The Effectiveness of the Mobile e-Health Individual and Family Self-management Program for Primiparous Pregnant Adolescents: A Quasi-experimental Study

Taevika Choakprasanchai, Srisamorn Phumonsakul, Bualuang Sumdeangrit, Noppawan Piaseu*

Abstract: Adolescent pregnancy is considered high-risk of health problems that impair their quality of life. Also, many pregnant adolescents are likely to have poor self-management behavior during pregnancy, affecting their health status. This quasi-experimental study aimed to determine the effectiveness of a mobile e-health individual and family self-management program for primiparous pregnant adolescents. Seventy pregnant adolescents who attended a prenatal clinic at a provincial hospital near Bangkok, Thailand, were assigned to the experimental (n = 35) and control group (n = 35). The experimental group received the intervention program and usual care, while the control group received only usual care. The program was held in three sessions over four weeks, and the outcomes were evaluated three times, at baseline, two weeks (time 1), and four weeks (time 2) after completing the program. Data collection took place from July to December 2022 using a personal data form, the Self-Management Behavior Questionnaire on Pregnancy Health of Adolescent Pregnant Women, the Pregnancy Health Status Record Form, and the WHOQOL-BREF-Thai questionnaire. Descriptive statistics, RM-ANCOVA, independent t-test, and chi-square analyzed the data.

The findings revealed that four weeks after completion of the program (time 2), there was a statistically significant difference in the mean scores of self-management behavior between the experimental and control groups. Still, there was no statistically significant difference in the mean quality of life scores. In addition, the experimental group's hemoglobin level, hematocrit level, and gestational weight gain were significantly higher than the control group's. Moreover, the number of participants with urinary tract infections in the experimental group was lower, whereas the average fetal weight gain was higher than in the control group. Nurses and midwives can use this program for adolescent pregnancy to improve self-management behaviors, health status, and quality of life. However, further testing is needed before it is widely used.

Keywords: Adolescent pregnancy, Health status, Mobile e-health, Prenatal, Quality of life, Self-management

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Introduction

Adolescent pregnancy is defined as occurring between the ages of 10–19 years.[1] According to monitoring of the Sustainable Development Goals, the global pregnancy rate for girls aged 10–14 and 15–19 was estimated in 2023 to be 1.5 and 41.3

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births per 1,000, respectively.[2] The birth rate for these groups of pregnant women in Thailand is between 0.9 and 24.4 per 1,000 girls, respectively.[3] Adolescent pregnancy remains a major global health problem relevant to achieving the SDGs.[1,3] Pregnant adolescents and their offspring face several health problems, including anemia,[4] pregnancy-induced hypertension,[4] intra-uterine growth restriction,[4-5] preterm delivery,[4,6] low birth weight,[7] low APGAR score,[8] and stillbirth.[9] Adverse health conditions may be inadequate access to health services or prenatal care,[10-11] and low social support from spouses, families, and medical personnel.[12-13] Inadequate prenatal care and low levels of social support may lead to poor self-management behaviors[14] that have adverse effects on their health status during pregnancy.[10,15]

Pregnant adolescents often face stigma from society, which contributes to depression during pregnancy.[16] They may be in a developmental crisis, an internal conflict between the need for independence and the need for dependency or between their teen role and the maternal role.[17] Family support, including that of spouses and parents of teenage mothers, may encourage pregnant adolescents to express appropriate maternal roles and a good attitude toward motherhood; this support can help pregnant adolescents confront problems and resolve them suitably.[17] To sum up, good health can and does occur among pregnant adolescents, but they need to perform appropriate and suitable health behaviors during pregnancy and in accordance with the developmental tasks of the adolescent. To achieve good self-management, the family is essential in promoting and stimulating pregnant adolescents to have good self-management and healthy behaviors.

Mobile e-health is a digital health tool used to improve nursing care delivery, leading to better health outcomes,[17] and was used in this study with pregnant adolescents. Adolescent mothers now are often classified as Generation Z, and it was found that approximately 58.2% of the population aged 10-19 years in Thailand use information technology and communication via mobile phones.[19] Therefore, efforts are being made to develop methods for promoting the self-management behavior of pregnant adolescents by using technology as a tool. Thus, this study aimed to develop and test the effects of the Mobile e-Health Individual and Family Self-Management Program (MeH-IFSMP) for primiparous pregnant adolescents.

Conceptual Framework and Literature Review

This study used the Individual and Family Self-management Theory (IFSMT) proposed by Ryan and Sawin[20] and relevant literature to develop an intervention. The IFSMT emphasizes a person's ability to manage health in a family context based on three key dimensions: 1) context is defined as risk and protective factors that influence the self-management process, 2) the process of self-management refers to a method fostering individual abilities and skills of self-regulation to manage health by increasing health knowledge and changing beliefs with support from social, and 3) outcome is defined as results of the self-management process on person's behaviors and cost of health care service (proximal outcome) and the results of the achievement of proximal outcomes including health status, quality of life, and health cost (distal outcome). This theory focuses on clarifying risk and protective factors that foster self-management by enhancing knowledge and self-regulation skills and increasing social facilitation to change healthy behaviors successfully.

