

Effectiveness of the SATUSEHAT Mobile Application on Knowledge, Attitude, and Behavior Regarding Early Detection of Pregnancy Risk in Bandar Lampung City

^{1*} Bambang Setiaji, ¹Yessica Putri Arum, ¹Aila Karyus, ¹Dian Utama Pratiwi Putri

¹ Universitas MITRA Indonesia, Lampung, Indonesia

ARTICLE INFO

Article History:

Received :28-06-2026

Revised :27-07-2026

Accepted :27-08-2026

Keywords :

SATUSEHAT Mobile,
Digital Health, Knowledge

Correspondence :

Bambang Setiaji

Email:

mentarisetiaji67@gmail.com

ABSTRACT

Background: Infant mortality remains an important indicator of public health status, partly caused by delayed early detection of pregnancy complications due to inadequate knowledge, attitudes, and behaviors of pregnant women regarding pregnancy danger signs. Digital health technology (mobile health/mHealth), including the SATUSEHAT Mobile application, has the potential to improve maternal health literacy. This study aimed to analyze the effectiveness of the SATUSEHAT Mobile application in improving pregnant women's knowledge, attitudes, and behaviors toward early detection of pregnancy risks in Bandar Lampung City in 2026. A quasi-experimental study with a non-equivalent control group design was conducted on 72 second- and third-trimester pregnant women (36 intervention and 36 control). The intervention group received education and guidance on using the application for four weeks. Data were collected using pretest-posttest questionnaires and analyzed using paired sample and independent sample t-tests. Results showed significant improvements in the intervention group, with knowledge increasing from 49.88 to 69.88 ($p < 0.001$), attitude from 40.77 to 49.52 ($p < 0.001$), and behavior from 53.13 to 63.69 ($p < 0.001$), with large to very large effect sizes. The independent sample t-test revealed significant differences between the intervention and control groups in knowledge, attitude, and behavior ($p < 0.001$). The SATUSEHAT Mobile application is effective as a digital health promotion tool for improving pregnant women's knowledge, attitudes, and behaviors toward early detection of pregnancy risk.

INTRODUCTION

Infant mortality serves as a primary indicator of public health status. Indonesia's infant mortality rate (IMR) remains a significant challenge, currently at 21 per 1,000 live births, compared to the Sustainable Development Goals (SDGs) target of ≤ 12 per 1,000 live births by 2030 (1). The majority of infant deaths occur during the neonatal period and are associated with conditions that are largely preventable through early detection and appropriate management (2). In 2024, Bandar Lampung City recorded 72 infant deaths, primarily attributed to inadequate early detection of pregnancy complications, delayed management, and limited maternal knowledge of pregnancy danger signs.

Effective health promotion for pregnant women requires approaches that are both interactive and sustainable, rather than solely informative (3). The implementation of digital technology through mobile health (mHealth) represents an effective strategy for enhancing health literacy and promoting positive health behaviors among pregnant women. Knop et al. demonstrated that digital interventions improve antenatal care (ANC) compliance and significantly enhance maternal and neonatal outcomes (4). Similarly, Kusyanti et al. reported that technology-based applications for pregnancy monitoring in Indonesia increased maternal engagement and preparedness for childbirth (5). Ameyaw et al., in a systematic review, identified that mHealth applications integrating educational content and early warning systems exert the greatest influence on maternal behavior change (6). Mishra et al. found that mothers using mHealth applications showed a 1.5-fold improvement in recognizing danger signs compared with the control group (7). Xu et al. confirmed that technology-based obstetric scoring systems increase the efficiency of risk detection and reduce referral times (8). Arifianti et al. observed that pregnancy education applications increased maternal knowledge by 25-40% (9), while Rahmawati et al. demonstrated a 30% increase in maternal awareness of pregnancy danger signs through mHealth interventions (10). Comparable findings have been reported internationally, where pregnancy applications have contributed to reduced referral delays (11).

