

Prevention of Preterm Birth and Low Birth Weight Through the mHealth Self-Efficacy Program Among First-Time Pregnant Adolescents in Northern Thailand: A Quasi-Experimental Study

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Abstract: Preterm and low birth weight are significant health challenges among first-time pregnant adolescents in Thailand. Accessible, theory-driven interventions are needed to address these outcomes. This quasi-experimental study evaluated the effectiveness of the mHealth Self-Efficacy Program in improving knowledge and self-efficacy, and in reducing rates of preterm birth and low birth weight. One hundred and eight first-time pregnant adolescents were purposively recruited from five community hospitals in one province, Northern Thailand. The experimental group (n = 54) received the intervention, which consisted of five systems: 1) Screening; 2) Interactive Learning; 3) Advice; 4) Notification; and 5) Monitoring, plus usual care, whereas the control group (n = 54) received only usual care. Instruments used were a Demographic and Health Information Questionnaire, the Knowledge for Prevention of Preterm Birth and Low Birth Weight Assessment, the Self-Efficacy Questionnaire, and the Premature Birth and Low Birth Weight Newborn Monitoring Record. Data analyzed using descriptive statistics, independent t-test, paired-sample t-test, and Chi-square tests.

The experimental group demonstrated significantly higher knowledge scores following completion of the interactive learning system than the control group at the antenatal assessment, and also exhibited significantly higher self-efficacy, and lower rates of preterm birth and low birth weight than the control group at the postpartum assessment. Thus, the mHealth Self-Efficacy Program is effective in improving knowledge, self-efficacy, and birth outcomes among pregnant adolescents. Nurses can use this program to empower adolescent mothers to improve maternal and neonatal outcomes. However, further testing in multisite settings is needed.

Keywords: Adolescents, Health education, Low birth weight, Mobile application, Premature birth, Pregnancy, Self-efficacy, Thailand

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Introduction

Preterm birth and low birth weight remain pressing global obstetric challenges, significantly contributing to neonatal complications and mortality. Preterm birth is defined as the delivery of a live birth before 37 weeks of gestation, and affects approximately 13 million infants annually worldwide.^{1,2} These infants,

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often weighing less than 2,500 grams at birth, face heightened risks of respiratory distress, developmental

delays, and extended hospitalizations.³⁻⁴ Similarly, low birth weight, defined as a birth weight below 2,500 grams, affects 15–25% of all live births globally, or roughly 20 million newborns each year.⁵ These infants are at increased risk for hypoglycemia, hypothermia, jaundice, and long-term growth and developmental impairments.

Adolescents are disproportionately affected by these adverse birth outcomes. In 2022, the World Health Organization reported a global adolescent fertility rate of approximately 21 births per 1,000 girls aged 15–19 years.⁵ In Thailand, the incidence of preterm birth among adolescent mothers is estimated at 21 per 1,000 pregnancies, with a particularly high rate of 16.8% reported in the Northeastern region.⁶ Adolescent mothers are more likely than adult women to give birth prematurely or to deliver low birth weight infants due to biological immaturity, poor nutritional status, socioeconomic disadvantages, and limited access to comprehensive antenatal care.^{3-5,7} These statistics underscore the continued burden of teenage pregnancy.

Evidence indicates that inadequate knowledge and low self-efficacy in pregnancy-related behaviors among adolescents increase the risk of adverse birth outcomes.⁸ Research has shown that enhancing self-efficacy in pregnant women, especially those at risk of preterm labor, can promote healthier behaviors and improve both maternal and neonatal outcomes.⁹⁻¹¹

Innovative mobile health (mHealth) interventions offer an accessible and scalable platform for delivering health information to adolescents. When tailored to their cognitive and emotional development, mHealth programs can provide personalized, interactive, and on-demand education. Despite global progress, there remains a shortage of practical and accessible mHealth interventions designed specifically to prevent preterm birth and low birth weight among first-time adolescent mothers.^{8,10} Thailand currently lacks targeted mHealth programs that focus on these critical outcomes for adolescent first-time mothers. In this context, technology-enhanced learning methods such as microlearning, the delivery of short, targeted educational

content, have gained attention for improving knowledge retention and learner engagement.¹²⁻¹⁴ In maternal health, mHealth strategies including reminders, health monitoring, and education have shown positive impacts on pregnancy outcomes.¹⁵ To address this critical issue, we developed and evaluated a mHealth Self-Efficacy Program (mH-SEP), grounded in microlearning principles and self-efficacy theory, to enhance knowledge, self-efficacy, and reduce rates of preterm birth and low birth weight among pregnant adolescents in Northern Thailand.