Although there are no studies reported among pregnant women using the IFSMT, this theory has often been applied to individuals and families with chronic illnesses and has had positive results.[21-22] In this study, we included pregnant adolescents and their families in self-management behaviors to improve their health status and quality of life. The IFSMT considers that the family and patient influence each other, and the

family is the center of care.[20] Changes in one person in the family, whether in thoughts or actions, lead to changes in the family system, such as causing patients to have appropriate self-management behavior that can be practiced continuously.[20] The IFSMT also focuses on developing knowledge and self-regulation skills and abilities.[20] This leads to the ability to practice those behaviors and continued engagement in self-management. The current situation shows that people should have easy access to self-management support by increasing convenient access to information, making health tracking more accessible, and providing communication channels between patients and healthcare providers.[23] As a result, facilitation by using smartphones as mobile e-health or smartphone applications is increasingly used to assist in the self-management of patients.[24] Therefore, we argue that this theory is appropriate for adolescent pregnancy. The MeH-IFSMP was developed using context and process of self-management in identifying and evaluating the risk and protective factors, increasing knowledge, changing beliefs about prenatal health care and enhancing the support from the family of pregnant adolescents to develop their self-regulation skills and abilities to encourage them for sustaining their self-management behaviors during pregnancy. The proximal outcome was self-management behaviors, and distal outcomes were quality of life (QOL), hemoglobin and hematocrit levels, gestational weight gain, urinary tract infection, and fetal weight gain.

Aims and Hypotheses

This study aimed to determine the effects of the MeH-IFSMP on self-management behaviors, health status, and QOL. The hypotheses of the study were:

1. The experimental group's mean scores of self-management behaviors and QOL would be significantly higher than those of the control group measured at two weeks (time 1) and four weeks (time 2) after the program's completion. Hemoglobin, hematocrit, and gestational weight gain would also be significantly higher, measured four weeks after the program's completion (time 2).

2. The number of urinary tract infections would be lower, and the normal fetal weight gain of the experiment group would be higher than that of the control group four weeks after program completion (time 2).

Methods

Design: This study used a quasi-experimental, pre-test, post-test repeated measures design. This report was written following the Transparent Reporting of Evaluations with Non-randomized Designs (TREND)[25] statement for quasi-experimental research.

Purposive sampling was used to obtain the primiparous pregnant adolescents, 10-19 years old, receiving antenatal care at one provincial hospital in Bangkok, Thailand. The inclusion criteria were: 1) having a gestational age of less than or equal to 20 weeks, 2) no obstetric or medical complications, 3) living with family or spouse and receiving support from them, and 4) having a smartphone. The exclusion criteria were: 1) eligible participants were hospitalized due to some gestational complications or withdrew before the end of the intervention, 2) participants who could not fulfill the requirements of the study protocol, and 3) family members could not support the participants throughout the study. We used Twisk's method,[26] a standard method for calculating sample sizes in experimental studies, to utilize dependent variables as continuous variables. An attrition rate of 10% was added based on the study design. The total sample was equal to 70 participants divided into two equal groups of 35, experimental and control **(Figure 1).**

