โปรแกรมการส่งเสริมพัฒนาการของทารกคลอดก่อนกำหนดแบบเบ็ดเสร็จ ขณะรักษาตัวในโรงพยาบาล: การศึกษานำร่อง
The Comprehensive Preterm Infant Developmental Care Program in Hospitalized Preterm Infants: A Pilot Study

นิพนธ์ต้นฉบับ

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Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความเป็นไปได้ของโปรแกรมการส่งเสริมพัฒนาการของทารกคลอดก่อนกำหนดแบบเบ็ดเสร็จต่อการรับรู้สมรรถนะแห่งตนของผู้ปกครอง การเจริญเติบโตและพัฒนาการด้านประสาทพฤติกรรมของทารกคลอดก่อนกำหนดขณะรักษาตัวในโรงพยาบาล **วิธีการศึกษา:** การศึกษานำร่องนี้เป็นการวิจัยกึ่งทดลองเปรียบเทียบกลุ่มเดียววัดผลก่อน-หลังการทดลองและติดตามผล กลุ่มตัวอย่างคัดเลือกโดยใช้เทคนิคการสุ่มกลุ่มตัวอย่างอย่างง่าย เป็นผู้ปกครองและทารกคลอดก่อนกำหนดอายุครรภ์ 28 - 32 สัปดาห์ ที่รักษาตัวในหอผู้ป่วยทารกแรกเกิดวิกฤต โรงพยาบาลชลบุรี 10 ราย รวบรวมข้อมูล 4 สัปดาห์ โดยจัดกิจกรรมเป็นรายบุคคลใช้เวลา 1 สัปดาห์ จำนวน 4 ครั้ง ๆ ละ 60 - 90 นาที ครอบคลุมกิจกรรมทั้ง 6 ระยะ เครื่องมือที่ใช้เก็บรวบรวมข้อมูลประกอบด้วยแบบประเมินพัฒนาการด้านประสาทพฤติกรรมของทารก เครื่องชั่งน้ำหนัก เทปวัด และแบบสอบถามการรับรู้สมรรถนะแห่งตนในการเลี้ยงดูทารกของผู้ปกครอง วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสถิติความแปรปรวนทางเดียวแบบวัดซ้ำ **ผลการศึกษา:** หลังการเข้าร่วมโปรแกรมกลุ่มตัวอย่างมีค่าเฉลี่ยคะแนนการรับรู้สมรรถนะแห่งตน การเจริญเติบโตและพัฒนาการด้านประสาทพฤติกรรมของทารกคลอดก่อนกำหนดระยะหลังการเข้าร่วมโปรแกรมและระยะติดตามผลเพิ่มขึ้นกว่าในระยะก่อนเข้าร่วมโปรแกรมอย่างมีนัยสำคัญทางสถิติที่ P-value < 0.01 กลุ่มตัวอย่างมีความพึงพอใจในกิจกรรมของโปรแกรม **สรุป:** โปรแกรมการดูแลพัฒนาการของทารกคลอดก่อนกำหนดแบบเบ็ดเสร็จมีความเป็นไปได้ที่จะนำทดสอบในการศึกษาหลัก โดยทดลองกับกลุ่มตัวอย่างที่ใหญ่ขึ้น

คำสำคัญ: โปรแกรมการส่งเสริมพัฒนาการแบบเบ็ดเสร็จ, ทารกคลอดก่อนกำหนด, ประสาทพฤติกรรม, สมรรถนะแห่งตน

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Abstract

Objective: To examine the feasibility of the comprehensive preterm infant developmental care program on parental self-efficacy, growth and neurobehavioral development of hospitalized preterm infants. **Methods:** This pilot study was a quasi-experimental design with a one-group comparison, pre-posttest, and follow-up. Ten parent-preterm infant dyads were recruited by using a simple random sampling technique. Preterm infants were born at a gestational age of between 28 – 32 weeks and were hospitalized in the NICU at Chon Buri Hospital, Muang district, Chon Buri province, Thailand. Data were collected for 4 weeks. The program was carried out at a hospital with individuals, which contained activities of one week's duration, including six stages within four sessions. Each session lasted 60 - 90 minutes. Questionnaire consisted of the Neonatal Neurobehavioral Examination, a digital weight scale, a measuring tape, and the Perceived Maternal Parenting Self-Efficacy. Data were analyzed by using descriptive statistics and repeated measures ANOVA. **Results:** The scores of parental self-efficacy, preterm infant growth, and neurobehavioral development at post-test and follow-up were significantly higher than the pre-test (P-value < 0.01 for all). The parents were satisfied with the program's activities. **Conclusion:** The comprehensive preterm infant developmental care program was feasible for further studies with a larger sample size.