Conceptual Framework and Review of Literature

In this study, the mHealth Self-Efficacy Program (mH-SEP) was grounded in Bandura's Self-Efficacy Theory,⁹ microlearning,¹² and findings from a literature review. Self-efficacy refers to individuals' beliefs in their ability to carry out actions required to achieve desired outcomes.⁹ Self-efficacy is developed through four main sources. First, mastery experience involves success in performing tasks, which builds confidence, and can be fostered through knowledge provision, skills training, and demonstrations. Second, vicarious experience refers to observing others, particularly when similar individuals succeed, which enhances one's belief in one's own capabilities. Third, verbal persuasion involves encouraging individuals that they are capable of success in specific tasks. Fourth, emotional arousal includes reducing negative emotions, stress responses, and misconceptions about physical states to enhance self-belief and promote behavioral engagement. Self-efficacy functions as a key internal motivator in social cognitive theory.⁹ Additionally, outcome expectancy, or the belief that a behavior will result in positive outcomes, also influences motivation. Previous evidence shows that maternal self-efficacy promotion programs can be effective for primiparous women, improving both maternal and neonatal

outcomes.^{9,11} Moreover, knowledge is a significant factor related to preterm labor, with the potential to reduce its occurrence and predict preventive self-care behaviors.¹⁴ These insights support the application of theory-based and innovative educational approaches in maternal health interventions.

Microlearning is an instructional approach that delivers brief, focused content. Microlearning refers to bite-sized, just-in-time learning, designed for quick consumption and easy retention.¹² It is particularly effective in digital education environments, where it can enhance learner engagement, motivation, performance, interaction, and memory retention. Rooted in cognitive learning theory, microlearning posits the idea that the human brain processes information more efficiently when presented with concise, targeted material. In contrast, extended study periods may lead to cognitive overload and learning fatigue, which vary among individuals. To address this, educators are encouraged to break down complex concepts into smaller, manageable components, promoting deeper understanding and preventing burnout.¹³

Nowadays, mHealth interventions have shown promise in improving mother and child health.¹⁵ The World Health Organization¹⁶ defines mHealth as the use of mobile devices, including phones, monitoring equipment, and personal digital assistants, in medical care and public health, with the ability to increase self-management, maternal acceptance, and social support. In addition, the advantages of mHealth applications include the ability to provide information to individuals at any time and from any location, as well as the ability to connect with and modify certain domains and target groups. Numerous pregnancy-related mHealth apps have been developed, showing potential to enhance maternal health care.¹⁷⁻¹⁹

To meet the special health care needs of first-time pregnant adolescents, our program integrated Bandura's Self-Efficacy Theory⁹ and microlearning¹² with previous findings to develop an innovation of mHealth. It was expected that this innovative intervention

could improve knowledge, self-efficacy, and reduce preterm and low birth weight among this group of pregnant adolescents.

Study Aim and Hypotheses

This study aimed to evaluate the effects of the mHealth Self-Efficacy Program (mH-SEP) on knowledge, self-efficacy, preterm birth, and low birth weight among first-time pregnant adolescents. We hypothesized that: 1) participants in the experimental group would exhibit significantly higher knowledge and self-efficacy mean scores than both their baseline measurements and those of the control group; and 2) the experimental group would have significantly lower rates of preterm and low birth weight than the control group.

Methods

Design: We used a two-group quasi-experimental design with a pre- and post-test and reported the findings in accordance with the checklist of the Transparent Reporting of Evaluations with Non-randomized Designs (TREND).

Participants and Setting: Using G*Power Version 3.1.9.4, we calculated the sample size, considering an effect size of 0.5,²⁰ a power of 0.80, and a significance threshold of 0.05, and we increased the sample size by 20% to prevent dropouts. Thus, the required sample size was 122 participants in total, with 61 per group.