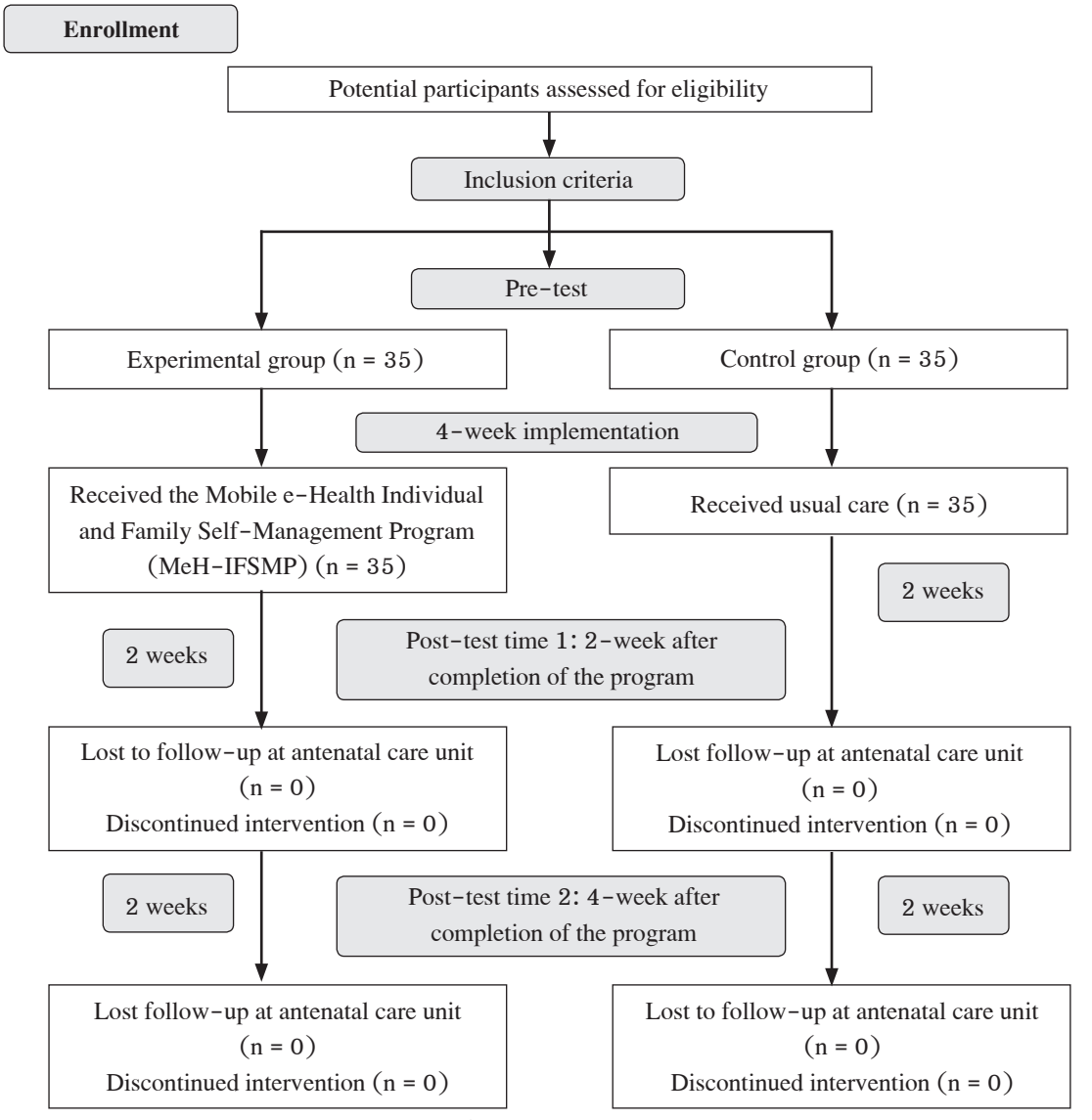

Figure 1. Flow of participants throughout the study

Note. Data collection began first in the control group and was completed before collection in the experimental group.

Ethical Considerations: This study was approved by the Institutional Committee on Human Rights related to Research Involving Human Subjects of the Faculty of Medicine Ramathibodi Hospital, Mahidol University (# COA, MURA2022/184) and the research ethics committee of the studied hospital (# Oq 02165). Potential participants were informed about the study aims, expected beneficial outcomes, the research process, and their rights to participate or withdraw from the study at any time without any effect on the health services they received from the hospital. Finally, the potential participants 18 years and over signed a consent form. If they were under 18, their parents were requested to sign a consent form after the adolescents agreed to join the study.

Instruments: These consisted of the data collection instruments and the intervention. The data collection instruments comprised the Personal Data Form, the Pregnancy Health Status Record Form, and the WHOQOL-BREF-Thai questionnaire. The instruments used for the intervention programs included the Mobile e-Health Individual and Family Self-Management Program (MeH-IFSMP), the booklet, and the e-book. The primary investigator (PI) developed all instruments except the WHOQOL-BREF-Thai questionnaire based on IFSMT[20] and a literature review. All instruments were evaluated for content validity by a panel of three experts in nursing: two maternal and child nursing faculty members and a nurse working with pregnant adolescents. The instruments were revised according to the experts' suggestions to improve the clarity and appropriate order of the questions. The reliability of data collection instruments was tested with a pilot of ten pregnant adolescents. After revising the intervention instruments following the experts' suggestion, they were tested on three adolescents with the same characteristics as the sample.

The *Personal Data Form* is a self-reported questionnaire consisting of general and obstetrics data. It has 11 items: age, educational level, employment status, family monthly income, marital status, family type, social support resource, telephone number, pregnancy plan, gestational age, maternal weight and height, and body mass index.

The PI developed the *Self-Management Behavior Questionnaire on Pregnancy Health of Adolescent Pregnant Women* (Pregnant Teens-SMQ) based on IFSMT[20] and a literature review. It has 23 items with six dimensions: adherence to visiting antenatal care and receiving appropriate health care service (2 items), consumption of appropriate nutrition (8 items), appropriate drug and substance use (5 items), suitable exercise during pregnancy (2 items), management of unpleasant symptoms during pregnancy (2 items), and stress management (4 items), for example, the item "You receive prenatal care as scheduled." The response choice is a 4-point Likert scale ranging from 0 = 'not at all' to 3 = 'always.' The total score ranges from 0-69, with higher scores indicating better self-management behaviors. The content validity index obtained was 0.86, and IOC was calculated with criterion as clearly measuring item (score 1), clearly not measuring (score -1), or unclearly measuring (score 0) for each objective. The value of IOC was equal to 0.66-1. In the pilot study, Cronbach's alpha coefficient reliability was 0.89; in the actual research, it was 0.84.

The *Pregnancy Health Status Record Form* (PHSRF) includes two parts: clinical measures, including maternal and fetal weight gain, and laboratory investigations, including Hb and Hct levels, blood pressure levels, and urine analysis. Each pregnancy outcome was gathered from medical record data.

