Enhancing Maternal Self-efficacy in Caring for Preterm Infants with Ventilator through a Telehealth Program: A Randomized Controlled Trial

Kritsana Kongsaenkaew, Somsiri Rungamornrat, Sudaporn Payakkaraung*

Abstract: Telehealth is increasingly important in nursing, encouraging mothers of preterm infants with ventilators to have confidence in their infant care. This study investigated the impact of a telehealth program on maternal self-efficacy in caring for preterm infants with ventilators in the early postpartum period. We employed a randomized controlled trial using the block allocation method, enrolled 42 mothers of preterm infants receiving ventilators and randomly assigned 21 in the experiment group and 21 in the control group. The experimental group received asynchronous and synchronous telehealth programs for six days to enhance their self-efficacy. Data were obtained using the demographic data questionnaire and the maternal self-efficacy questionnaire. Data were analyzed using the Chi-square test, Fisher's Exact test, Mann–Whitney U test, independent t-test, and paired t-test.

After completing the program, the experimental group had a significantly higher mean score of maternal perceived self-efficacy than the control group, and this was significantly higher than before the trial. A telehealth program is effective for mothers with preterm infants with ventilators. Nurses should allow the mothers to practice care activities with infants at least once before discharge and when they arrive home and provide health information via telehealth. These can enhance maternal self-efficacy in caring for premature infants with ventilators in the first week of life. However, further testing of the program in other settings is needed before widespread implementation.

Keywords: Maternal self-efficacy, Nursing, Preterm infants, Randomized controlled trial, Telehealth, Ventilator

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Kritsana Kongsaenkaew *RN, Master of Nursing Science Program in Pediatric Nursing (Candidate), Mahidol University, Bangkok, Thailand. E-mail: kongsaenkaewk@gmail.com*

Correspondence to: Somsiri Rungamornrat, RN, PhD, Department of Pediatric Nursing, Faculty of Nursing, Mahidol University, Bangkok, Thailand. E-mail: somsiri.run@mahidol.ac.th*

***Sudaporn Payakkaraung**, RN, PhD, Department of Pediatric Nursing, Faculty of Nursing, Mahidol University, Bangkok, Thailand. E-mail: sudaporn.pay@mahidol.ac.th*

Introduction

The younger the gestational age of premature infants, the greater the risk of health problems and prolonged hospital stays. Premature infants require observation in a neonatal intensive care unit (NICU). This situation can greatly affect the mothers, leading to stress, anxiety, sadness, or insomnia due to their child's condition. Consequently, they may lack confidence in participating in caring for their premature infants in the NICU.[1-3] Furthermore, mothers may encounter difficulties in interacting with their premature infants and fulfilling maternal roles.[4-5] Premature infants receiving basic care from their mothers in the NICU can improve

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their neurological development and physical growth, reducing complications and hospital costs.[6-10]

A previous study found that participation in caring for mothers with preterm infants receiving ventilator support should cover participation in information sharing, decision-making, routine care, and technical care.[11] Healthcare professionals should conduct a two-way exchange of information about the disease, symptoms, and treatment with parents. The decision-making aspect depends on patient autonomy. Mothers can practice the right to self-determination and accept the outcome of decision-making. Regarding infant care activities, healthcare professionals should encourage mothers to participate in activities such as expressing breast milk, cleaning the infant's body, putting the baby to sleep, or reducing noise and light.

Regarding the activities with nurses, mothers can take their infant's body temperature, observe the vital sign trackers, notify the health team about apnea, and so on.[1,6,8,12-14] However, it has been observed that mothers are often less involved in caring for their preterm infants in the NICU than they would like to be. This lack of involvement is often attributed to the mother's confidence in her ability to care for preterm infants[4,12] and her limited access to healthcare services within the NICU.[3,9,15-16] Therefore, this study aimed to investigate whether a telehealth program can help mothers enhance their self-efficacy in caring for preterm infants requiring ventilator support.

Conceptual Framework and Literature Review

The conceptual framework for this study was based on self-efficacy theory[17] to enhance mothers' confidence in their ability to engage in childcare behavior. Four crucial sources of information influence self-efficacy: (1) mastery experience, which refers to the actual performance of behavior, where individuals gain confidence by successfully executing the desired actions; (2) vicarious experience, this involves observing similar individuals who have effectively performed the same activity, serving as role models and inspiring confidence in one's capabilities; (3) emotional arousal: Individuals assess their capacity to perform tasks based on physiological and emotional responses. This includes feelings of tension, anxiety, or depression, which can impact their self-efficacy; and (4) verbal persuasion: Providing instructions, suggestions, and advice can persuade individuals that they can excel in challenging tasks, thereby reinforcing their self-efficacy.[17] These four sources of information were employed to guide the development of the telehealth program in this study.