This study recruited first-time pregnant adolescents who attended antenatal care at five community hospitals in one province of Northern Thailand, where teenage pregnancy rates are notably high. Participants were selected through convenience sampling based on the following inclusion criteria: 1) first-time pregnancy; 2) aged 13–19 years; 3) gestational age ≥ 28 weeks; 4) singleton pregnancy; 5) absence of obstetric or medical complications; and 6) ability to read and communicate in Thai. Purposive

sampling was utilized to select participants based on predefined inclusion criteria aligned with the study objectives. The principal investigator (PI) led the recruitment process in collaboration with an antenatal care (ANC) clinic identified for its high prevalence of adolescent pregnancies. Access to potential participants was granted following formal approval from the clinic administration.

To minimize potential contamination between groups within the same hospital setting, data collection for the control group was completed first, followed by recruitment and intervention delivery for the experimental group. This sequential approach helped reduce the risk of cross-group contamination.

In the control group, seven participants discontinued participation: five withdrew due to unwillingness to continue, and two experienced intrauterine fetal death. Similarly, seven participants in the experimental group discontinued: six due to unwillingness to continue, and one due to intrauterine fetal death. Thus, there were 54 participants in each group. The control group received usual care, while the experimental group received usual care supplemented with the mH-SEP.

Ethical Considerations: Our study was approved by the Research Ethics Committee of the Chiang Rai Provincial Public Health Office, Chiang Rai Province, Thailand. (CRPPHO No. 18/2567, COA No. 103/2568). All participants agreed to participate in the study. They were given a description of the study's objectives, participants' rights, and possible risks. All participants provided written informed consent. For participants under 18 years of age, additional consent was obtained from their parents or legal guardians. Anonymity was secured using codes rather than participant names, and confidentiality was ensured by storing research data on a password-protected computer accessible only to the research team.

Research Instruments comprised four instruments for data collection, and the mH-SEP. All instruments were developed by the research team based

on a literature review. Five experts: 1) an obstetrician; 2) a nurse specialist in antenatal, delivery, and postpartum care; 3) an obstetrician lecturer; 4) an obstetric nursing lecturer; and 5) an expert in technology-based learning methods reviewed the content validity index (CVI) and the reliability in the pilot study with 30 pregnant adolescents.

The Demographic and Health Information Questionnaire included age, education, occupation, income, and health.

The Knowledge for Prevention of Preterm Birth and Low Birth Weight Assessment based on a literature review²¹ evaluates understanding of pregnancy-related practices and strategies for preventing low birth weight. The instrument consists of 20 multiple-choice items, categorized into three modules: 1) risk factors, 2) self-care during pregnancy, and 3) emergency hospital conditions and preparedness. Each item offers four answer choices, with only one correct response. For example, one item asked: "Which condition would require a pregnant woman to visit the hospital prior to her scheduled appointment?" One point is given for each correct answer; incorrect or unanswered items are scored as zero. The scores range from 0–20, with higher scores indicating greater knowledge to help prevent pre-term birth and low birth weight. The CVI was 0.98. Reliability, assessed through a pilot study using the Kuder-Richardson Formula 21 (KR-21), was 0.79 in the pilot study and 0.81 in the actual study.

The Self-Efficacy in Self-Care for the Prevention of Preterm Labor and Low Birth Weight Questionnaire. This instrument was developed by the researchers based on a literature review,²² and grounded in Bandura's concept of self-efficacy. It includes 20 items, each rated on a 5-point Likert scale ranging from "Lowest Self-Efficacy" (1) to "Highest Self-Efficacy" (5). For example, "I have self-efficacy in my ability to take care of myself to prevent preterm labor." The score ranges from 20 to 100, with higher scores indicating higher self-efficacy in self-care for the prevention

of preterm labor and low birth weight. The content validity index (CVI) was 1.00, and the Cronbach's alpha reliability coefficient was 0.86 in the pilot study and 0.89 in the actual study.

The Premature Birth and Low Birth Weight Newborn Monitoring Record included the estimated date of confinement (EDC), with preterm birth defined as the delivery of a live birth before 37 completed weeks of gestation,¹ and low birth weight defined as a baby weighing less than 2,500 grams.⁴

The mHealth Self-Efficacy Program (mH-SEP) and Implementation

The mH-SEP was developed by the research team based on Self-Efficacy Theory⁹ and the principles of microlearning.¹²⁻¹⁴ Designed for mobile delivery, the mH-SEP aims to strengthen self-efficacy through four core mechanisms: mastery experience, vicarious

experience, emotional arousal, and verbal persuasion. The program delivers short, focused learning modules to support accessible, structured, and self-directed learning. There are five systems in the intervention:

Screening system implemented at 28-28⁺⁶ weeks of gestation, which identifies risks for preterm birth and low birth weight among the newborns of first-time pregnant adolescents.