However, research evaluating the effectiveness of SATUSEHAT Mobile, particularly in the context of early detection of pregnancy risk, remains limited and has predominantly focused on electronic medical records or health service administration. Bandar Lampung City, as a provincial capital with high population density and diverse levels

of digital literacy, provides a relevant context for implementing application-based health interventions. The present study introduces a novel evaluation of the official application of the Indonesian Ministry of Health, employing a quasi-experimental nonequivalent control group design among pregnant women in Bandar Lampung City, an approach not previously undertaken. The objective of this study is to assess the effectiveness of the SATUSEHAT Mobile application as a digital health promotion tool to improve knowledge, attitudes, and behaviors related to the early detection of pregnancy risks among pregnant women in Bandar Lampung City in 2026. SATUSEHAT Mobile was selected for its provision of accessible health information through digital technology and its potential to facilitate the dissemination of pregnancy-related health information, particularly for recognizing and early detection of pregnancy risks.

METHODS

A quantitative, quasi-experimental design with a nonequivalent control group design was employed to compare the intervention and control groups using pretest and posttest measurements. The study was conducted from February 5 to March 6, 2026, at four Public Health Centers (Puskesmas) in Bandar Lampung City: Puskesmas Sumur Batu, Puskesmas Kota Karang, Puskesmas Susunan Baru, and Puskesmas Sukabumi. The study population comprised 1,871 pregnant women in the second and third trimesters who were registered at these health centers. Sample size was determined using the paired mean difference test formula ($\alpha=0.05$, power 80%, standard deviation of score difference 10, pre-post correlation 0.5, clinically meaningful mean difference 5) (12), resulting in 32 respondents per group. An additional 10% was added to account for potential dropout, yielding 36 respondents per group (total $n=72$; 36 in each group). Consecutive sampling was applied to pregnant women meeting the inclusion criteria: second trimester (gestational age 14-28 weeks) or third trimester (up to 32 weeks), ownership of an Android smartphone without prior download of the SATUSEHAT Mobile application, literacy in Indonesian, willingness to participate in the 4-week intervention, and provision of informed consent. Exclusion criteria included severe complications, delivery during the study period, cognitive impairment, or intervention non-adherence of 25% or greater.

The intervention group received education and guidance on using the SATUSEHAT Mobile application over a four-week period. This included an introduction to the application, education on pregnancy danger signs and application features, periodic guidance (one to two times per week), and a posttest evaluation. The control group did not receive any intervention. Data collection utilized a structured questionnaire with 60 items assessing knowledge, attitudes (using a Likert scale) (13), and early detection behaviors for pregnancy risk. The instrument demonstrated validity (calculated $r >$ table r of 0.312 at $n=30$) and reliability (Cronbach's $\alpha = 0.940$) in Metro City. Data analysis included univariate analysis and the Shapiro-Wilk normality test. Bivariate analysis employed the paired-sample t -test to assess pretest-posttest differences within groups and the independent-samples t -test to compare posttest scores between groups. Statistical significance was set at $p<0.05$, and effect size was calculated using Cohen's d . Ethical approval was obtained from the Research Ethics Committee of Universitas Mitra Indonesia (S.25/043/FKES10/2026), and all respondents provided informed consent prior to participation.

RESULT AND DISCUSSION

Table 1. Distribution of Respondent Characteristics by Age, Education, and Trimester of Pregnancy n (36)

Characteristic	Intervention Group n (%)	Control Group n (%)
Age < 20 years	2 (7%)	1 (6%)
Age 20-35 years	25 (83%)	26 (82%)
Age > 35 years	3 (10%)	3 (10%)
Elementary/Junior High education	5 (16%)	4 (13%)

Senior high education	19 (59%)	23 (71%)
Higher education	8 (25%)	5 (16%)
Trimester II	19 (59%)	20 (62%)
Trimester III	13 (41%)	12 (38%)
Total	36 (100%)	36 (100%)

The study involved 72 respondents who were pregnant women in the second or third trimester, divided into 36 in the intervention group and 36 in the control group. The characteristics of respondents in both groups were relatively homogeneous (Table 1), with the majority of respondents aged 20-35 years (83% in the intervention group; 82% in the control group), having a senior high school education (59% and 71%), and being in the second trimester of pregnancy (59% and 62%).

