

## Research article

## Impact of the mother–nurse partnership programme on mother and infant outcomes in paediatric cardiac intensive care unit

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## ARTICLE INFO

## Article history:

Accepted 26 March 2018

## Keywords:

Congenital heart defects  
 Mother–nurse partnership programme  
 Parental participation in care  
 Parental satisfaction  
 Parental self-efficacy

## ABSTRACT

**Objectives:** To identify the effects of a mother–nurse partnership programme based on the core components of information sharing, negotiation and participation in care. Specifically, we examined the programme's effects on parental satisfaction, parental self-efficacy, perceived partnership and anxiety, as well as infants' time to reach full oral feeding and length of postoperative hospital stay, following cardiac surgery on infants at a paediatric intensive care unit with a restrictive visiting policy.

**Research methodology/design:** Quasi-experimental study. An analysis of covariance was used to investigate between-group differences while ensuring homogeneity.

**Setting:** A paediatric cardiac ICU.

**Main outcome measures:** Parental satisfaction, parental self-efficacy, perceived partnership and anxiety. **Results:** Data from 37 and 36 mothers in the control and experimental groups respectively, were analysed. Compared with controls, experimental group mothers reported significantly higher parental satisfaction ( $F = 39.29, p < .001$ ), parental self-efficacy ( $F = 7.45, p = .008$ ), perceived partnership ( $F = 62.30, p < .001$ ) and lower anxiety ( $F = 12.93, p < .001$ ), upon transfer to the ward. Infant outcomes did not differ between the groups.

**Conclusion:** This programme appears to facilitate collaboration between nurses and mothers and positively influences mothers' emotional and cognitive outcomes following infants' cardiac surgery.

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## Implications for clinical practice

- The mother–nurse partnership programme (MNPP) was developed as structured family centred care and implemented during limited visiting hours based on three components; sharing information, negotiation and participation in care.
- The partnership programme for infants with heart defects during immediate postoperative care significantly improved parental satisfaction, parental self-efficacy, perceived partnership and reduced anxiety.
- The partnership programme could overcome barriers to family centred care related to systemic factors such as restrictive visiting policies in the health care system and could be an alternative intervention for family centred care in the paediatric intensive care unit.

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## Introduction

Intensive care is inevitable during the early postoperative period in most infants with congenital heart defects (CHD). During this time, parents have greater demands for understandable information. Parents of infants with CHD particularly require information about postoperative care such as incision care, signs and symptoms of infection, pain control, and activity restrictions (Daily et al., 2016). Mothers of infants with CHD tend to experience considerable distress during the children's treatment (Hearps et al., 2014; Re et al., 2013), and experience higher levels of anxiety than do fathers (Jantien Vrijmoet-Wiersma et al., 2009). In fact, mothers of hospitalised children in general report higher stress levels than do fathers (Jee et al., 2012) and are more concerned about the child's possible death (Colville et al., 2009). Mothers also typically seek more information because they tend to readily participate in children's care (Jackson et al., 2008) and stay at the child's bedside for longer (Colville et al., 2009). Some mothers may experience a sense of lacking control over their children's care due to being separated from their child in the intensive care unit (ICU), which can be a major source of stress (Jee et al., 2012).

ICU nurses caring for infants with CHD should help parents independently care for their infants in the general ward or at home. However, current transitional care provides insufficient support for parents of infants with CHD. Family-centred care (FCC) is a fundamental philosophy of paediatric nursing that has been advocated as an ideal model of paediatric care for some time. However, it has been criticised for such problems as the large discrepancy between theory and practice and there are currently few intervention studies examining FCC for hospitalised patients (Coyne, 2015; Shields et al., 2012). FCC naturally emphasises parents' participation in their child's care; however, it may be inappropriate as an approach for infants with CHD who are critically ill following cardiac surgery in the ICU. First, CHD infants' progression during the immediate postoperative period is unique compared to other age groups—they might be critically ill for any number of reasons, such as transitional circulation, their immature organ systems, or the effects of cardiopulmonary bypass (Krishnamurthy et al., 2013). Nursing practices such as holding tend to be restricted because the infants are attached to several invasive lines (e.g., intracardiac lines) or have an open chest and infants need cluster care to allow them opportunities for rest (Sood et al., 2016). Therefore, parental participation in care must be approached cautiously depending on the infants' haemodynamic stability. Second, mothers of children with CHD generally experience greater distress than do mothers of children with other conditions because of the acuity of CHD (Muscara et al., 2015): anywhere from 30% to 80% of parents of a child with CHD experienced severe psychological distress in the immediate postoperative period (Woolf-King et al., 2017). Such severe psychological distress could affect active participation in child care. CHD infants' appearance and behaviour were identified as the greatest stressors in the paediatric ICU (PICU; Lisanti et al., 2017) and ventilators have also been shown to affect mothers' distress (Needle et al., 2009). Mothers' distress levels also change according to infants' recovery (Franck et al., 2010). Consequently, FCC should be structured to provide mothers with enough information on their child's progression, recovery and role boundaries for participation in care. Third, systematic factors such as restrictive visiting policies and a shortage of nursing staff in the health care system in the Republic of Korea might be barriers to FCC. A survey of 70 hospitals in the Republic of Korea revealed that the average ICU visiting hours was about one hour a day and most ICU nurses perceived open visiting policies as having more disadvantages than advantages, such as greater work burden and interruption of nursing care (Kim et al., 2010). These perceived burdens of an open visiting policy could be related to low nurse-to-patient

ratios. In fact, only 25% of hospitals in the Republic of Korea had a ratio of ICU nurses to patients of 1:2, while 42% and 33% had ratios of 1:3 and 1:4 respectively (Cho et al., 2012). Thus, the core components of FCC should be condensed into a structured form to realise FCC under these restrictive visiting practices.