Interactive learning system: This covers five essential topics: 1) risk factors leading to preterm birth and low birth weight; 2) prenatal self-care to prevent these; 3) proper nutrition and weight gain according to criteria of each trimester; 4) self-assessment of maternal and fetal health at home; and 5) signs and symptoms that required hospitalization before the appointments and initial action behavior before hospitalization (**Figure 1**).

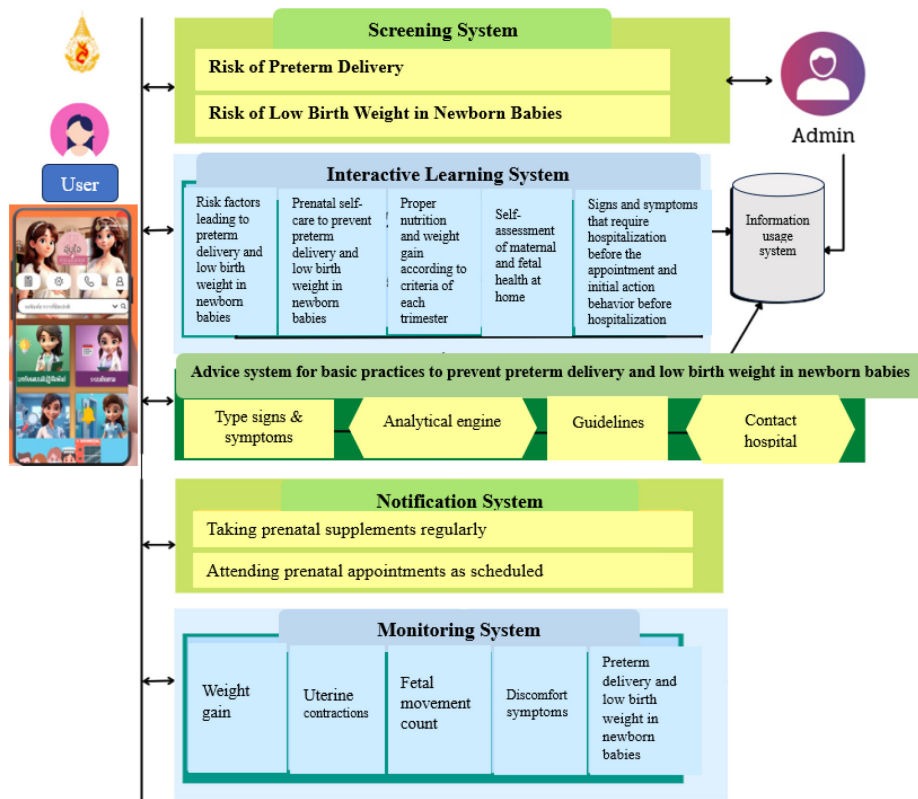


Figure 1. An overview of the working structure within a “mH-SEP” mobile web application

Applied from 28–28+6 weeks of gestation, this system incorporates vicarious experience through social modeling; observing others with similar characteristics succeed enhances users' belief in their own capabilities, consistent with the self-efficacy framework.⁹ Content is delivered through microlearning modules of 3–10 minutes each, promoting efficient and sustained knowledge acquisition.

The advice system offers basic practices to prevent preterm birth and low birth weight. Pregnant adolescents can input symptoms, which are evaluated by the system to generate appropriate guidance. A communication feature is also provided, allowing users to contact healthcare providers as needed.

The notification system functions as a behavioral prompt, reminding users to take prenatal supplements regularly and attend prenatal appointments as scheduled.

The monitoring system includes a weekly monitoring feature to track maternal indicators such as weight gain, uterine contractions, fetal movements, discomfort symptoms, preterm birth, and low birth weight in newborns.

The mH-SEP Implementation

In this study, the experimental group received the mH-SEP at 28–28⁺⁶ weeks of gestation. Participants installed the mH-SEP mobile application on their smartphones and received an orientation to the program structure (30 minutes). They subsequently completed a screening module for preterm birth and low birth weight risk, followed by five interactive learning modules (50 minutes). Upon completion of these modules, participants completed a post-intervention knowledge assessment (20 minutes). Participants also engaged in a skill-based practice session to enhance mastery of uterine contraction assessment and fetal movement counting, and they participated in a verbal persuasion activity designed to strengthen their self-efficacy in preventing preterm birth and low birth weight (60 minutes).