Keywords: comprehensive preterm infant developmental care program, preterm infants, neurobehavioral development, self-efficacy

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Introduction

Preterm infants are at an increased risk of morbidity and mortality, as well as neurodevelopmental disabilities. Preterm infant survival is currently increasing with gestational and postnatal age due to advances in medical and nursing technology.[1] However, survivors are at higher risk of health problems as their vital organs are immature and require special care in the neonatal intensive care unit (NICU), so preterm infants are at risk for neurodevelopmental disorders. According to the morbidities of preterm infants, their parents also endure extreme stress, fatigue, feelings of helplessness, poor parent-infant interaction, knowledge deficits, depression, and anxiety.[2,3]

Preterm infants who are hospitalized in a NICU are placed in an environment different from the maternal womb and are

exposed to noxious stimuli. Environmental stimuli from the NICU are classified as environmental factors affecting preterm infants. Preterm infants are affected by potentially dangerous stimuli such as bright lights, loud noises, frequent disruptions, and specific painful medical procedures. Preterm infants' reactions to harmful stimuli have an impact on both short- and long-term growth and development outcomes[4], particularly for neurobehavioral developmental problems.[5,6] A previous study discovered that preterm infants at term equivalent age continue to have less optimal neurobehavior than full-term infants.[7] Preterm infants were also found to have a longer hospital stay, more days of ventilation use, and higher interventional and consumable costs than older gestational age infants.[8] Furthermore, the mothers of these infants were discharged from the hospital during this time. As a result, the infants were separated from their parents.

Preterm infants are separated from their parents during their hospitalization in the NICU, resulting in limited interaction with them. A parent's inability to interact affectionately with their baby can lead to a loss of connection.[9] Mother-child interaction influences brain development including brain structure and function.[10] Tactile stimulation between mother and infant promotes maternal response and infant attachment.[11] In addition, active parental participation in their infant's NICU care has been shown to improve infant weight gain.[12] Therefore, it is necessary to encourage parental participation in the care of preterm infants.

In Thailand, preterm infants who require intensive care are often hospitalized for weeks and often months, bringing to the forefront the importance of policies and practices that minimize parent-infant separation in the NICU. Some mothers refuse to interact with their preterm infants, and they only spend a short time with the preterm infant on their first visit (only 2 – 5 minutes).[13] Furthermore, 63.6% of mothers reported moderate participation in their preterm infant's care in the NICU.[14] Thai mothers with high-risk newborns must become more involved in their infant's care than they are now.[15] Thai parents desire to be close to their preterm infants, but lack confidence in providing care for their preterm infants, and parents believed in the capability of physicians or nurses as health care professionals with greater expertise regarding their infant's physiologic status and care needs.[16] Parental participation in the care of hospitalized preterm infants is important for the quality of infant care. Because parents have different expectations, attitudes, and perceptions about such participation, nurses must assess their needs effectively and provide appropriate information and support based on mutual partnerships. To promote parental participation in the care of preterm infants, it is necessary to identify Thai cultural underpinnings of parent participation in the care of a hospitalized infant.

According to existing studies from systematic reviews of neurodevelopmental care interventions, the effectiveness of interventions provided during NICU hospitalization includes developmental care interventions such as positioning, clustering of nursery care activities, modification of external stimuli, and individualized developmental care interventions,[17] NICU noise reduction,[18] skin-to-skin contact,[19] and early intervention related to parents' participation or involvement in their infant's care.[20] Participation of parents in the NICU can help reduce stressful exposures. Facilitated tucking, breastfeeding, and skin-to-skin care have been shown to reduce stress and pain in this population,[21,22] and brain development can be optimized by having parents participate in the NICU.[23] The findings indicated that some of the programs could improve preterm infant growth and neurobehavioral development, while others could improve parent-infant interaction. However, there are few programs that can promote parental participation, enhance parent confidence, and improve preterm infant growth and neurobehavioral development all at the same time.

Furthermore, the intervention components are classified into three categories based on systematic reviews of neurodevelopmental care interventions: 1) parent education, which includes aspects such as teaching, sensitization, training, or awareness creation; 2) parent psychosocial support, which includes guidance, encouragement, or other forms of support; and 3) infant support/therapeutic developmental interventions, which includes infant care or therapy elements.[24-27] These three components are critical for improving parent and preterm infant outcomes. Nonetheless, few studies include all three critical elements in the intervention to assess parent and infant outcomes. All interventions include some form of parent education. The most effective and efficient method of educating and involving parents in developmental care needs is the first priority. However, few studies examine or discuss the parents' confidence or ability to provide intervention care, potentially

compromising the studies' validity.[24] Therefore, a comprehensive intervention program with three key components aimed at improving parental self-efficacy, growth, and development of preterm infants is expected to be developed and tested.