According to the requirement for specialized care, such as incubator support, respiratory assistance, or nutritional supplementation, premature infant births frequently result in maternal confidence deficits in caring for their preterm infants.[1-4,9] It is essential for them to initially have faith in their capabilities. The foundation of maternal confidence empowers them to effectively care for their premature infants.[17] Based on the literature, promoting self-efficacy perception significantly enhances mothers' confidence with preterm infants.[18-20] Furthermore, the limitations imposed during the COVID-19 pandemic have substantially hindered the interaction between mothers and preterm infants receiving ventilatory support in NICUs.[21-25] Consequently, the utilization of telehealth can prove to be advantageous in the current healthcare service. In summary, telehealth presents a spectrum of benefits that augment healthcare accessibility, convenience, and efficacy, rendering it valuable in contemporary healthcare delivery.[23-25]

The World Health Organization defines telehealth as a method of accessing health services through technology to promote patient well-being regardless of location.[26] There are two types of telehealth: 1) asynchronous telehealth: This technology supports information sharing, enabling self-care and providing healthcare services without immediate in-person interactions via an online platform. (e.g., sending photos or health information via email or a telehealth

application and receiving recommendations at their convenience); and 2) synchronous telehealth: This technology facilitates real-time interaction through online platforms, often involving video conferencing or scheduled online chats, such as online appointments, where patients and physicians log in at predetermined times for immediate consultations.[27] Recent studies have reported that telehealth enhances mothers' confidence in caring for their preterm infants.[28-31] Moreover, real-time video conferencing tools like Facetime, Skype, and Webcam can increase mothers' awareness of their infant care abilities and reduce the stress and anxiety of mothers who cannot visit their premature infants.[24,28-29,32] However, integrating synchronous and asynchronous maternal support for caring for preterm infants with ventilators, and in cases of limited healthcare access, can still pose challenges in enhancing self-efficacy.[30-33]

A literature review revealed various methods for improving self-efficacy in the care of preterm infants, including knowledge dissemination, hands-on demonstrations, and active caregiving.[18-20] Studies on remote healthcare interventions for preterm neonatal care often span two weeks or more.[6-7,18-19] Mothers must independently learn from applications[25,32] and employ them when the infant is prepared for discharge back home.[18] Consequently, providing immediate support to mothers after childbirth, especially during the first week of the infant's life, poses a challenge.[10]

Study Aim and Hypothesis

This study aimed to investigate the outcomes of a newly developed telehealth program on maternal self-efficacy in caring for preterm infants on ventilators aged 1-7 days. It was hypothesized that the mean score of maternal perceived self-efficacy would be higher among mothers in the group receiving self-efficacy enhancement through telehealth programs than mothers in the group receiving only routine nursing care and significantly higher than their scores before participating in the program.

Methods

Design: This study employed a single-center, single-blind, pre-test, post-test, parallel-group (1:1 ratio) blocked randomized controlled trial design. The writing of this report was guided by the Consolidated Standard of Reporting Trials (CONSORT).

Sampling and Settings: The study setting was one NICU of a university hospital in Bangkok, Thailand. The sample size was calculated using the G* Power program. The power analysis used the F test for the analysis of variance (ANCOVA)[34] with a power of 0.80 level, α =.05, and the effect size calculated from previous similar study's standardized mean difference of 0.89,[35] which was converted into an effect size for an F test of 0.45. Thus, the sample size required 42 mothers as participants (n = 21 experimental and n = 21 control group).

The inclusion criteria for mothers were: 1) aged >18 years who could communicate and understand Thai; 2) had no experience caring for a newborn receiving a ventilator; 3) had a tool for Internet access, such as a tablet, touch screen mobile phone, or computer, and had a LINE application; and 4) had to visit the infant in the NICU more than two times before they were discharged from the postpartum ward. Inclusion criteria for the preterm infants were: 1) they weighed < 2,500 g; 2) they were admitted to the NICU within the first 24 hours after birth; and 3) they received an endotracheal tube (ETT), nasal continuous positive airway pressure (NCPAP), or heated humidified high flow nasal cannula (HHHFNC) ventilators. The exclusion criteria for mothers were: 1) postpartum mothers with critical symptoms requiring further hospitalization, such as postpartum hemorrhage, endometritis, or infections, infected with COVID-19; and 2) postpartum depression or psychiatric problems. Exclusion criteria for the preterm infants were: 1) congenital anomalies or genetic abnormalities, such as congenital heart disease, congenital hydrocephalus, choanal atresia, cleft lip and palate, myelomeningocele,

omphalocele, gastroschisis, and Down syndrome; and 2) had a worsening of progress or died during the implementation.

Randomization: The primary investigator (PI) requested the in-charge nurse invite eligible mothers, as per the specified criteria, to participate in the research on a daily basis. The participants were randomly selected from the mothers who met the inclusion criteria using a simple random sampling method. Participants were placed in chronological order according to the time of their first NICU visit, with the control group comprising mothers receiving only routine nursing care instructions and the experimental group comprising mothers who received routine care and telehealth support while caring for their preterm infants with ventilators. The participants were randomly assigned to the groups by block randomization. The experimental and control groups were assigned the letters "E" and "C," respectively. The two groups were further divided into four subgroups to balance E and C. The primary investigator (PI) sorted the blocks in six different ways as follows: CCEE, CECE, ECCE, ECEC, EECC, and CEEC; after which, the numbers 1-6 were assigned to these methods. Subsequently, the randomization by number was carried out by an assistant who was not involved in data collection. A computer-based random number generator program was employed in the block randomization process, sorted according to the method obtained in each block, and placed in questionnaire envelopes, sealed according to the sequential code of the sample until there were 42 participants.