Following the initial intervention, participants were encouraged to use the mH-SEP application

throughout their pregnancy. The application features an advice system for symptom monitoring and triage, a notification system promotes adherence to prenatal supplements and scheduled antenatal visits, and a monitoring system tracks weight gain, uterine contractions, fetal movement, and discomfort symptoms every week up until delivery.

Usual Care

This care involves the provision of maternal health services by midwives and physicians. Educational content is delivered twice through the parent class. For the first time, at < 24 weeks of gestation, six core topics are given: 1) use of a MCH handbook, 2) maternal nutrition and drugs, 3) fetal development, 4) physiological and psychological changes in pregnancy, 5) self-care during pregnancy and monitoring for complications, and 6) maternal dental health, about 1–2 hours. For the second time, at about 28–29 weeks of gestation, four core topics are presented: 1) fetal movement count, 2) abnormal symptoms that require hospitalization before the appointment, 3) true labor and false labor, and 4) preparing for birth, about 1–2 hours.

Risk assessment for pregnant women is conducted using the criteria outlined in the Maternal and Child Health (MCH) Handbook (commonly referred to as the “pink book”). When a risk condition is identified, care is provided in accordance with standard protocols for risk-based care. In addition, pregnant women receive guidance on when to seek medical attention, following the guidelines of the Department of Health and the Royal Thai College of Obstetricians and Gynecologists.²³

Data Collection: This study was conducted between March and December 2024, following IRB approval, by the PI and co-researchers, who were trained in the use and implementation of the mH-SEP intervention.

Data collection began at antenatal clinics before participants in both groups attended the second session of the parental class, which comprised usual care. Participants completed the questionnaires on demographic and health information, Knowledge,

and Self-Efficacy (Baseline or T0). For the control group, participants answered only Knowledge at the end of the second session (T1) and continued with usual care until after childbirth before discharge from the hospital. They also completed the Self-Efficacy Questionnaire (T2), and preterm and low birth weight were recorded from the summary labor and delivery sheet.

For the experimental group, after baseline data collection (T0), participants installed the mH-SEP mobile application on their smartphones and received an orientation to the program. After they completed all five modules in the interactive learning system at the antenatal clinic, they answered the Knowledge Questionnaire (T1), as did the control group. After childbirth and before discharge from the hospital, they answered the Self-Efficacy Questionnaire (T2). Again, preterm and low birth weight were recorded from the summary labor and delivery sheet.

Data Analysis: Statistical analyses were performed using SPSS software version 21. Descriptive statistics were used to summarize the data. To compare outcomes before and after the mH-SEP intervention, independent t-tests, paired sample t-tests, and Chi-square tests were employed.

The Shapiro-Wilk test was used to assess normality and confirmed that the distributions of knowledge and self-efficacy scores for preventing

preterm labor and low birth weight were normally distributed in both experimental and control groups, both pre- and post-intervention. Consequently, the paired sample t-test was used for within-group comparisons, and the independent t-test was used for between-group comparisons.

Results

Characteristics of participants and basic health status

In this study, the participants comprised 108 pregnant teenage women (54 in each group). There were no significant differences in the demographic characteristics between the two groups. The mean age was 17.73 (± 1.38) years. Most participants had completed junior high school (58.33%), were housewives (74.07%), and had a monthly family income average of 7,717.59 baht (\$237.76 USD). All participants were classified as low risk for preterm labor and low birth weight. In the experimental group, all participants used the advice system and reported symptoms such as low back pain (85.19%), frequent urination (81.48%), heartburn (27.78%), swollen feet (16.67%), and insomnia (14.81%). The system assessed the reported symptoms and provided appropriate guidance prior to hospital visits (**Table 1**).

Table 1. Sociodemographic and basic health status characteristics of study participants at baseline

Characteristics	Total (n = 108)	Experimental group (n = 54)	Control group (n = 54)	Statistic value	p-value
	Frequency (%)	Frequency (%)	Frequency (%)		
Age (years), mean (SD)	17.73 (1.38)	17.56 (1.45)	17.91 (1.29)	1.331 ^a	0.186
Education level				4.643 ^b	0.200
Primary school	12 (11.11)	3 (5.56)	9 (16.67)		
Junior high school	63 (58.33)	33 (61.11)	30 (55.56)		
Senior high school	32 (29.63)	18 (33.33)	14 (25.92)		
Vocational certificate	1 (0.93)		1 (1.85)		
Occupation				4.002 ^b	0.406
Student	11 (10.19)	4 (7.41)	7 (12.96)		
Housewife	80 (74.07)	39 (72.22)	41 (75.93)		
Employee	9 (8.33)	6 (11.11)	3 (5.56)		

Table 1. Sociodemographic and basic health status characteristics of study participants at baseline (Cont.)