The *WHOQOL-BREF-Thai Questionnaire* of Mahahnirankul et al.[27] comprises 26 items covering four parts of QOL: physical health, psychological health, environment, and social relationships. In this study, some items were modified for use with pregnant adolescents by the PI. For instance, item 1, "How satisfied are you with your health?" was modified to "How satisfied are you with your health during pregnancy?". The 26 items of the WHOQOL questionnaire are divided into two parts, and there are three negative questions. The response choices are on a 5-point Likert scale, ranging from 1 = 'not at all' to 5 = 'extremely.' Negative questions are reversed before summing the score. The total score ranged from 26-130, with higher scores indicating a higher QOL. The CVI of these instruments in this study was 0.94, within an acceptable level. A pilot with 10 participants having characteristics similar to those in the actual study yielded Cronbach's alpha coefficient of .94, but in the main study, this was .95.

Mobile e-Health Individual and Family Self-management Program (MeH-IFSMP): The program included a booklet and e-book, "Self-management for the Health of Teenage Pregnant Women." The content in self-management included physiological changes during pregnancy in each trimester, discomfort

symptoms, general health promotion during pregnancy, true and false labor pain, how to relieve pain and discomfort symptoms, and stress management. The intervention was a 4-week program with three sessions: 1) identifying and measuring risk and protective factors; 2) enhancing the knowledge and changing beliefs about self-management during pregnancy and developing a self-management process; and 3) encouraging social facilitation **(see Appendix, Table 1).**

Usual Care: This care was delivered by a multidisciplinary team through formal health education and standardized care, including taking personal health information, assessing physical and abdominal examinations, and measuring fundal height (HOF) with palpation. An ultrasound is performed to evaluate fetal growth and calculate gestational age, and two shots of tetanus toxoid are given. Additionally, laboratory testing, including blood and urine analyses, is used to screen for risk and other complications. Lastly, nurses offered pregnancy education classes, including childbirth preparation and breastfeeding.

Data Collection: This was started in the control group, which received the usual care until the sample number was obtained before being collected in the experimental group. The aim was to prevent discrimination between the groups. After recruitment, the personal data form, the Pregnant Teens-SMQ and the WHOQOL-BREF-Thai questionnaires were administered as a baseline. In addition, the PI gathered information about the health status (baseline) using the PHSRF the following week. Two weeks after completion of the program, the Pregnant Teens-SMQ and the WHOQOL-BREF-Thai questionnaires were gathered as time 1. Four weeks after the program, the PI met the participants and collected the last round of data (time 2) and health status data. After that, the booklet was given to participants in the control group, and they were thanked for their cooperation in this study. The experimental group received a standard health education program, health service care, and the MeH-IFSMP.

Data Analysis: Descriptive statistics were analyzed using SPSS Version 26 to describe the demographic characteristics of the participants, health status, and QOL. The significance level was set at 0.05 ($\alpha = 0.05$) and the power of analysis at 0.80 ($\beta = 0.80$). Repeated measures, such as the ANCOVA (RM-ANCOVA) test, independent t-test, and Chi-square, were employed using SPSS. To test the assumptions underlying RM-ANCOVA, an independent t-test and Chi-square were performed to ensure the assumptions were not violated. The results demonstrated a normal distribution of variables for the t-test, and compound symmetry for RM-ANCOVA indicated homogenous variance and covariance. All assumptions of statistics used were tested without violation.

Results

Participant Characteristics

As shown in **Table 1**, the individual characteristics of both groups were similar. The ages of the participants in the experimental and control groups ranged from 14 to 19 years. Two-thirds of the participants in both groups completed secondary school, and about 60% had dropped out. Moreover, 80% of participants in both groups were unemployed and lived with their spouses, whereas around half lived in their own families. About two-thirds of both groups had an unplanned pregnancy, but most (82.9 % and 71.4%, respectively) attended antenatal care as soon as they got pregnant. The gestational age at the first visit ranged from 7-19 weeks in the control group and 4-18 weeks in the experimental group. The characteristics of the participants in the two groups were not significantly different.

Table 1. Comparison of the demographic and obstetrics data between groups

Characteristics	Control group (n = 35)	Experimental group (n = 35)	Statistical value	p-value
	Case (%)	Case (%)		
Age (years)				
14-16	11 (8.6)	12 (5.7)		
17-19	24 (74.3)	23 (88.6)		
	M = 17.06 (±1.41)	M = 16.94 (±1.37)	0.343[a]	.732
	Range = 14-19	Range = 14-19		
Gestational age (weeks)			0.627[b]	.341
≤ 12	17	15		
> 12	18	20		
Body mass index (kg/m^2)	M = 21.09 (±4.02)	M = 19.37 (±2.53)	0.310[a]	.757
	Range = 16-34.5	Range = 15.26-26.20		
Educational level			-1.632[b]	.107
Non-educated	6 (17.1)	2 (5.7)		
Primary school	3 (8.6)	2 (5.7)		
Secondary school	26 (74.3)	31 (88.6)		
Educational status			0.112[b]	.739
Studying with pregnancy	6 (17.1)	7 (20.0)		
Breaking from school	8 (22.9)	9 (25.7)		
Dropping out of school	21 (60)	19 (54.3)		
Employment status			2.779[b]	.100
Employed	10 (28.6)	7 (20)		
Unemployed	25 (71.4)	28 (80)		
Marital status			1.597[b]	.211
Lived with spouse	30 (85.7)	28 (80)		
Separation	5 (14.3)	7 (20)		
Type of family			0.283[b]	.596
Nuclear family	3 (8.6)	4 (11.4)		
Lived with own family	19 (54.3)	17 (48.6)		
Lived with spouse's family	13 (37.1)	14 (40)		
Family support			0.559[b]	.457
Own parent	12 (34.3)	17 (48.6)		
Spouse	18 (51.4)	14 (40)		
Relatives	5 (14.3)	4 (11.4)		
Plan for pregnancy			1.026[b]	.315
Planned	12 (34.3)	10 (28.6)		
Unplanned	23 (65.7)	25 (71.4)		
Attended prenatal clinic			5.297[b]	.211
Immediately	29 (82.9)	25 (71.4)		
Delayed	6 (17.1)	10 (28.6)		