Among the 89 mothers of newborns admitted to NICU, 45 women were excluded because they were in a group meant for testing the instrument quality, ten people did not meet the inclusion criteria, 35 met the criteria, and 30 had full-term infants. One infant had a severe illness and died before enrollment, and four were preterm infants without ventilator support. Altogether, 44 women met the inclusion criteria and were willing to participate in the study. Two women, including one from the experimental group, had an infant who died during the implementation, and one woman from the control group who did not answer the post-test questionnaire was excluded from participating in the program. Therefore, the PI randomly collected data to complete each group of 21 participant dyads, totaling 42 people (**Figure 1**).

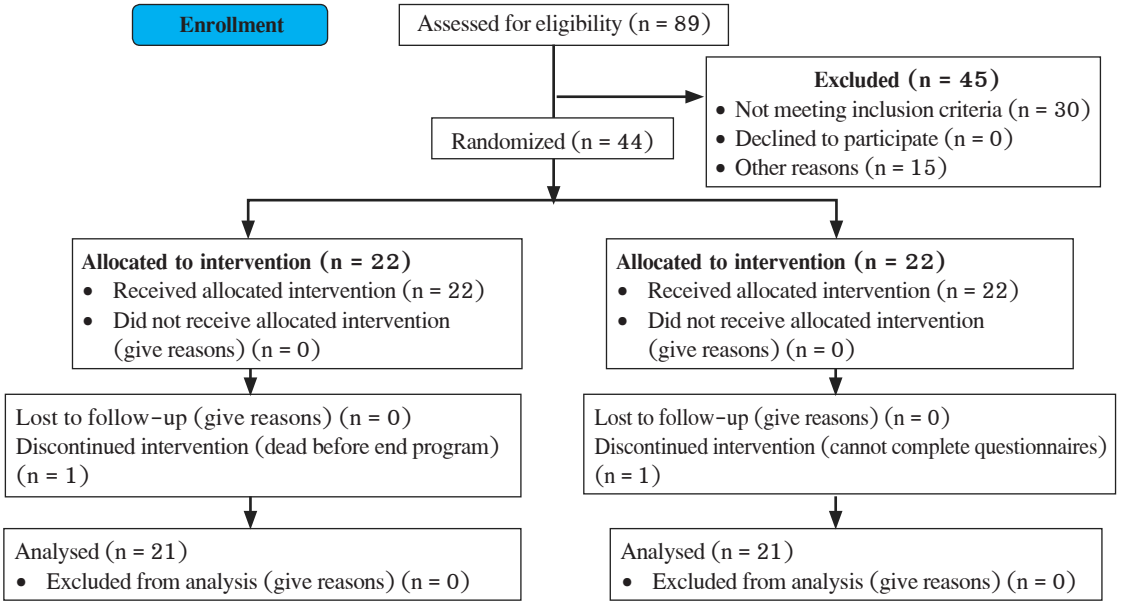

Figure 1. CONSORT allocation, follow-up, and analysis diagram

Ethical Considerations: This research was approved by the Human Research Ethics Committee of the Faculty of Nursing, Mahidol University (project code IRB-NS 2021/52.0312, COA No. IRB-NS 2022/655.0802) and the Research Ethics Committee of the studied hospital (Project Code 306/64 E, COA No. 070/2565). In addition, this trial was registered in the Thai Clinical Trials Registry at https://www.thaiclinicaltrials.org (TCTR20230725003) on July 25, 2023. Written informed consent was obtained from each mother. The study was conducted following the Declaration of Helsinki and provided participants with protection of their study rights throughout. The authors declare that they have no competing interests.

Research Instruments: The instruments were in two parts: the instruments for data collection and the telehealth program. The instruments for data collection were the demographic questionnaire of mothers and preterm infants receiving ventilators and maternal self-efficacy.

The PI developed the *Demographic Questionnaire* to gather participant information. Part 1 was general information about mothers collected via a Google Form questionnaire, including age, education level, employment status, monthly income, mode of delivery, and gestation age. Part 2 was general information about premature infants obtained from medical records, including gender, body weight, diagnosis, and type of ventilator used.

The *Maternal Self-efficacy Questionnaire* for caring for preterm infants on a ventilator was based on the conceptual framework of Self-efficacy Theory.[17] This instrument was developed by the PI based on a literature review and a self-efficacy questionnaire originally in Thai focused on participatory involvement in newborn care within the NICU. Permission to use the original scale was obtained from the author.[35] It was considered an appropriate instrument for this study as it measures maternal perceived self-efficacy in participating in the care of preterm infants receiving ventilator support. The questionnaire has 28 positively phrased items organized into four dimensions: information sharing (8 items), decision-making (5 items), routine care (11 items), and technical care (5 items). For example, "I am confident that I can safely change my baby's diapers, even if they have tubes and medical equipment attached," "I am confident that I can help the nurse accurately assess my baby's fever." and "I am confident that I can make decisions together with the nurse about taking care of my baby, such as deciding when to bathe them." Respondents used a scale that ranged from 'not confident at all' (0) to 'certainly confident' (100). Total scores were obtained, and the average scores were calculated for analysis. A higher percentage of confidence represents higher perceived self-efficacy in participation in caring for preterm infants with ventilators. The content validity of the questionnaire was validated by five experts in pediatrics, including two neonatal nurses from the ward, two nursing instructors from the department of pediatric nursing, and one neonatologist. The CVI was .99. The instrument's internal consistency reliability was evaluated using Cronbach's alpha coefficient, yielding a value of .94 during the pre-test with ten mothers exhibiting characteristics similar to the sample group and .97 in the actual study involving 42 participants.