Characteristics	Total (n = 108)	Experimental group (n = 54)	Control group (n = 54)	Statistic value	p-value
	Frequency (%)	Frequency (%)	Frequency (%)		
Self-employed	5 (4.63)	4 (4.71)	1 (1.85)		
Farmer	3 (2.78)	1 (1.85)	2 (3.70)		
Monthly family income USD, mean (SD)	237.76 (5.88)	231.34 (7.34)	244.18 (3.99)	0.348 ^a	0.729
Screening of preterm labor & low birth weight					
Low risk	108 (100.00)	4 (100.00)	54 (100.00)	0 ^b	1.000
High risk		–	–		
Discomfort signs and symptoms ^c					
Low back pain	94 (87.04)	46 (85.19)	48 (88.89)	0.328 ^b	0.567
Frequent urination	86 (79.63)	44 (81.48)	42 (77.78)	0.228 ^b	0.633
Heartburn	27 (25.00)	15 (27.78)	12 (22.22)	0.444 ^b	0.505
Swollen feet	19 (17.59)	9 (16.67)	10 (18.52)	0.064 ^b	0.800
Insomnia	15 (13.89)	8 (14.81)	7 (12.96)	0.077 ^b	0.781

Note. ^a = independent t-test, ^b = Chi-square test, ^c = multiple symptoms can be reported for each participant, as the nature of the condition may involve more than one symptom at a time.

Effectiveness of the mH-SEP

In the experimental group, the mean score for knowledge before attending the second session of the parental class (T0) was 12.13; after learning from the interactive learning system, this increased to 17.46, which was significantly higher than at T0 and significantly higher than the control group ($p < 0.01$) (Table 2).

Self-efficacy in self-care to prevent preterm labor and low birth weight

In the experimental group, the mean self-efficacy score for self-care before attending the second parental class (T0) was 85.09. After they received the mH-SEP throughout pregnancy until delivery, it increased to 91.24, which was significantly higher than measured at T0 and the control group ($p < 0.05$) (Table 2).

Table 2. A comparison of the means on knowledge and self-efficacy within groups and between groups

Variable	Experimental group (n = 54)		Control group (n = 54)		Independent t	p-value
	Mean	SD	Mean	SD		
Knowledge						
T0	12.13	2.43	12.74	3.65	1.024	0.308
T1	17.46	1.58	13.39	3.79	-7.297	< 0.001
	$t^a = -17.174, p < 0.001$		$t^a = -6.298, p < 0.001$			

Table 2. A comparison of the means on knowledge and self-efficacy within groups and between groups (Cont.)

Variable	Experimental group (n = 54)		Control group (n = 54)		Independent t	p-value
	Mean	SD	Mean	SD		
Self-efficacy						
T0	85.09	5.94	85.52	5.97	0.371	0.711
T2	91.24	7.42	86.91	4.88	-3.585	0.001
	t ^a = - 4.752, p < 0.001		t ^a = -4.174, p < 0.001			

Note. a = Paired t- test

T0 = before attending the second session of parental class for both groups

T1 = after attending second session of parental class for the control group and after using interactive learning system for the experimental group

T2 = postpartum period; after childbirth and before discharge from hospital

Preterm delivery and low birth weight rates

The incidence of preterm delivery was significantly lower in the experimental group (6 of 54) compared with the control group (14 of 54) ($p < 0.05$). Likewise,

the incidence of low birth weight was significantly lower in the experimental group (8 of 54) than in the control group (19 of 54) ($p < 0.05$) (Table 3).