Individualized developmental care is a concept that is frequently used in the NICU. This concept is defined as the protection of preterm infants' neurodevelopment against the extrauterine environment.[24] It describes activities performed by nurses to reduce excessive environmental stimuli.[10] The most widely used concept is based on the Synactive Theory of Development, a framework for understanding infant behavior.[28] As a result, interventions aimed at sustaining or modifying these NICU factors during preterm infant hospitalization should promote preterm infant neurodevelopment.

The Comprehensive Preterm Infant Developmental Care Program (CPIDCP) was developed and tested for feasibility in our pilot. The research question was whether the CPIDC program had effects on parental self-efficacy, growth, and neurobehavioral development of hospitalized preterm infants. For actual outcomes, we aimed to preliminarily determine how much the intervention could improve scores of parental self-efficacy, growth, and neurobehavioral development of preterm infants. The findings of this pilot study may be useful for future research aiming at improving parental self-efficacy, growth, and neurobehavioral development of hospitalized preterm infants. Specifically, we hypothesized that the mean score of parental self-efficacy, growth, and neurobehavioral development at post-intervention (day 14) and at follow-up (day 28) would differ from baseline or pre-intervention. We also hypothesized that the CPIDC program would be feasible.

Study conceptual framework

The conceptual framework of this study was integratedly developed based on the synactive theory,[28] the Neonatal Integrative Developmental Care (NIDC) model,[10] and related synthesized research evidences and contexts from the perspectives of preterm infants' parents. The synactive theory provides a framework for conceptualizing the organization of neurobehavioral capabilities during the early development of the fetus, newborn, and young infants.[28] The NIDC model provides clinical guidelines to promote neuroprotective developmental care intervention for preterm infants in the NICU with family-centered care involvement. Parents are the most important caregivers in an infant's life, and partnering with families to provide developmental care for preterm infants is the central core neuroprotective intervention.[10] Previous research evidence has classified the effectiveness of the developmental care intervention process into three components: parent psychosocial support; parent education; and therapeutic infant development support.[24-27] These three components are the essential elements for improving parental and preterm infant outcomes. However, to develop parental self-efficacy, verbal persuasion[29] from their family and coaching could persuade parents to successfully participate in the care of a preterm infant. Therefore, the new intervention should incorporate such research evidence into the intervention process, with the aim of increasing parental self-efficacy, promoting preterm infant growth, and enhancing neurobehavioral development. The brief conclusion of conceptual framework of this study is shown in Figure 1.

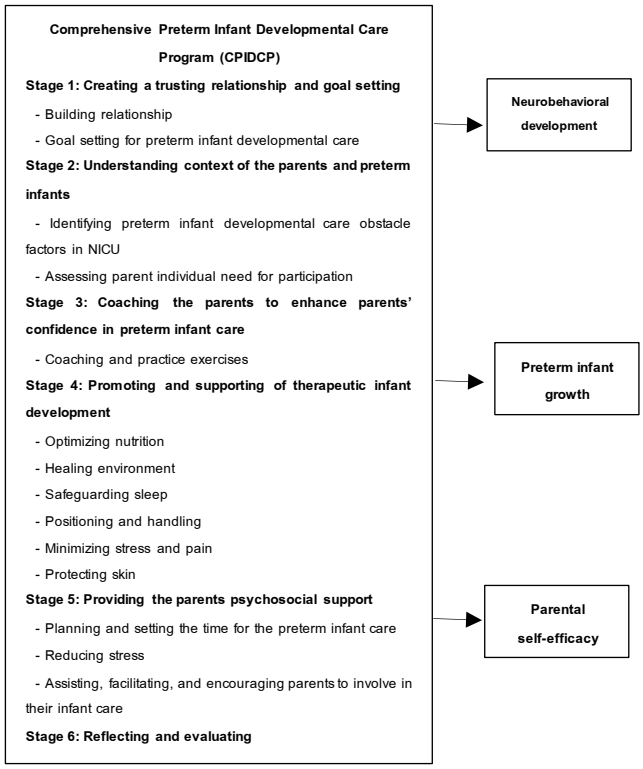

Figure 1 Study conceptual framework.

Methods

The pilot study employed a quasi-experimental, one-group pretest-posttest and follow-up design. The impact of this program on parental self-efficacy, preterm infant growth, and

neurobehavioral development was also determined at three time points.

