or maternal and infant outcomes. Future studies could use a larger sample, a quasi-experimental or controlled trial design, longer follow-up, and measurable behavioral and service outcomes.

CONCLUSION

The AM AkbidManna mobile application was successfully developed as a complementary pregnancy education and monitoring medium for pregnant women in Darat Sawah Village, with content feasibility of 84.50% (very feasible), media feasibility of 78.00% (feasible), and acceptable usability (SUS 73.75). The mean self-reliance score increased from 69.80 to 78.10, representing an 8.30-point increase, although the N-Gain of 0.275 remained in the low category. These findings indicate that the application is feasible and usable and may support pregnant women's self-reliance; however, they do not establish causal effectiveness or clinical impact because of the small sample, one-group design, and short evaluation period. The finding that only seven of ten participants could independently identify pregnancy danger-sign information indicates that this component requires priority improvement before wider implementation. Therefore, the danger-sign feature should be operationally improved by simplifying the language, using clearer icons or illustrations, placing the danger-sign menu in a prominent location, and providing an explicit referral pathway that directs users to contact a midwife or seek appropriate health services when danger signs are identified. Midwives should also provide repeated demonstrations and brief competency checks to ensure that pregnant women can independently recognize and respond to danger signs. Future studies should evaluate the revised application using a larger sample, a comparison group, longer follow-up, and outcomes such as ANC adherence, timely referral, actual danger-sign recognition, and relevant maternal and neonatal outcomes.

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