In the intervention group, before the intervention, most respondents were in the moderate knowledge category (64%), and no respondents were in the good category. After the intervention, 36% of respondents reached the good category, and only 6% remained in the poor category. Respondents' attitudes, which were initially mostly moderate (97%), became entirely positive (100%) after the intervention. Early detection behavior, which was initially entirely in the moderate category (100%), improved to 97% in the good category after the intervention. In contrast, no meaningful changes in category were found in the control group across the three variables during the same observation period.

The Shapiro-Wilk normality test results showed that all study variables were normally distributed ($p > 0.05$), so the analysis proceeded using parametric tests. The paired sample t-test results (Table 2) showed an increase in the mean knowledge score in the intervention group from 49.88 ± 11.69 to 69.88 ± 9.95 (difference 20.00; $p < 0.001$; Cohen's $d = 1.173$), attitude from 40.77 ± 2.81 to 49.52 ± 2.22 (difference 8.75; $p < 0.001$; $d = 2.190$), and behavior from 53.13 ± 3.09 to 63.69 ± 1.52 (difference 10.55; $p < 0.001$; $d = 2.934$). In the control group, changes in knowledge score (difference: 1.89; $p = 0.574$), attitude (difference: 0.64; $p = 0.388$), and behavior (difference: 0.69; $p = 0.295$) were not statistically significant, with very small effect sizes.

Table 2. Analysis of Differences in Knowledge, Attitude, and Early Detection Behavior of Pregnant Women Before and After Intervention (Paired Sample T-Test)

Variable	Group	Pretest Mean $\pm$ SD	Posttest Mean $\pm$ SD	Mean Difference	P-value	Cohen's d
Knowledge	Intervention	49.88 $\pm$ 11.69	69.88 $\pm$ 9.95	20.00	<0.001	1.173
	Control	50.66 $\pm$ 9.75	52.55 $\pm$ 14.53	1.89	0.574	0.095
Attitude	Intervention	40.77 $\pm$ 2.81	49.52 $\pm$ 2.22	8.75	<0.001	2.190
	Control	40.80 $\pm$ 3.29	41.44 $\pm$ 2.77	0.64	0.388	0.146
Behavior	Intervention	53.13 $\pm$ 3.09	63.69 $\pm$ 1.52	10.55	<0.001	2.934
	Control	51.44 $\pm$ 3.97	52.13 $\pm$ 3.82	0.69	0.295	0.177

Independent-samples t-test results (Table 3) indicated significant posttest differences between the intervention and control groups in knowledge (difference 17.33; $p < 0.001$; $d = 1.391$), attitude (difference 8.08; $p < 0.001$; $d = 3.217$), and behavior (difference 9.42; $p < 0.001$; $d = 3.967$), all with large to very large effect sizes.

Table 3. Independent Sample T-Test Results between the Intervention Group and the Control Group

Variable	Intervention Mean±SD	Control Mean±SD	Mean Difference	P-value	Cohen's d	Description
Knowledge	69.88±9.95	52.55±14.53	17.33	<0.001	1.391	Significant
Attitude	49.52±2.22	41.44±2.77	8.08	<0.001	3.217	Significant
Behavior	63.69±1.52	54.27±3.82	9.42	<0.001	3.967	Significant

Among all the factors, the process aspect stood out as the key driver behind the varying achievements of puskesmas. Those puskesmas that fostered vibrant socialization, strong teamwork between health workers and cadres, and proactive outreach efforts consistently outperformed those with less engagement. These results highlight the crucial need to strengthen health promotion and empower cadres, who serve as the vital bridge between puskesmas and the community.