The study population consisted of parent-preterm infant dyads who were treated in the NICU at Chon Buri hospital. To be eligible, the parents had to be a father and mother having preterm infant hospitalized in the NICU, be at least 18 years old, have no experience of caring for premature birth, and be able to speak, read, write, and understand Thai fluently. For the infants, they had to be a preterm infant with gestational age between 28 - 32 weeks, have birth weight of less than 2,500 gram, be absent of critical conditions such as intraventricular hemorrhage (grades III and IV) or have no evidence of severe birth asphyxia or congenital anomalies, have a singleton pregnancy, be the first time hospitalized in NICU with Clinical Risk Index for Babies (CRIB)[30] score $\leq$ 15, and have parents participation in the study. Infants who had worsening conditions were excluded.

Recommendations for determining sample size for the pilot study varied; some suggested 10% of the sample size in the main study, while others suggested 10 to 75 cases per arm.[31] For a power of 80%, Bell and colleagues recommended at least 10 cases per arm.[32] As a result, the participants in this pilot study were chosen using a simple random sampling technique to recruit a total of 10 participants, specifically 10 parents and their 10 preterm infants.

Research instruments

Instruments included demographic record form, weight, head circumference and length measuring scales, questionnaires, and the comprehensive preterm infant developmental care program (CPIDCP) as the intervention. The demographic data of the participants included age, current marital status, education, occupation, monthly income, intention to plan pregnancy, antenatal care, complications in pregnancy, type of delivery, separation time, number of children, the experience of preterm infant care, and significant person. The infant's demographic data included gestational age, gender, birth weight, type of feeding, diagnosis, complications, duration of hospitalization, and duration of NICU stay. A digital weight scale (Seca model 727) was used to measure the body weight of preterm infants in grams. A measuring tape was used to measure the head circumference and length of preterm infants in centimeters.

The Neonatal Neurobehavioral Examination (NNE)[33] was used to measure the neurobehavioral functions of preterm infants with increasing age. It consists of 27 items divided into three sections namely 1) tone and motor patterns, 2) primitive reflexes, and 3) behavioral responses. Each section comprised nine items scored on three-point scales (1 - 3) of rating. The total score ranged from 27 to 81 points. The higher overall score indicated better gestational maturation and neurobehavioral status. Reliability of the Neonatal Neurobehavioral Examination (NNE) Scale was tested by inter-rater methods among 3 preterm infants. The inter-rater process was conducted by the researcher and research assistants, who independently used the scale to examine the same preterm infants at the same time. The calculation index of agreement of inter-rater observer reliability of 0.90 is acceptable (Morgan et al., 1988). The inter-rater reliability of NNE, which was obtained in this study, was 0.93.

The Perceived Maternal Parenting Self-Efficacy (PMP S-E)[34] scale was used to assess mothers' perceptions of their ability to understand and care for their hospitalized preterm infants. The researcher used back translation to translate it into Thai after obtaining permission from the developer to use and translate the tool. The scale has 20 items that are divided into four subscales: caretaking procedures, evoking behaviors, reading behaviors, and signaling and situational beliefs. Each item was ranked on a 4-point scale. The total score ranged from 20 to 80 points. Higher scores indicated a higher level of maternal self-efficacy. The internal consistency reliability of the PMP S-E was tested on 15 parents of a preterm infant using Cronbach's coefficient. In this study, the Cronbach's alpha reliability of the PMP S-E was 0.94.

For the intervention, the comprehensive preterm infant developmental care program (CPIDCP) was developed by the researcher and verified by five experts, consisting of two neonatologists, two pediatric nursing instructors, and one advanced practice nurse in pediatric nursing. The content validity index of CPIDC program was 0.95. The CPIDC program consisted of six stages divided into four sessions. The first session created a trusting relationship and goal setting. This stage aimed to establish a relationship between the researcher and the parents as well as set goals for preterm infant developmental carem. The second session provided understanding about the context of the parents and preterm infants. This stage aimed to understand the parents'

expectations and needs, as well as to read preterm infant cues. The third session coached the parents to enhance parents' confidence in preterm infant care. This stage aimed to enhance parents' knowledge and parent self-efficacy in preterm infant care. The fourth session promoted and supported therapeutic infant development. This stage aimed to enhance the neurobehavioral development of preterm infants; 5) providing the parents' psychosocial support. This stage aimed to support parent participate in their preterm infant care; and 6) reflecting and evaluating. This stage aimed to reflect and evaluate the program. This program's intervention was conducted in 4 sessions within one week. The brief details of the CPIDC program were as follows.

Session 1 was held on day 1 or 2 (60 minutes). The intervention focused on stages 1, 2, and 4. The researcher provided information to the parents about the NICU environment and explained the importance of parents as essential person for their infant. In each session, the researcher invited fathers to participate in this study alongside mothers, then informed fathers about preterm infant care and invited them to interact with their infants. Furthermore, the researcher informed mothers and fathers about medical equipment for preterm infants. The researcher worked collaboratively with the NICU nurses to organize activities to promote infant development.