a = Independent t-test, b = Chi-square test

Effectiveness of the MeH-IFSMP

When comparing the mean scores of self-management and quality of life at each point in time between the two groups, it was found that at baseline, the mean score of self-management behavior in the control group was significantly higher than that of the experimental group. Still, no significant difference in the quality of life was found. At time 1, the mean scores of self-management behavior and quality of life between the two groups were not significantly different. However, at time 2, the mean scores of both variables in the experimental group were significantly higher than those of the control group (**Table 2**).

Table 2. Comparison of self-management behavior and quality of life between groups at baseline, time 1, and time 2 (n = 70)

	Control group (n = 35)			Experimental group (n = 35)			t
	Possible range	Actual range	Mean (SD)	Possible range	Actual range	Mean (SD)	
Self-management behavior							
Baseline	0-69	38-67	47.54 (5.82)	0-69	33-55	43.06 (5.71)	3.25*
Time 1	0-69	36-68	49.29 (6.02)	0-69	42-62	49.71 (4.99)	-0.32
Time 2	0-69	36-66	49.57 (5.79)	0-69	50-67	55.97 (3.72)	-5.50*
Quality of life							
Baseline	26-130	59-110	87.63 (14.53)	26-130	62-96	82.57 (8.59)	1.78
Time 1	26-130	56-115	86.26 (14.38)	26-130	68-100	88.46 (7.45)	-0.80
Time 2	26-130	57-113	86.14 (14.08)	26-130	70-108	93.17 (8.42)	-2.53*

Note. * $p < .05$

Further analyses with RM-ANCOVA, controlling for the influence of self-management behavior and QOL at baseline, were conducted, as shown in **Table 3**. There was a significant main effect of the program on self-management behavior and a significant interaction effect of the program and time on self-management behavior and QOL. These significant interaction effects indicated improved self-management behavior and QOL, as illustrated in **Figures 2 and 3.**

Table 3. Repeated measures ANCOVA (RM-ANCOVA) comparing mean scores of self-management behaviors and quality of life between groups at times 1 and 2 by controlling self-management behavior and quality of life at baseline (n = 70)

Source of variable	SS	df	MS	F	p-value
Self-management behavior					
Within-subject effect					
Time	112.63	1	112.63	36.36	< .001

Table 3. Repeated measures ANCOVA (RM-ANCOVA) comparing mean scores of self-management behaviors and quality of life between groups at times 1 and 2 by controlling self-management behavior and quality of life at baseline (n = 70) (Cont.)

Source of variable	SS	df	MS	F	p-value
Time*SMB at baseline	68.36	1	68.36	22.07	< .001
Time*Program	179.43	1	179.43	57.92	< .001
Error 1	207.53	67	3.10		
Between-subject effect					
SMB at baseline	2,503.53	1	2,503.53	184..65	< .001
Program	1,380.69	1	1,380.69	101.84	< .001
Error 2	908.39	67	13.56		
Quality of life					
Within-subject effect					
Time	118.40	1	118.40	8.19	.006
Time*QOL at baseline	57.52	1	57.52	3.98	.050
Time*Program	928.83	1	928.83	64.26	< .001
Error 1	968.05	67	14.45		
Between-subject effect					
QOL at baseline	3,770.99	1	3,770.99	11.13	.001
Program	1,018.61	1	1,018.61	3.01	.087
Error 2	22,695.19	67	338.73		

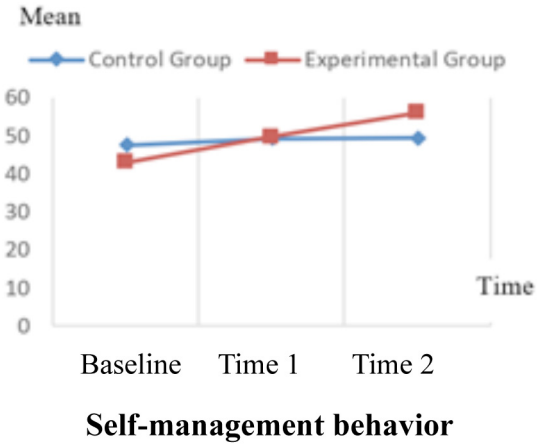

Figure 2. Trend of change over time in self-management behavior mean scores in control and experimental groups