Table 3. Preterm delivery rate and low birth weight rate of the two groups*

Variables	Experimental group (n = 54)	Control group (n = 54)	χ^2	p-value
	Frequency (%)	Frequency (%)		
Preterm delivery			3.927	0.048
Yes	6 (11.11%)	14 (25.93%)		
No	48 (88.89%)	40 (74.07%)		
Low birth weight			5.975	0.015
Yes	8 (14.81%)	19 (35.19%)		
No	46 (85.19%)	35 (64.81%)		

Note. * preterm = a live birth before 37 weeks, low birth weight = birth weight < 2,500 grams

Discussion

The mH-SEP demonstrated effectiveness in improving knowledge and self-efficacy and in reducing the rates of preterm births and low birth weight among participants. Our findings support the validity of Self-efficacy Theory and microlearning principles to improve knowledge and self-efficacy among first-time pregnant Thai adolescents.

By presenting reliable, age-appropriate content in an accessible format, the mH-SEP contributed to informed health behaviors and enhanced maternal health literacy. It addresses common barriers among adolescents, such as limited access to health education and inconsistent engagement in antenatal care. These outcomes support the utility of mHealth tools in low-resource settings to bridge gaps in maternal health services and improve pregnancy outcomes through

behavior change support. Beyond direct benefits to the target users, the mH-SEP also has potential as a standardized educational tool for healthcare providers. It may serve to enhance training efficiency, ensure consistent messaging, and reduce time and cost in delivering maternal health education. The application highlights how digital tools can support both individual-level self-care and broader health system efficiency.²⁴

The intervention also fostered active learning, empowering users and health personnel to build knowledge through repeated, practical engagement. These results align with Sewpaul et al.²⁵ who found that tailored mHealth tools improved antenatal care-seeking behavior and health behaviors such as self-efficacy and risk perception among pregnant adolescents in South Africa. Similarly, Wiens et al.²⁶ reported in their scoping review that mHealth apps supported multiple health behaviors in young mothers by helping them feel more prepared, improving accessibility, maintaining contact, and providing peer support. Musiimenta et al.²⁷ also confirmed that mHealth apps improved maternal and child health knowledge and practices among rural women in Uganda with low education levels.

The intervention's impact on clinical outcomes was also notable. The rates of preterm birth and low birth weight were significantly lower in the experimental group compared to the control group. The mH-SEP was carefully designed to address these outcomes through five integrated systems: 1) a screening system for preterm labor and low birth weight risk; 2) an interactive learning system covering risk factors, prenatal care, nutrition, symptom monitoring, and early warning signs; 3) an advice system providing personalized recommendations based on user-reported symptoms, with contact options for healthcare providers; 4) a notification system to support adherence to prenatal supplements and appointments; and 5) a monitoring system tracking maternal health indicators such as weight gain, uterine contractions, fetal movement, and discomfort symptoms. Similarly, a study conducted

in Thailand²⁸ demonstrated that the use of mobile e-health interventions to support self-management among primiparous pregnant adolescents improved health behaviors, regular attendance at prenatal checkups, adherence to dietary guidelines, and prevention of pregnancy-related complications.

The effectiveness of mH-SEP was supported by other findings that mHealth interventions significantly improved maternal healthcare utilization.²⁹ This study highlighted that digital health tools enhance maternal and fetal health, expand access to care, and reinforce adherence to recommended practices. This aligns with previous findings indicating that adolescent pregnancy is associated with adverse outcomes related to developmental immaturity, cultural factors, and insufficient family preparedness.²⁹ Consequently, appropriate guidance and support are essential to preventing complications, mitigating the risk of depression, and enhancing health outcomes among first-time adolescent mothers.^{30,31} These results validate the role of well-designed, context-specific mHealth interventions in improving both behavioral and clinical outcomes in maternal health.

Limitations of the Study

Despite its contributions, this study has noteworthy limitations that should be considered. Firstly, the sample was limited to first-time pregnant adolescents in Northern Thailand, which may limit the generalizability of the findings to other populations. Secondly, while the mH-SEP was intended for mobile use, varying levels of digital literacy and smartphone familiarity among participants may have influenced the degree of engagement with the intervention. Third, this study lacks randomization and allocation concealment, and the different timeframes of the experimental and control groups present a potential source of bias. Furthermore, the fact that the researcher and co-researcher conducted data collection and implemented the intervention in the experimental

group may have introduced unconscious bias into the results

Conclusion and Implications for Nursing Practice

In spite of its limitations, the mH-SEP intervention appears effective in enhancing knowledge and self-efficacy, while also contributing to reduced rates of preterm birth and low birth weight among adolescent mothers. The program provides nurses with a valuable digital tool to complement traditional antenatal care. By promoting self-care behaviors and strengthening health education, the program empowers adolescent mothers to take an active role in managing their pregnancies and preparing for childbirth. Its theory-based, user-centered design supports flexible and accessible learning that can be integrated into both clinical and community settings. Future research should examine long-term maternal and infant outcomes, explore adaptation for broader populations, and evaluate implementation across diverse healthcare contexts.