Session 2 was held on day 3 (90 minutes). The intervention focused on stages 3-6 with provided education training, including the healing environment and optimizing nutrition as follows: 1) breast pumping, 2) breastfeeding, 3) effect of mother milk odor, 4) mouth care with mother milk, 5) a parent soft touch such as kangaroo care, and 6) parent's voice. The parents practiced training tactics, including demonstration and return to demonstration strategies. The parents were asked to reflect and evaluate the activities of this session, and then the researchers gave them comments and suggestions and thanked them for their participation in the program. Participants were given a handbook and daily plans to guide them in their preterm infant care.

Session 3 was held on day 5 (90 minutes). The intervention focuses on stages 3-6 with provided educational training in the topics of safeguarding sleep, positioning, and handling comprised of 1) preterm infant's sleep stage, and 2) position of preterm infant and handling. The parents practiced training tactics, including demonstration and return to demonstration strategies. The parents were asked to reflect and evaluate the activities of this session, and then the researchers gave them comments and suggestions and thanked them for their participation in the program.

Session 4 was held on day 7 (90 minutes). The intervention focused on stages 3 - 6 with provided educational training including minimizing stress and pain and protecting their skin by 1) how to release stress and pain for the preterm infant, 2) how to read infant's behavioral cues related to stress and pain, and 3) how to provide comfort such as facilitated tucking, and how to protect their skin. The parents practiced training tactics including demonstration and return to demonstration strategies. The parents were asked to reflect and evaluate the activities of this session, and then the researchers gave them comments and suggestions and thanked them for their participation in the program.

After completion of participation in the program, the researcher asked participants to evaluate the CPIDC program in four main aspects including 1) the appropriateness of the program's content and activities, 2) the use of the handbook and daily plan, 3) the time period of the program activities, amd 4) satisfaction with the program.

Ethical considerations

This pilot study was approved by the Institutional Review Board committee, Burapha University (approval code: G-HS 102/2563), and Chon Buri Hospital (approval code: 150/63/O/q) based on its main study. The purpose, processes, potential risks and benefits of this study, and the right to withdraw from the study were all explained to the participants. Participants' confidentiality was protected. The informed consent was signed once they agreed to participate in the study.

Data analysis

Descriptive statistics were used to analyze and describe the demographic characteristics of the parents and preterm infants. A one-way repeated measures ANOVA was used to compare the effects of the CPIDC program on parental self-efficacy, preterm infant growth (weight gain, length gain, and head circumference gain), and neurobehavioral development of the preterm infant at pre-test, post-test, and follow-up. If the homogeneity of variance-covariance matrices was not

statistically significant, the assumption of sphericity of variance-covariance matrices was met, and repeated measure ANOVA with assumed sphericity could be performed. For pairwise comparisons of within-subject changes in the pilot group, Bonferroni post-hoc adjustment was used. The data were analyzed using a statistical software program, with the statistical significance level set at a type I error of 5%.

Results

Ten parent-preterm infant dyads consented to participate in this pilot study and met the inclusion criteria. All of them completed four sessions of the CPIDC program and the three-time evaluations. Of these 10 parents, their mean age was 30.50 years (SD = 6.88). All of them were mothers (100%), 70% had below bachelor's degree education, most of them were employees or workers during the time of pregnancy (90%), and half of them had family income ≤ 20,000 baht/ month with extended family background. The majority were single in marital status and planned to get pregnant (60%), all of them had antenatal care (100%), and 60% had complications during pregnancy. Half of them were first order of infant, but all of them had no experience of having preterm infant (100%) and gave delivery by Cesarean section (70%). The grandmothers supported to care preterm infants at home (30%). The range of separation time between mother and preterm infant was 2 - 6 days with mean 3.55 (*SD* = 1.001) days. For preterm infants, most infants were girl (60%). The mean of preterm infant gestational ages were 30.20 weeks (*SD* = 1.69). The mean of body weight at birth 1,194 grams (*SD* = 425.11), and at birth, 60% of infants were appropriate for gestational age (AGA). At birth, the mean of length were 37.55 centimeters (*SD* = 4.13) and mean of head circumference were 25.60 centimeters (*SD* = 2.07). In the fifth minute, most infants had an Apgar score of 7 - 10 (60%). All preterm infants were diagnosed with respiratory distress syndrome (100%), hyperbilirubinemia (100%), apnea of prematurity (60%), feeding intolerance (50%), patent ductus arteriosus (60%), anemia (50%), and no intraventricular hemorrhage. All preterm infants (100%) were provided with total parenteral nutrition (TPN), lipid, and breast milk.