Telehealth Program and Implementation

The 6-day program was developed by the PI based on Bandura's Self-efficacy Theory[17] and an extensive literature review to enhance maternal perceived self-efficacy of preterm infants with ventilators through a structured sequence of four steps.[17] In this study, the PI employed a telehealth approach using the LINE application for message delivery, information sharing,[6,7] electronic books,[28] and video call conferences.[30] The intervention steps of this telehealth program were as follows: 1) providing face-to-face education to mothers in the postpartum period, encompassing four lessons on participating in the care of preterm infants with ventilator and demonstrating caregiving activities; 2) skill-building through re-demonstrations and allowing mothers to perform care tasks independently;

3) learning from role models through videos featuring mothers with similar experiences and E-books; and 4) emotional support, fostering positive relationships, creating opportunities for emotional expression, and being available for inquiries at all times. The program encompassed onsite and online formats, utilizing asynchronous and synchronous methods. Instruments used in the intervention comprised firstly asynchronous components consisting of an electronic book (E-book) titled 'Care of Premature Infants Using a Ventilator for Mothers' developed by the PI, covering information sharing, decision-making, routine care, and technical care, complemented with multimedia elements and video clips. This E-book includes images, narration, audio narration, and 11 video clips demonstrating care activities for premature infants with ventilators. Additionally, the PI created an 8-minute video clip titled 'When the Baby is in the NICU,' featuring mothers with experience caring for premature infants on ventilators. These materials were accessible via QR codes, links, and SMS alerts. Secondly, synchronous elements in the program involved using the LINE application for video calls to conduct follow-up sessions and provide support. Before implementation, content validity and language suitability were rigorously reviewed by five experts, resulting in necessary revisions. Comprehensive details and implementation specifics are available in **Appendix, Table 1**.

Routine care: On the first visit (15-30 minutes), the mothers received information from physicians and nurses regarding the disease, symptoms, and treatment of the acute illness episode and what to do when visiting their preterm infant in the NICU, such as washing hands, breastfeeding, talking and skin-to-skin. Moreover, the mother could ask for a video call to visit the preterm infant once a day, for 5 min each time.

On the second visit (on the sixth day after the first meeting: 30 min), the PI sent the Google Form link to the mothers via an online application. After completing the questionnaire, the PI provided them with video files and the electronic handbook (E-book) "Care of Premature Infants Using a Ventilator for Mothers."

Data Collection: This study was conducted from March to November 2022, after receiving approval from the IRB. The nurse in the NICU introduced the PI to the mother. Subsequently, the PI recruited postpartum mothers who met the inclusion criteria and consented to participate in the study. The PI picked the sealed envelopes according to the sample code sequence. When it was found that the mother was in the experimental group or control group, she explained the details of her rights. She asked her to complete the questionnaires to obtain personal information and data on maternal self-efficacy in caring for ventilated preterm infants (pre-test) using a Google Form before proceeding. The experimental group completed a pre-test questionnaire before receiving routine care and the telehealth program. In contrast, the control group completed the pre-test questionnaire before receiving routine care exclusively from the NICU. Following the intervention period of six days, participants in both groups were requested to complete a questionnaire through Google Forms.

Data Analysis: Data were analyzed using the IBM Statistical Package for Social Science Statistics for Windows version 18.0. General maternal and infant data were used in the descriptive statistics. To compare the differences in the sociodemographic data between the experimental and control groups, the researchers used the chi-square test, Fisher's exact test, independent t-test, and Mann-Whitney U test. The difference in maternal self-efficacy between the experimental and control groups was assessed using an independent t-test, and the difference in the data of the experimental group before and after the program was analyzed using the paired t-test.

Results

Sociodemographic Data

The experimental and control groups were aged between 21 and 40 years. More than half had graduated

with a bachelor's degree. Most mothers were employed. More than half of the mothers had more than one child.