DISCUSSION

The observed increase in knowledge within the intervention group can be interpreted using the Health Belief Model (14). Education delivered through the SATUSEHAT Mobile application enhanced pregnant women's perceived susceptibility and severity of pregnancy complications, while also offering perceived benefits through accessible, repeatable information. This result aligns with findings by Amalia and Putri, who demonstrated that mHealth applications effectively improve maternal health literacy (15), and Handayani et al., who reported significant improvements in pregnant women's understanding following mobile application-based health promotion in Indonesia (16). Furthermore, this increase in knowledge supports optimizing the official Ministry of Health application as a policy instrument for digital health transformation at the primary care level (17).

Attitudes toward early detection of pregnancy risk improved significantly in the intervention group, consistent with the Theory of Planned Behavior, which posits that attitude change is shaped by behavioral beliefs reinforced through consistent information (18). Structured education via the application provided knowledge that encouraged pregnant women to regard early detection as both important and beneficial. This finding is supported by Bachtiar and Yuliani, who reported that mobile application-based education enhanced adherence and positive attitudes toward antenatal care visits (19), and by Ginting et al., who found that digital health interventions improved maternal attitudes toward pregnancy risk detection (20).

The intervention group exhibited a substantial improvement in early detection behavior, consistent with the Knowledge-Attitude-Practice framework, which identifies knowledge as the basis for attitude formation and subsequent health behavior. Ongoing guidance during the intervention acted as a cue to action, motivating pregnant women, encouraging early detection behaviors, such as engaging in regular antenatal checkups and attending, and increasing vigilance for findings are consistent with previous studies: Cahyani and Setyawan found that digital reminders effectively changed pregnant women's health behavior (21); Gultom and Siagian demonstrated the effectiveness of application-based education in recognizing pregnancy danger signs (22); Larasati and Andriani showed that mobile phone-based interventions improved recognition of pregnancy complications (23); Nurhayati et al. reported that mHealth use enhanced identification of pregnancy risk at public health centers (24); Oktaviani and Melati evaluated digital education as effective in promoting early detection of pregnancy risk (25); and Hussein et al., in a randomized controlled trial, demonstrated that mHealth applications are effective for early detection of pregnancy complications (26).

These results reinforce evidence that the SATUSEHAT Mobile application can be further optimized as a health-promotion tool for pregnant women at the community level. This is consistent with Susanto and Putra (27), who highlighted the importance of SATUSEHAT for community-based maternal health monitoring in Indonesia, as well as with Dewi and Wulandari (28) and Riyanti et al. (29), who demonstrated that mobile application-based education effectively prevents risky behavior during pregnancy. While this study did not directly assess reductions in infant mortality rates, the observed improvements in knowledge, attitudes, and behavior constitute a critical initial step in supporting early detection of pregnancy complications and facilitating timely access to health services.

This study is limited by its quasi-experimental design without full randomization, which may introduce selection bias. Additionally, the relatively short four-week intervention period captures only early-stage behavioral changes.

CONCLUSION

The SATUSEHAT Mobile application significantly improved knowledge (mean difference of 20.00 points; $p < 0.001$), attitudes (8.75 points; $p < 0.001$), and early detection behaviors for pregnancy risk (10.55 points; $p < 0.001$) among pregnant women in Bandar Lampung City, with large to very large effect sizes. All variables showed significant differences between the intervention and control groups, demonstrating the application's statistical and practical effectiveness as a digital health promotion tool. The Health Office and public health centers should further integrate the SATUSEHAT Mobile application into antenatal care services and provide pregnant women with guidance on its use. Future studies should consider longer intervention periods and improved control of confounding factors to better assess the sustainability of behavioral changes.

AUTHOR'S CONTRIBUTION STATEMENT

BS: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Resources, Validation, Supervision, Project Administration, Writing – Original Draft. YPA, AK, DUPP: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Visualization, Validation, Supervision, Writing – Original Draft, Writing – Review & Editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors acknowledge the use of ChatGPT, Scispace, Perplexity, Grammarly, and DeepL to support language improvement, improve clarity, and improve the overall readability and structure of the manuscript.

FUNDING

The authors received no financial support for this research.

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