With sphericity of variance-covariance matrices assumption was met, repeated measures ANOVA of scores of parental self-efficacy, neurobehavioral development and growth (weight gain, head circumference gain, and length gain) with Bonferroni's adjustment for pairwise comparisons was appropriate. At three time points, parental self-efficacy, neurobehavioral development, and growth (weight gain, head circumference gain, and length gain) were all statistically significant (P-value < 0.001, η^2_p = 0.806, 0.985, 0.928, 0.666, and 0.736, respectively) (Table 1).

Table 1 Mean scores of parental self-efficacy, growth, and neurobehavioral development of preterm infant measures at 3 time points (N = 10).

Variables	Mean ± SD			Repeated measure ANOVA			
	Pre-test	Pre-test	Post-test	*F*	*df*	P-value	η^2_p
Parental self-efficacy	52.40 ± 11.92	69.30 ± 9.20	77.60 ± 5.56	37.442	2,18	< 0.001	0.806
Neurobehavioral development	33.90 ± 5.51	46.00 ± 5.66	57.90 ± 5.88	589.998	2,18	< 0.001	0.985
	14th day from birth	14th day from birth	28th day from day 14th	*F*	*df*	P-value	η^2_p
Weight gain	101.50 ± 73.15	353.50 ± 86.19	455.00 ± 145.49	115.776	2,18	< 0.001	0.928
Head circumference gain	0.85 ± 0.58	1.05 ± 0.37	1.90 ± 0.61	17.952	2,18	< 0.001	0.666
Length gain	1.10 ± 0.57	1.25 ± 0.49	2.35 ± 0.75	25.030	2,18	< 0.001	0.736

For Bonferroni's adjustment pairwise comparisons, both parental self-efficacy and neurobehavioral development scores at follow-up were significantly higher than those at post-test and pre-test (P-value = 0.027, < 0.001, < 0.001, and < 0.001, respectively). Furthermore, parental self-efficacy and neurobehavioral development scores were significantly higher at post-test than pre-test (P-value = 0.001, and < 0.001, respectively) (Table 2).

Table 2 Pairwise comparisons of mean differences of parental self-efficacy, growth, and neurobehavioral development of preterm infant measures at 3 time points (N = 10).

Variables	Time	Time	M_{diff}	SE	P-value
Parental self-efficacy	Pre-test	Post-test	-16.900	3.002	0.001
		Follow-up	-25.200	3.339	< 0.001
	Post-test	Follow-up	-8.300	2.504	0.027
Neurobehavioral development	Pre-test	Post-test	-12.100	0.752	< 0.001
		Follow-up	-24.000	0.843	< 0.001
	Post-test	Follow-up	-11.900	0.433	< 0.001
Weight gain	14th day from birth	28th day from day 14th	-252.000	20.952	< 0.001
		28th day from birth	-353.500	27.254	< 0.001
	28th day from day 14th	28th day from birth	-101.500	23.131	0.005
Head circumference gain	14th day from birth	28th day from day 14th	-0.200	0.238	1.000
		28th day from birth	-1.050	0.117	< 0.001
	28th day from day 14th	28th day from birth	-0.850	0.183	0.004
Length gain	14th day from birth	28th day from day 14th	-0.150	0.236	1.000
		28th day from birth	-1.250	0.154	< 0.001
	28th day from day 14th	28th day from birth	-1.100	0.180	0.001

For the preterm infant growth at the 28th day from birth (T3), there were significantly higher mean scores of weight

gain, length gain and head circumference gain than those at the 28th day from the 14th day (T2) and at 14th day from birth (T1) (P-value = 0.005, < 0.001, 0.004, < 0.001, 0.001, and < 0.001, respectively). Moreover, it was found only weight gain at the 28th day from the 14th day (T2) that was significantly higher than that at 14th day from birth (T1) (P-value < 0.001) (Table 2).

Measurement of the CPIDC program

The rate of participant retention was the first objective indicator of program feasibility. None of the participants withdrew during the four sessions in one week and a follow-up on the 28th day after participating in the program, resulting in a 100% retention rate. The program's feasibility was determined by all participants, as was the problem of program implementation. According to the findings, the length of stay of a preterm infant in the NICU was 3 – 38 days, and the duration of hospitalization was 30 – 68 days. As a result, the duration of the CPIDC program developed by the researcher based on the integration of related theoretical and scientific knowledge, research evidence, and parental perspectives is appropriate.