Most preterm infants in the experimental and control groups were delivered by cesarean section, and the normal labor rate was equal in both groups. The mean gestational ages of the experimental and control groups were 31.19 and 30.19, respectively. The mean birth weights were 1,652.14 gm and 1,504.14 gm, respectively. Over half of the infants were diagnosed with respiratory distress syndrome and other complications. Preterm infants received an NCPAP ventilator on the first day of data collection. The experimental and control groups accounted for 66.7% and 47.6%, respectively, of the sample. Before commencing the program, there were no statistically significant differences in the demographic characteristics of the mothers and preterm infants between the two groups, as illustrated in **Table 1.**

Table 1. General characteristics of mothers and infants and results of the comparison of sociodemographic characteristics between the experimental and control groups (n = 42)

Sample characteristics	Experiment group (n = 21)		Control group (n = 21)		Statistics	p-value
	Number	Percentage	Number	Percentage		
Age of mothers (years)					-	.217[b]
≤ 20	3	14.3	0	0		
21-40	16	76.2	20	95.2		
≥ 40	2	9.5	1	4.8		
Min-Max, Mean (SD)	18-41, 32.19(7.57)		23-41, 32.71(4.81)		.268	.791[c]
Education level					-	.292[b]
Grade 1-6	0	0	2	9.5		
Grade 7-9	2	9.5	2	9.5		
Grade 10-12	7	33.3	3	14.3		
Bachelor's degree	12	57.1	14	66.7		
Employment status					-	1.000[b]
Working	18	85.7	18	85.7		
Not working	3	14.3	3	14.3		
Income (baht/month)					185.00	370[d]
Min-Max, Mean (SD)	0-300,000, 43,255 (67,635.44)		0-170,000, 24,894.52 (36,014.71)			
Delivery					.000	1.000[a]
Cesarean section	12	57.1	12	57.1		
Normal labor	9	42.9	9	42.9		
Gestation age (weeks)					-	.499[b]
≤ $28^{6/7}$	3	14.3	5	23.8		
$29-32^{6/7}$	11	52.4	12	57.1		
$33-36^{6/7}$	7	36.8	4	19		
Min-Max, Mean (SD)	$25^{1/7}$-36,$^{2/7}$ 31.19 (3.16)		$24^{6/7}$-36,$^{1/7}$ 30.19 (3.52)		-.970	.338[c]
Body weight of infant (grams)					-	.698[b]
< 1,000	3	14.3	4	19		
1,001-1,500	5	23.8	7	33.3		
1,501-2,500	13	61.9	10	47.6		
Min-Max, Mean (SD)	875-2475, 1652.14 (482.95)		690-2430, 1504.14 (505.64)		-.970	.338[c]
Diagnosis of infants					1.898	.450[a]
Preterm with RD	6	28.6	5	23.8		
Preterm with RDS	4	19	8	38.1		
Preterm with other complications	11	52.4	8	38.1		

Table 1. General characteristics of mothers and infants and results of the comparison of sociodemographic characteristics between the experimental and control groups (n = 42) (Cont.)

Sample characteristics	Experiment group (n = 21)		Control group (n = 21)		Statistics	p-value
	Number	Percentage	Number	Percentage		
Type of ventilator (at 1st-day visit)					-	.481[b]
NCPAP	14	66.7	10	47.6		
ETT	6	28.6	8	38.1		
HHHFNC	1	4	3	14.3		

[a] = Chi-square test, [b] = Fisher's Exact test, [c] = Independent t-test, [d] = Mann-Whitney U test, RDS = Respiratory distress syndrome, NCPAP = Nasal continuous positive airway pressure, ETT = Endotracheal tube, HHHFNC = Heated humidified high flow nasal cannula

Effectiveness of the Telehealth Program

The results indicated that, on the sixth day after the NICU visit, the mean score of maternal self-efficacy in taking care of preterm infants with a ventilator in the experimental group was significantly higher than that of the control group and significantly higher than the pre-test score (**Table 2**).

When analyzing and comparing the mean scores of maternal self-efficacies in caring for preterm infants with a ventilator (post-test), the mean scores of the information-sharing and decision-making aspects of the experimental group were not significantly higher than those of the control group. The mean scores of the routine and technical care aspects were significantly higher in the experimental group than in the control group (**Table 2**).

Table 2. Comparison of the mean scores of maternal perceived self-efficacies in caring for preterm with ventilator classified into total score and four aspects between the experimental and control groups

Self-efficacy score	Experimental group		Control group		t**	p-value
	Range	M(SD)	Range	M(SD)		
Total mean score						
Pretest	10-100	62.65 (19.84)	9-100	62.36 (23.31)	.043	.966**
Post-test	48-100	87.62 (9.92)	17-100	70.38 (20.67)	-3.447	.002**
Difference scores		24.96 (15.34)		8.01 (10.52)	-3.27	<.001***
t*		-7.456		-3.489		
p-value		<.001*		.002*		
Mean score by aspects						
Pretest						
Information sharing	31-96	67.56(17.97)	20-96	69.55(20.06)	.339	.736**
Decision making	15-100	63.69(24.50)	20-100	66.25(24.18)	.341	.735**
Routine care	9-100	59.76(22.75)	9-100	57.99(27.06)	-.230	.819**
Technical care	10-94	60.33(26.35)	10-100	57.38(30.11)	-.327	.744***
Post-test						
Information sharing	60-100	84.93(12.16)	49-100	78.81(14.95)	-1.481	.146**
Decision making	48-100	82.68(15.50)	33-100	71.31(20.86)	-2.005	.052**
Routine care	70-100	90.43(10.04)	17-100	66.22(26.03)	-3.978	.001**
Technical care	67-100	89.67(10.18)	28-100	65.46(24.134)	-3.594	<.001***