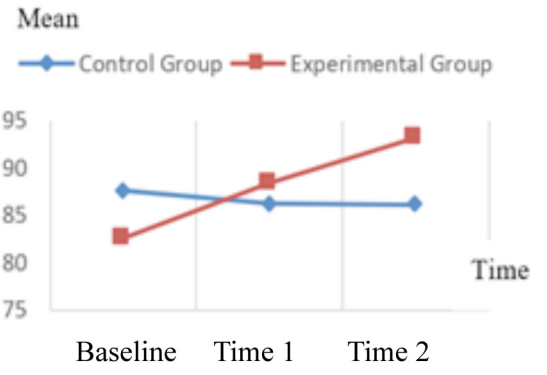

Figure 3. Trend of change over time in the quality of life mean scores in control and experimental groups

This study was conducted using independent t-tests and chi-square for health status data. Means of gestational weight gain at time 2 of the control group were significantly lower than the experimental group. For blood analysis values, the mean values of hemoglobin and hematocrit at time 2 in the experimental group were significantly higher than those of the control group. Furthermore, gestational weight gain at time 2 of the experimental group was higher than that of the control group. Lastly, the number of participants having urinary tract infections in the experimental group was significantly lower, whereas the normal fetal weight was significantly higher than that of the control **(see Tables 4 and 5).**

Table 4. Comparison of mean scores of hemoglobin, hematocrit, and gestational weight gain between groups at baseline and time 2 using independent t-test (n = 70)

Health status	Control group (n = 35) Mean (SD)		Experimental group (n = 35) Mean (SD)		t	
	Baseline	Time 2	Baseline	Time 2	Baseline	Time 2
Hemoglobin (g/dl)	11.44 (1.49)	11.18 (1.57)	11.08 (1.39)	12.13 (1.32)	1.02	2.74*
Hematocrit (%)	33.90 (3.10)	33.47 (3.23)	33.91 (3.18)	35.51 (2.60)	0.01	2.91*
Gestational weight gain (Kg)	1.07 (0.41)	3.96 (0.80)	1.12 (0.43)	4.43 (0.50)	0.54	2.87*

Note. * p < .05

Table 5. Comparison of urinary tract infection and fetal weight between groups at time 2 (n = 70)

Health status	Control group (n = 35)	Experimental group (n = 35)	Chi-square
Urine analysis			
Normal	25	32	4.63*
Abnormal	10	3	
Fetal weight			
Normal	23	30	3.81*
Less than normal	12	5	
Larger than normal	0	0	

Note. * p < .05

Discussion

The result of this study indicated that the MeH-IFSMP effectively increases self-management behavior, quality of life, and health outcomes, including gestational weight gain, hemoglobin level, and hematocrit level and reducing urinary tract infections. This program helps the participants identify and measure their risk and protective factors, enhance their knowledge of physiological changes during pregnancy, discomfort symptoms, general health promotion, and how to relieve pain and discomfort symptoms and manage stress. Also, mobile health is a valuable tool for pregnant teenage mothers who have difficulty accessing health information and health services to make it easier to access these services. In addition, the experimental group can access information from various sources, including the e-book and an interactive form in which they could ask and answer questions from the PI. Furthermore, they received support from families and friends through program activities. The social facilitation from the family helped the adolescents set the goal of good health during pregnancy, plan the activities they had to perform for good health and encourage them to maintain appropriate self-management behaviors. As part of peer support, pregnant adolescents can share their experiences and act out self-management behaviors to improve their health and the problems that they face. Other pregnant adolescents who attended the peer support group may bring the information gained from the group to modify and apply to act self-management on health during pregnancy. Thus, the participants could perform self-management behaviors, which resulted in improved health outcomes as indicated by gestational weight gain, improved hemoglobin and hematocrit levels, and reduced urinary tract infections. Our findings support the validity of the Individual and Family Self-management Theory.[20]

Previous studies supported our findings. For example, Sakamoto et al.[28] found that a mobile health application was a useful tool for pregnant teenage mothers who had difficulty accessing health information and health services to make it easier to access these services Prommate et al.[29] demonstrated that pregnant women receiving knowledge via online educational programs improved their knowledge, self-care behaviors and clinical outcomes including hemoglobin, hematocrit, and gestational weight gain. Nakkrasae et al.[30] organized a teaching program for primiparous adolescent mothers that encouraged them to realize the benefits of practicing health behaviors, reduce cognitive barriers, and incentivize more health-promoting behaviors. On the other hand, Borgen et al.[31] found that their smartphone application did not affect controlling gestational blood glucose levels. Using such applications can lead to a lack of motivation to modify healthy behaviors. Therefore, using a mobile application alone may not help pregnant women maintain good health habits. Social support is also required. Pregnant women receiving appropriate social support tend to have more ability to access health care services and apply health information to promote healthy life than women who have less family support.[32]

Another main finding in our study was that MeH-IFSMP did not affect the QOL of the participants. On the contrary, the findings of Panyaso et al.[33] indicated that self-management and social support were statistically significant factors associated with health-related QOL. Pregnant women with good self-management and who received enough social support usually perceived an excellent QOL. Although we found that the program did not affect QOL, there was a significant interaction effect of program and time on QOL, indicated by a positive trend of improvement over time in the experimental group. Many factors affect QOL, such as family characteristics or family income, and this may be why there was no difference in QOL when comparing the groups. It might take a longer time for QOL to improve. An explanation is that the experimental group received the MeH-IFSMP, which helped them develop appropriate self-management behaviors. Additionally, they received support from family, spouses, friends, and healthcare

providers, who helped them perceive a good QOL. This finding was supported by the study of Bedaso et al.,[34] which demonstrated that mothers living alone were more likely to encounter mental health problems and poorer socioeconomic status than those who lived with a partner.