The program's acceptability was determined by participant ratings on the CPIDC program evaluation questionnaire as well as participant comments. The questionnaire included 9 items, including the helpfulness to increase self-efficacy in caring for their babies; the helpfulness to increase knowledge about promoting the growth of babies; the helpfulness to increase knowledge about promoting the neurobehavioral development of their babies; the helpfulness to increase skills in promoting growth and neurobehavioral development of their babies; easy to read and understand language in the handbook; easy to use daily plan; appropriate for the program's time period; and satisfaction with the program. The answers to the questions were either "agree" or "disagree." The findings revealed that all participants accepted and were satisfied with the CPIDC program.

Discussions and Conclusion

Findings revealed that this pilot CPIDC program supported its effectiveness and feasibility. All participants had higher significant parental self-efficacy, growth, and neurobehavioral development. The CPIDC program started with trusting relationship building and goal setting for first time parents. The objectives of this stage were to build a trusting relationship between the researcher and the parents of a preterm infant, to create parents' awareness of being an essential person to their preterm infant, and setting goals for preterm infant developmental care. This stage initiates relationship between the researcher and parents to build mutual trust so that parents became relax and open-minded. Mutual trust between researcher and parent started with a positive mindset to gather proper data by asking right questions and demonstrating thoughtful and unexpected acts of kindness reflecting the importance of relationship.[35] Friendly nurses who were supportive of their demands provided an environment favorable to maternal–newborn bonding.[36] According to the mothers, meeting friendly nurses and midwives in the NICU made them feel accepted and recognized as mothers. Their confidence in infant care grows as a result of these feelings. Then, the researcher provided information about the NICU environment and policy, explained the important role of parents to their infant while being hospitalized, and encouraged parents to set reality-oriented goals about parent participation in preterm infant developmental care.

The second stage was the effort to understand the context of the parents and preterm infants. The stage emphasized understanding the parents' expectations and needs, as well as reading preterm infant cues. The CPIDC program encouraged parents to express their feelings about their preterm infants' situation so that parents could receive specific aids and gain an understanding of their feelings, perceptions, and knowledge about preterm infant cues. Their involvement in preterm infant care enabled them to understand their behaviors and problems in this situation. Supporting parents in understanding their preterm infant's behaviors can boost parental confidence.[37]

The third stage was coaching parents to develop their self-efficacy in preterm infant care. The objective of this stage was to enhance the parents' knowledge and self-efficacy in preterm infant care. This stage consisted of one-by-one coaching and practicing exercises. Parents learned about preterm infants' cues and behavioral state when they expressed their signals. In addition, parent learned the appropriate strategies to respond to their preterm infants' cues while interacting with them. Furthermore, parents learned and practiced providing developmental care for their preterm infants through 6 practices of neuroprotective care including

1) healing environment, 2) positioning & handling, 3) safeguarding sleep, 4) minimizing stress and pain, 5) protecting skin, and 6) optimizing nutrition. These six care practices in neuroprotective interventions promoted the stability of the infant's autonomic, sensory, motoric, and state regulation, and directly benefited the improvement of neurobehavioral development of preterm infants.[10] The program provided educational trainings by means of demonstration and return-demonstration strategies, which included one-by-one coaching between the researcher and parents in a private room or by the bedside. They could perform activities directly with their preterm infants. According to the previous study, mothers who participated in the family-integrated care program stated that daily educational sessions and bedside teaching were extremely beneficial and relaxing.[38] This strategy promoted a seamless transition to individual-guided bedside practice such as reading the infant's behavioral cues and exhibiting developmentally appropriate care. Moreover, this study gave a handbook to parents to guide and support them in providing care for preterm infants. This handbook provided parents with the opportunity to review their knowledge whenever they needed it. The beneficial educational effect, according to a previous study, was due to the provision of more opportunities to mothers so that they could apply what they learned and give relevant feedback or responses after a face-to-face session via booklets and PowerPoint slides.[39]

The improvement in parental self-efficacy scores in this study could be due to educational and psychosocial support. These findings are consistent with those of a study on educational intervention on the behavior of preterm infants for the promotion of parental confidence. It was discovered that a parental education program could assist parents in increasing their understanding of preterm infant behavior and better understanding their preterm infants.[37] This is consistent with Jang and Ju's study, which discovered that mothers of late-preterm infants who participated in the late-preterm infant care education program had significantly higher parenting confidence scores over time than those who did not.[39]