Note. Range of possible mean scores is 0-100, * = Paired t-test, ** = Independent t-test, *** = Mann-Whitney U test, Difference score = post-test score - pretest score

Discussion

This study yielded significant results in enhancing maternal perceived self-efficacy in caring for preterm infants with ventilators through the telehealth program, underpinned by Bandura's Self-efficacy Theory.[17] The telehealth program utilized both asynchronous and synchronous modes. Initially, mothers actively engaged in all four aspects of caring for preterm infants using a ventilator while still in the hospital. This approach allowed them to gain mastery in caring for premature infants requiring ventilator support. Remarkably, mothers initiated care for their preterm infants with ventilators 1-2 days after birth. They interacted with various learning resources, including E-books and observations of the PI performing caregiving activities. They promoted these skills using baby models until they felt confident. Mothers excelled in bathing and assessing the infants' body temperature. These findings align with prior research emphasizing the effectiveness of hands-on experience in increasing self-efficacy.[19,36-38] Furthermore, the experimental group exhibited significantly higher scores in routine activities and activities involving nurses than the control group. Both scores improved despite differences in caregiving activities between the experimental and routine care groups. The post-experiment mean difference score in the experimental group was notably higher than that of the control group, indicating the program's success in enhancing maternal self-efficacy within six days.

Notably, in this study, the experimental and control groups exhibited statistically significant increases in post-test scores compared to pre-test scores. This phenomenon could be attributed to the healthcare information support program provided within the hospital context, where both groups received prompt information from physicians and nurses regarding the disease, symptoms, and treatment within 1-2 days of the acute illness episode. Previous studies have established a statistically significant positive correlation between providing information and support for caregiving and self-efficacy.[39] This suggests that mothers in the control group, who received support and information regarding their caregiving roles, were more likely to improve their self-efficacy scores.

Furthermore, the program utilized the asynchronous mode as a symbol model, incorporating E-books, model mother videos, and SMS as vicarious experiences. The E-book presented the premature care process, while the videos featured mothers with prior experience in caring for premature infants with ventilators, making it particularly valuable for mothers without such experience. This facilitated easy access to information for future reference. Similar to previous studies, it was found that videos showcased others' achievements or experiences.[36-37] Encouraging messages through the LINE application as a form of verbal persuasion[6] and audio information[40] collectively enhanced self-efficacy. Additionally, the PI employed the synchronous mode as a mastery experience on days 3-6. This involved real-time video calls with mothers at home to review premature infant care. Mothers received suggestions, advice, and verbal encouragement during these video calls, leading to emotional arousal. This situation often made mothers feel relaxed and gain confidence, similar to previous studies.[37] As a result, the mean scores of maternal self-efficacy were significantly higher in the experimental group compared to the control group. This diverges from previous research that relied on one type of telehealth, such as software manuals alone,[28] or video calls exclusively,[32] to promote the self-efficacy of mothers with preterm infants in the NICU.

Additionally, telehealth provides other conveniences. Most studies mentioned the opportunity for mothers to see their preterm infants by video calling while they were sleeping in incubators,[24,29] as did the control group of this study. However, in the experimental group, PI implemented a hybrid program that allowed mothers to observe their infants both in the NICU and online via mobile video calls from their homes. Mothers

initially visited their premature infants while still in the hospital. During this time, they watched videos and E-books, and healthcare professionals demonstrated infant care activities and provided encouragement. Subsequently, once mothers were discharged home, online activities were organized, including video calls, lesson reviews, and video consultations. This approach significantly improved maternal self-efficacy. Similar to a previous study, it has been found that using an integrated activity program both at the hospital and through mobile phone calls at home can enhance confidence in infant care.[32] This can raise awareness of maternal self-efficacy after childbirth until the mother is discharged home.

Mothers who can share information about their child's illness and make decisions about their child's treatment can reduce stress and anxiety while caring for their child.[39] In this study, the researchers allowed mothers to practice questioning symptoms and making decisions with the researcher. Thus, in real situations, some mothers could express their needs; for example, Islamic mothers requested their husbands to make a video call to pray for them so that the infants would open their ears or mothers would use milk to open the infants' mouths. Thai mothers were allowed to put the Buddhist amulet on the infant beds. However, the experimental and control groups showed no difference in scores for both aspects. It may be due to Thai culture, as Thais can be very submissive. For example, Thai mothers did not dare to ask their doctors and thought that the doctors had made the best treatment decision.[3]

Limitations

The participants in this study consisted solely of postpartum women from a single university hospital in Thailand, which limits the ability to generalize the findings to other groups or settings. Furthermore, this program may not be suitable for postpartum women who do not possess smartphones. Additionally, the relatively short duration of the program during the first week may be insufficient to achieve the expected outcomes related to infant neurodevelopment and growth. Further research in diverse settings and populations with varying access to technology is warranted to explore the program's broader applicability and long-term effects.