In the MeH-IFSMP, the PI provided knowledge on stress management and included several methods in the booklet that pregnant adolescents could use to adapt to themselves at home. These may have helped participants manage their anxiety or stress better. In addition, this study employed the family as social facilitators to empower the adolescents to take care of themselves physically and to deal better with mental health negativity. After completing the program, the participants continued to adopt good health habits through encouragement from family members.

Limitations

There are limitations in this study. Firstly, the purposive sampling of participants and the study being conducted in one urban hospital limits the generalization of the findings. Secondly, this study was quasi-experimental in which participants were not randomized to intervention or control groups, and the time for data collection was different. Therefore, a systematic bias that may affect group membership is inevitable. Thirdly, the study was conducted in the short term, not until the delivery of the babies and beyond. Thus, the study results need to be read or used with caution.

Conclusion and Implications for Nursing Practice

The mobile e-health individual and family self-management program could benefit the health of pregnant adolescents. According to the findings, this study provides practical implications for implementing self-management intervention through e-health in hospitals. Nurses should promote self-management behaviors in pregnant adolescents to achieve positive health status. The main findings suggest that nurses should encourage spouses and parents of pregnant adolescents to collaborate on programs to motivate them to maintain their self-management behaviors throughout pregnancy. However, the intervention's content and implementation process must be tailored to the user. Further testing of the program's effectiveness is also needed with the long-term follow-up until delivery, which includes both mother and baby outcomes.

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Appendix

Table 1: Contents, objectives and activities of MeH-IFSMP

Week/Time	Objectives	Activities
Week 1: (60 min) **Session 1:** (15 min)	- Identifying and measuring risk and protective factors	- Having participants complete pre-test questionnaires - Having individual conversations between facilitator and participant to clarify risk and protective factors related to self-management behavior
Session 2: (45 min)	- Increasing knowledge and changing beliefs about self-management on health during pregnancy (30 min)	- Individual verbal health education on physiological changes during pregnancy in each trimester, discomfort symptoms, general health promotion during pregnancy, true and false labor pain, how to relieve pain and discomfort symptoms, and stress management using a PowerPoint presentation - Assess knowledge taught using open-ended questions to express ideas/opinions and answer any questions - Give e-book and booklet to review, and explain use of same so participants can access the right information
	- Developing self-management process (self-regulation skills and abilities) (15 min)	- Ask the participants and family questions about their health during pregnancy so that goal(s) of self-management can be set. For example, "I will take three meals from all five food groups daily." - The participants and family write a list of what they will do to care of her health during pregnancy. - Ask questions to assist them in reflexive thinking and encourage their decision-making about their self-management plan and steps
Session 3: (45 min)	- Encouraging social facilitation	- Provide individual verbal health education, like the participants received with their family using a PPT - Assess knowledge given using open-ended questions for family and encourage them to express their opinions - Invite participants and their families to join the LINE application and explain how to use it, including testing it beforehand. On LINE, the participants record and discuss everyday activities related to their goal(s) and self-management plan. For example, "What planned activities can I do each day?" They also evaluate whether their behavior is appropriate. If it is not, how can it be adjusted? The family and health care team then help make a new self-management plan with them.
	- Encouraging family to help the adolescent to follow self-management process	- Discuss the planned self-management behavior of the participant, how much they can do, and encourage their families to praise them when they progress in behaviors and self-management.

Table 1: Contents, objectives and activities of MeH-IFSMP (Cont.)

Week/Time	Objectives	Activities
Week 2: **Session 2:**	- Increasing the knowledge and changing beliefs about self-management on health during pregnancy • 15 min/time and 1 time/week	- Phone call to review health care knowledge and follow up on behavioral changes according to goals and plans - Provide further information if there is any misunderstanding, difficulty attaining goals, or certain behaviors
	• 4 hours/day and 3 days/week (4 p.m.-8 p.m. on Monday, Wednesday, and Friday)	- Have the participant use Q&A service about self-management during pregnancy on LINE application
Session 3: (15 min)	- Encouraging social facilitation (1 time/week)	- Further encouragement and counselling of the participants to maintain self-management process
Week 3: **Session 2:**	- Increasing the knowledge and changing beliefs about self-management on health during pregnancy • 15 min/time once a week	Follow up with participants via telephone (same activities as in week 2)
	• 4 hours/ day and 3 days/week (for example, 4 p.m.-8 p.m. on Monday, Wednesday, and Friday)	- Encourage the participant to use Q&A service of self-management during pregnancy on LINE application
Session 3:	- Encouraging social facilitation (1 time/week)	- As for Week 2, Session 3
Week 4: **Session 3:** (40 min)	- Encouraging social facilitation	- Organize a self-help group with adolescent peers on the topic of "Sharing experiences about self-management on health during pregnancy" - Adolescents are encouraged to share experiences of caring for themselves during pregnancy, such as "What you should do and what you shouldn't do." - Give praise when they practice proper health self-management and give additional information and advice as required.