Author Contributions

Conceptualization: S.C.

Literature review: S.C., S.K.

Method and design, Data collection: S.C., S.K.

Data analysis and interpretation, Drafting, revising, and editing the manuscript, Final approval of the submitted version: S.C.

Supervision, revising, and editing the manuscript, Final approval of the submitted version: K.M.

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Conflicts of Interest

The authors declare no conflicts of interest.

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การป้องกันการคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อยด้วยโปรแกรมการรับรู้สมรรถนะแห่งตนผ่านระบบ mHealth สำหรับสตรีตั้งครรภ์วัยรุ่นครรภ์แรกในภาคเหนือของประเทศไทย : การวิจัยแบบกึ่งทดลอง

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บทคัดย่อ : การคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อยถือเป็นความท้าทายทางสุขภาพที่สำคัญในกลุ่มสตรีตั้งครรภ์วัยรุ่นครรภ์แรกในประเทศไทย การดูแลที่เข้าถึงได้ง่ายและมีพื้นฐานทางทฤษฎีจึงเป็นสิ่งจำเป็นเพื่อแก้ไขปัญหาดังกล่าว การวิจัยแบบกึ่งทดลองนี้มีวัตถุประสงค์เพื่อประเมินประสิทธิผลของโปรแกรมการรับรู้สมรรถนะแห่งตนผ่านระบบ mHealth ในการเพิ่มความรู้ การรับรู้สมรรถนะแห่งตน และลดอัตราการคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อย กลุ่มตัวอย่าง คือ สตรีตั้งครรภ์วัยรุ่นครรภ์แรก จำนวน 108 ราย ซึ่งได้รับการคัดเลือกแบบเจาะจงจากโรงพยาบาลชุมชน 5 แห่งในจังหวัดหนึ่งทางภาคเหนือของประเทศไทย แบ่งเป็นกลุ่มทดลอง ($n = 54$) ซึ่งได้รับการดูแลตามปกติร่วมกับได้รับโปรแกรมที่ประกอบด้วย 5 ระบบ ได้แก่ 1) การคัดกรอง 2) การเรียนรู้แบบมีปฏิสัมพันธ์ 3) การให้คำแนะนำ 4) การแจ้งเตือน และ 5) การติดตามผล ขณะที่กลุ่มควบคุม ($n = 54$) ได้รับการดูแลตามปกติเท่านั้น เครื่องมือที่ใช้ในการวิจัยประกอบด้วย แบบสอบถามข้อมูลส่วนบุคคลและข้อมูลสุขภาพ แบบประเมินความรู้เรื่องการป้องกันการคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อย แบบสอบถามการรับรู้สมรรถนะแห่งตน และแบบบันทึกการติดตามการคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อย วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา independent t-test, paired-sample t-test และ Chi-square tests

หลังใช้ระบบการเรียนรู้แบบมีปฏิสัมพันธ์ในระยะตั้งครรภ์ กลุ่มทดลองมีคะแนนความรู้สูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ นอกจากนี้หลังใช้โปรแกรมในระยะหลังคลอดกลุ่มทดลองยังมีการรับรู้สมรรถนะแห่งตนสูงกว่า และมีอัตราการคลอดก่อนกำหนดและทารกแรกเกิดน้ำหนักน้อยต่ำกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ดังนั้น โปรแกรมการรับรู้สมรรถนะแห่งตนผ่านระบบ mHealth จึงมีประสิทธิผลในการพัฒนาความรู้ การรับรู้สมรรถนะแห่งตน และผลลัพธ์ของการคลอดในสตรีตั้งครรภ์วัยรุ่น พยาบาลสามารถนำโปรแกรมนี้ไปใช้เพื่อเสริมสร้างการรับรู้สมรรถนะแห่งตนแก่มารดาวัยรุ่นในการปรับปรุงผลลัพธ์ทางสุขภาพของมารดาและทารกแรกเกิด อย่างไรก็ตาม การทดสอบเพิ่มเติมในหลายสถานที่ ยังมีความจำเป็น

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