Conclusions and Recommendations for Nursing Practice

The results of this study suggest that a telehealth program positively impacts maternal self-efficacy in caring for ventilated preterm infants in the first week, compared to the traditional methods that require the mother to visit the preterm infants on the ward. Additionally, E-books and videos are provided for mothers to enhance their self-efficacy and practice independently when they cannot visit their preterm infants. However, in the future, studies should explore how to enhance mothers' autonomy to have confidence in decision-making and information sharing. The study results can be a model for nursing practice. They can be used to encourage mothers to have self-efficacy in caring for preterm infants using ventilators in situations wherein mothers are unable to visit their infants in the hospitals. Further testing of the program is warranted with other groups in Thailand before being integrated into practice.

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Appendix

Table 1. Telehealth program and implementation

Time	Topic	Method /Activity	Instrument/ setting
Onsite Location: Hospital 1st visit Days 1-2 after infant admission) Duration: 45-60 minutes	**Introduction** *(Individual interaction stage)*	After providing routine nursing care to the mothers, the nurse introduced the PI to those interested in the project, and the PI administered a pre-test. **Preparation:** Building a strong rapport with mothers, enabling them to self-assess physical and emotional issues during this period. Emotional support was provided through active listening.	**Telephone** (Google Form) **NICU meeting room**
	Lesson 1: Participation in information sharing *Part 1 Acknowledgement:* Name of disease, causes, treatment, and illness effects *Part 2 Questioning:* weight and changes. *Part 3 Telling:* venting feelings, care barriers, characteristics of the baby	**Education:** Delivered information through Lessons 1-2 to help mothers comprehend the condition of their premature infants with ventilator **Learning from similar people:** Mothers were instructed to watch a video featuring successful mothers who had cared for premature infants with ventilators, serving as role models.	**E-book** "Care of Premature Infants Using a Ventilator for Mothers" (picture, letter, audio information) **Video** "When the baby is in the NICU" Telephone LINE app
	Lesson 2: Participation in decision-making *Part 1* Participate in patient care activities *Part 2* Consent to the procedure	**Provide:** The E-book and video were transmitted to the mothers via the Line app for their review. **Practicing:** Mothers were encouraged to practice information sharing by asking questions about their infant's symptoms and articulating their needs or obstacles in caring for the infant. Emotional support was offered, and necessary information was provided for decision-making.	**Bedside**
Onsite Location: Hospital 2nd visit Days 2-3 Duration: 45 minutes	**Lesson 3: Participation in Routine Care** *Part 1*: Basic care activities, express breast milk, cleansing (mouth, body, umbilical, oral care with colostrum, change diapers) *Part 2:* Promoting the development (eye contact, talk to baby, skin-to-skin contact)	**Demonstration:** Preterm infant care instructions were provided to mothers through visual and auditory learning in Lessons 3 and 4. The PI demonstrated preterm infant care activities using an infant model and equipment. **Redemonstration:** Mothers were given the opportunity to practice with the equipment until they felt confident. **Skill building:** Mothers were encouraged to independently care for their infant, including tasks like cleaning, diaper changing, and expressing breast milk. The PI also instructed mothers on how to assess the infant's temperature, oxygen saturation, and recognize abnormal symptoms such as cyanosis, breathlessness, or irregular breathing.	**NICU meeting room** **E-book** (video step care in E-book 11 clips) **Bedside** Incubator Infant model **Instrument** (thermometer, cotton ball, 70% alcohol, NSS or colostrum (each mother), pampers, oxygen saturation monitor)

Appendix

Table 1. Telehealth program and implementation (Cont.)

Time	Topic	Method /Activity	Instrument/ setting
	Lesson 4: Participation in Technical Care *Part 1 Simple activity support:* body temperature measurement, respiratory rate, heart rate, estimating oxygen saturation *Part 2 Notification:* abnormal symptoms (breathes faster, dyspnea, cyanosis)	**Encourage:** Compliments were offered when the mother performed tasks correctly, along with suggestions, consultations, and motivational support.	
Online video call 3rd visits Days 3-4 Duration: 10-15 min	**Autonomy.** *Part 1 takes care of an infant by themselves:* facilitative, information support *Part 2 Motivation:* consultant	**Encourage:** -Reminder SMS messages were sent via Line app from 9:00 to 11:00 a.m. to prompt mothers to inquire about the infant's status with the case manager nurses. - Send text responses to provide consultation, guidance, and answer maternal questions through the LINE application **Motivation:** The PI conducted video calls with the mothers to follow up on information exchange and decision-making with the nurses, offering suggestions, advice, and consultation.	**Telephone** (SMS Line app) **Telephone** (Video call via Line app)
Online video call 4th visits Days 4-5 Duration: 10-15 min		**Encourage:** Reminder SMS messages were sent via Line app from 9:00 to 11:00 a.m. to prompt mothers to inquire about the infant's status with the case manager nurses. - Send text responses to provide consultation, guidance, and answer maternal questions through the LINE application **Motivation:** The PI conducted video calls with the mothers to follow up on information exchange and decision-making with the nurses, offering suggestions, advice, and consultation.	
Online video call 5th visit Day 5-6 Duration: 20 min	**Reinforcements.** *Part 1 Participation in information sharing* *Part 2 Participation in decision-making* *Part 3 Participation in Routine Care* *Part 4 Participation in Technical Care*	**Review:** A 5-minute video call with the mothers to discuss their experiences in caring for preterm infants from the first day after birth to the present, along with addressing their needs. Then, for 10 minutes, the PI reviewed routine nursing activities by asking the mothers to share their activities and inquired about any tasks they had not learned or felt unsure about. The PI provided advice, referred to the E-book, and reiterated the activities. The PI asked for feedback from the mothers during a 5-minute segment.	**LINE app.** **E-book** "Care of Premature Infants Using a Ventilator for Mothers"
Online video call 6th visit Day 6-7 (30 min)	**Summarization and evaluation activity**	**Summary:** The PI assessed the program, requested the mothers to fill out the activity sheet, and offered praise (verbal persuasion) Upon concluding the program, the PI sent the post-test link to the mothers.	**LINE app.** **Telephone** (Google Form)