ผลของโปรแกรมการจัดการตนเองและครอบครัวผ่านการให้ความรู้ทางด้านสุขภาพบนอุปกรณ์สื่อสารเคลื่อนที่มือถือสำหรับหญิงตั้งครรภ์วัยรุ่นครรภ์แรก: การวิจัยกึ่งทดลอง

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บทคัดย่อ: การตั้งครรภ์ในวัยรุ่นถือเป็นกลุ่มที่มีความเสี่ยงสูงต่อปัญหาสุขภาพที่ทำให้คุณภาพชีวิตแย่ลง การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาประสิทธิผลของโปรแกรมการจัดการตนเองของบุคคลและครอบครัวผ่านการให้ความรู้ทางด้านสุขภาพบนอุปกรณ์สื่อสารเคลื่อนที่ในหญิงตั้งครรภ์วัยรุ่นครรภ์แรก โดยกลุ่มตัวอย่างเป็นหญิงตั้งครรภ์วัยรุ่นครรภ์แรกที่เข้ารับการฝากครรภ์ที่หน่วยฝากครรภ์ของโรงพยาบาลประจำจังหวัดแห่งหนึ่งใกล้กรุงเทพมหานคร จำนวนทั้งสิ้น 70 ราย โดยแบ่งออกเป็นกลุ่มทดลองและกลุ่มควบคุม กลุ่มละ 35 คน หญิงตั้งครรภ์วัยรุ่นในกลุ่มทดลองได้รับการดูแลตามมาตรฐานของคลินิกฝากครรภ์ร่วมกับโปรแกรมฯ ส่วนกลุ่มควบคุมได้รับการดูแลตามมาตรฐานของคลินิกฝากครรภ์อย่างเดียว โปรแกรมมีทั้งหมด 3 ส่วน ซึ่งดำเนินการในระยะเวลา 4 สัปดาห์ โดยประเมินผลลัพธ์ทั้งหมด 3 ครั้ง เก็บข้อมูลครั้งแรกก่อนเริ่มโปรแกรม เก็บข้อมูลครั้งที่สองในสัปดาห์ที่ 2 หลังจากสิ้นสุดโปรแกรม และเก็บข้อมูลครั้งที่สามในสัปดาห์ที่ 4 หลังจากสิ้นสุดโปรแกรม เก็บรวบรวมข้อมูลในเดือนกรกฎาคม-ธันวาคม พ.ศ. 2565 โดยใช้แบบสอบถามข้อมูลส่วนบุคคล แบบบสอบถามพฤติกรรมการจัดการตนเองของสตรีตั้งครรภ์วัยรุ่น แบบบันทึกภาวะสุขภาพขณะตั้งครรภ์และแบบสอบถามคุณภาพชีวิตขององค์การอนามัยโลกชุดย่อฉบับภาษาไทย การวิเคราะห์ข้อมูลใช้สถิติพรรณนา การวิเคราะห์ความแปรปรวนร่วมแบบวัดซ้ำ และ t-test

ผลการศึกษาพบว่าหลังได้รับโปรแกรมในสัปดาห์ที่ 4 หลังจากสิ้นสุดโปรแกรม พฤติกรรมการจัดการตนเองของหญิงตั้งครรภ์วัยรุ่นในกลุ่มทดลองและกลุ่มควบคุมหลังได้รับโปรแกรมแตกต่างกันอย่างมีนัยสำคัญทางสถิติ แต่คุณภาพชีวิตของหญิงตั้งครรภ์วัยรุ่นในกลุ่มทดลองและกลุ่มควบคุมหลังได้รับโปรแกรมไม่แตกต่างกัน สำหรับภาวะสุขภาพ พบว่า ระดับฮีโมโกลบิน ระดับฮีมาโตคริต และน้ำหนักมารดาที่เพิ่มขึ้นในระหว่างตั้งครรภ์ของกลุ่มทดลองสูงกว่ากลุ่มควบคุม จำนวนของการติดเชื้อในระบบทางเดินปัสสาวะในกลุ่มทดลองต่ำกว่าในขณะที่น้ำหนักของทารกในครรภ์สูงกว่ากลุ่มควบคุม โปรแกรมดังกล่าวสามารถนำไปเป็นแนวทางในการวางแผนการดูแลหญิงตั้งครรภ์วัยรุ่นเพื่อพัฒนาภาวะสุขภาพในขณะตั้งครรภ์และคุณภาพชีวิตที่ดีขึ้น อย่างไรก็ตาม จำเป็นต้องมีการทดสอบเพิ่มเติมก่อนที่จะนำไปใช้อย่างแพร่หลาย

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คำสำคัญ: หญิงตั้งครรภ์วัยรุ่น ภาวะสุขภาพ การดูแลสุขภาพผ่านอุปกรณ์สื่อสารเคลื่อนที่ คุณภาพชีวิต การจัดการตนเอง

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