The fourth stage promoted and supported therapeutic infant development. The objective of this stage was to enhance the neurobehavioral development of preterm infants. The researcher promoted therapeutic infant development care collaboratively with staff nurses to organize activities to enhance the development of infants. The researcher encouraged parents to visit their preterm infants in the hospital and participate in their care. Supporting and empowering mothers to attain their role enhanced their abilities and confidence resulting in less mother-infant separation. This would eventually facilitate bonding and development.[40] In addition, this program was carried out in collaboration with staff nurses to organize activities to improve infants' growth and neurobehavioral development by following the guidelines of six care practices of individualized developmental care. The NICU nursing staff followed the said guidelines that covered six care practices, for example, the regulation of sound and light in the NICU involved the measurement of sound and light levels to avoid disturbing the infant's sleep. The infant's sleep and awakening times was also recorded so that nursing could be performed without disturbing the infant more than necessary. The increase in neurobehavioral development scores in this study might be from a comprehensive program in six care practices. This congruent with the previous findings of a systematic review and meta-analysis, which discovered that the NIDCAP intervention was effective in improving neurobehavioral and neurological development of preterm infants at two weeks corrected age when compared to standard care.[41]

The six care practices could promote an infant's growth by reducing energy expenditure, increasing growth hormones, and optimizing nutrition through breast feeding. Gentle touch, kangaroo care, the odor of fresh breast milk, colostrum mouth care, eye-to-eye contact, and other practices could all help to reduce energy expenditure. Flex position, quiet sleep, and infant massage greatly enhance growth hormones. These practices provide emotional, tactile, proprioceptive, vestibular, auditory, visual, and thermal stimulation. Breastfeeding or nipple sucking and kangaroo care provided multisensory (emotional, tactile, proprioceptive, vestibular, olfactory, auditory, visual, and thermal) stimulation[42-43] as well as promote quiet sleep state and more stable physiological status.[44] Therefore, it demonstrated that the CPIDC program is effective in enhancing preterm infant's growth. The findings of this study support the findings of the previous one[45] which discovered that after a maternal participation program was implemented for a mother of a preterm infant. There was a statistically significant higher mean score of weight gain

velocity and growth velocity on the 28th day compared to those who did not participate.[45]

The fifth stage was to provide parents with psychosocial support. The objective of this stage was to support the parents in their participation in preterm infant care. The researcher stayed by their bedsides to assist them if they lacked confidence in their caring abilities or had difficulty performing caring activities, repeated trainings and facilitated participations in implementing caring practices in order to assisted them in terms of caring practices. Practice specific infant-care actions consistently thus enabled them to gain confidence.[39] The program also provided them with emotional support, positive feedback, one-to-one support through LINE Application, and telephone counseling depending on their availability of communication devices. When the mother expressed her confidence in providing care for her infant, this step provided her with a positive reinforcement. This program offered psychosocial support to parents of preterm infants, thereby increasing parents' self-efficacy in caring for preterm infants.

Reflection and evaluation were the final steps. Parents were invited to reflect on the program's activities that they had participated in. Finally, the researcher explained the program, presented the commendation, and thanked the participants for their participation. The mothers acquired confidence with increased ability to provide care for their preterm infants after participating in the CPIDC program. Furthermore, they were pleased with the program. Reflection and evaluation can help mothers understand planning, implementation, self-reflection, and self-assessment of their ability to care for their preterm infant.

Furthermore, fathers participated in every session of the CPIDC program, which is from their point of view. Fathers expressed a desire for information and education about caring for their infants alongside their wives. Family support is one of the social supports that may reduce mothers' stress, which impacts parental self-efficacy. Social support is a predictor of maternal and parental self-efficacy.[46] Parents who lack self-efficacy are at risk of disappointment, stress, and depression.[47] Besides that, low parental self-efficacy is associated with a lack of social support and poor health.[48] Finally, it demonstrates that the CPIDC program is effective in increasing parental self-efficacy.

The CPIDC program was developed based on scientific knowledge (theory and research evidence), as well as participants' needs, beliefs, competency, and context (parental perspectives), which was one of this study's strengths. Furthermore, the CPIDC program was a comprehensive program developed in collaboration with nurses and parents to promote preterm infant growth and neurobehavioral development while in the hospital. The study's weakness was the small sample size of the pilot study. As a result, those who will implement this program need to be careful about measuring the outcomes because the outcomes may differ.

In conclusion, the evidence from this pilot study suggests that the CPIDC program could be an effective approach to enhance parental self-efficacy, growth, and neurobehavioral development of preterm infants while they are hospitalized. This study provided evidence to guide nurses in enhancing preterm infant neurobehavioral development, growth, and parental self-efficacy. It was discovered that establishing parents' knowledge, confidence, and abilities to care for their preterm infants was an effective way to promote parental participation in preterm infant care with their families. This pilot study confirmed the feasibility of the program that can make a significant difference in parental self-efficacy, growth, and neurobehavioral development of preterm infants at the 14th day (post-test) and 28th day (follow-up). The effectiveness of this program should be examined further using well-controlled studies.

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