ผลของโปรแกรมการบริการสุขภาพทางไกลต่อการรับรู้สมรรถนะแห่งตนของมารดาในการดูแลทารกเกิดก่อนกำหนดที่ใช้เครื่องช่วยหายใจ: การทดลองแบบสุ่มและมีกลุ่มควบคุม

*กฤษณา กองแสนแก้ว สมสิริ รุ่งอมรรัตน์ * สุดาภรณ์ พยัคฆเรือง*

บทคัดย่อ: การบริการสุขภาพทางไกลเข้ามามีบทบาทในการพยาบาลเพิ่มมากขึ้น รวมถึงการนำมาใช้ในการส่งเสริมให้มารดาของทารกเกิดก่อนกำหนดที่ได้รับเครื่องช่วยหายใจมีความมั่นใจในการดูแล การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมการบริการสุขภาพทางไกลต่อการรับรู้สมรรถนะแห่งตนของมารดาในการดูแลทารกเกิดก่อนกำหนดที่ใช้เครื่องช่วยหายใจ โดยใช้การทดลองแบบสุ่มและมีกลุ่มควบคุมด้วยวิธีจัดสรรแบบบล็อก ในมารดาของทารกเกิดก่อนกำหนดที่ได้รับเครื่องช่วยหายใจ จำนวน 42 คน กลุ่มทดลองได้รับโปรแกรมการบริการสุขภาพทางไกลทั้งแบบข้อมูลทางเดียวและข้อมูลสองทางที่เกิดในเวลาพร้อมกันเป็นเวลา 6 วัน ประเมินประสิทธิภาพของโปรแกรมโดยใช้แบบสอบถามการรับรู้สมรรถนะแห่งตนของมารดาในการดูแลทารกเกิดก่อนกำหนดที่ใช้เครื่องช่วยหายใจ วิเคราะห์ข้อมูลเปรียบเทียบความแตกต่างระหว่างคะแนนเฉลี่ยของกลุ่มตัวอย่างทั้งสองกลุ่มด้วยสถิติ t-test หลังจากเสร็จสิ้นโปรแกรม กลุ่มทดลองมีคะแนนเฉลี่ยการรับรู้ความสามารถของตนเองของมารดาสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ นอกจากนี้ กลุ่มทดลองมีคะแนนเฉลี่ยการรับรู้ความสามารถของตนเองของมารดาสูงขึ้นอย่างมีนัยสำคัญทางสถิติหลังการทดลองเมื่อเปรียบเทียบกับก่อนการทดลอง

โปรแกรมการบริการสุขภาพทางไกลมีประสิทธิภาพสำหรับมารดาที่มีทารกเกิดก่อนกำหนดที่ได้รับเครื่องช่วยหายใจ ในการลดช่องว่างในการเข้าถึงบริการ นอกจากนี้มารดาควรได้รับอนุญาตให้ทำกิจกรรมการดูแลกับทารกอย่างน้อยหนึ่งครั้งก่อนออกจากโรงพยาบาลและเมื่อมารดาได้รับอนุญาตให้กลับบ้านได้ และควรได้รับข้อมูลสุขภาพของทารกผ่านการบริการสุขภาพทางไกล สิ่งเหล่านี้สามารถเพิ่มศักยภาพในตนเองของมารดาในการดูแลทารกเกิดก่อนกำหนดด้วยเครื่องช่วยหายใจในสัปดาห์แรกของชีวิตได้

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คำสำคัญ: การรับรู้สมรรถนะแห่งตนของมารดา การพยาบาล ทารกเกิดก่อนกำหนด การทดลองแบบสุ่มและมีกลุ่มควบคุม การบริการสาธารณสุขทางไกล เครื่องช่วยหายใจ

กฤษณา กองแสนแก้ว *นักศึกษาหลักสูตรพยาบาลศาสตรมหาบัณฑิต สาขาวิชาการพยาบาลเด็ก คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล*
E-mail: kongsaenkaewk@gmail.com
ติดต่อที่: สมสิริ รุ่งอมรรัตน์* *ภาควิชาการพยาบาลกุมารเวชศาสตร์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล E-mail: somsiri.run@mahidol.ac.th*
สุดาภรณ์ พยัคฆเรือง *ภาควิชาการพยาบาลกุมารเวชศาสตร์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล E-mail: sudaporn.pay@mahidol.ac.th*