Parents are generally devoted to caring for their children and can serve as another source of expertise in that area. According to a recent systematic review, recommended FCC practices included family presence in the ICU, family support, communication with family members, use of specific consultation and ICU team members and consideration of operational and environmental issues (Davidson et al., 2017). Butler et al. (2014) offered a perspective wherein parental presence was the usual practice. The presence of the family during resuscitation and invasive procedures can increase parents' satisfaction and coping (McAlvin and Carew-Lyons, 2014). Accordingly, parental participation interventions such as the mutual participation module of care (Curley, 1988), family integrated care (Patel et al., 2017) and parental empowerment care (Melnyk et al., 2004) might be useful alternatives to FCC. Strategies that help the family create an effective partnership with nurses have been emphasised to maximise the quality of care for their child (Tallon et al., 2015). Overall, parental participation in care has been shown to influence increased satisfaction, decreased anxiety, and length of stay (Bastani et al., 2015; Chan and Molassiotis, 2002; Hunsberger, 2000; Keatinge and Gilmore, 1996; Kristensson-Hallstrom et al., 1997).

CHD infants often have various feeding problems (Wong et al., 2015), which can often lead to delayed discharge (Baker-Smith et al., 2015; Wheeler et al., 2008). Furthermore, anxiety among mothers of infants with CHD has been shown to influence mother-child interactions during feeding (Lobo, 1992). Psychoeducation and parenting skill training programmes could positively influence the feeding process between mothers and infants with CHD (McCusker et al., 2010). Educational-behavioural intervention programmes could also influence parental mental health and reduce hospital length of stay (Brett et al., 2011; Melnyk et al., 2006).

Currently, there are no interventional studies on parents' active participation in care of infants with CHD based on a partnership between mothers and nurses in the PICU. Nursing programmes based on the collaborative partnership model could influence outcomes such as children's health status and families' quality of life (Tourigny and Chartrand, 2015). We hypothesised that an intervention based on mother-nurse partnership could influence the perceptions of mothers of infants with CHD and infants' outcomes.

## The purpose of this study

The purpose of this study was to evaluate the impact of a mother-nurse partnership programme (MNPP) on parental satisfaction, parental self-efficacy, perceived partnership and anxiety in mothers. We also wanted to examine its effects on the time taken to reach full oral feeding and the postoperative length of hospital stay for infants after cardiac surgery.

The hypotheses were as follows:

1. Parental satisfaction will be higher in mothers of the experimental group, who underwent MNPP, compared with mothers of a control group, who did not.
2. Perceived self-efficacy among mothers will be higher in the experimental group than in the control group.
3. Perceived partnership among mothers will be higher in the experimental group than in the control group.
4. Mothers' anxiety will be higher in the experimental group than in the control group.

5. Time taken to reach full oral feeding will be shorter among infants of the experimental group than among those of the control group.
6. Postoperative hospital stay will be shorter among infants of the experimental group than among those of the control group.

**Methods**

*Design*

A quasi-experimental study was conducted to evaluate the effects of the MNPP on mothers’ and infants’ outcomes.

*Setting*

An 11 bedded paediatric surgical ICU with nursing staff of twenty-four nurses and one clinical nurse specialist (CNS). The patient–nurse ratio was 2.2:1. The average number of paediatric cardiac operations was over 600 cases. ICU policy restricted visits to twice a day. Each visiting time was 30 minutes. In general wards, mothers stay with their infants all day, feed their child and independently perform infant care, such as maintaining hygiene, changing nappies, holding, carrying and soothing.

*Participants*

Participants were consecutively selected infants who received first-stage surgery for CHD within three months of birth and their mothers. Recruitment took place between January and November 2016, in Asan Medical Hospital in Seoul, Republic of Korea. Infants had to be in the Risk Adjustment for Congenital Heart Surgery (RACHS)-3 to 6 risk categories. For these, higher categories indicate more complex operations. The RACHS-1 category includes simple operations such as patent ductus ligation, while RACHS-6 includes complex operations such as the Norwood operation with hypoplastic left heart syndrome (Jenkins et al., 2002).

The sample size was calculated with G\*power 3.1 based on a previous study (McCusker et al., 2010). A sample size of 36 per group is required at an alpha of 0.05, effect size of 0.6, and power of 0.8. Data from 37 and 36 participants for the control and experimental groups, respectively, were analysed.

*Ethical considerations*

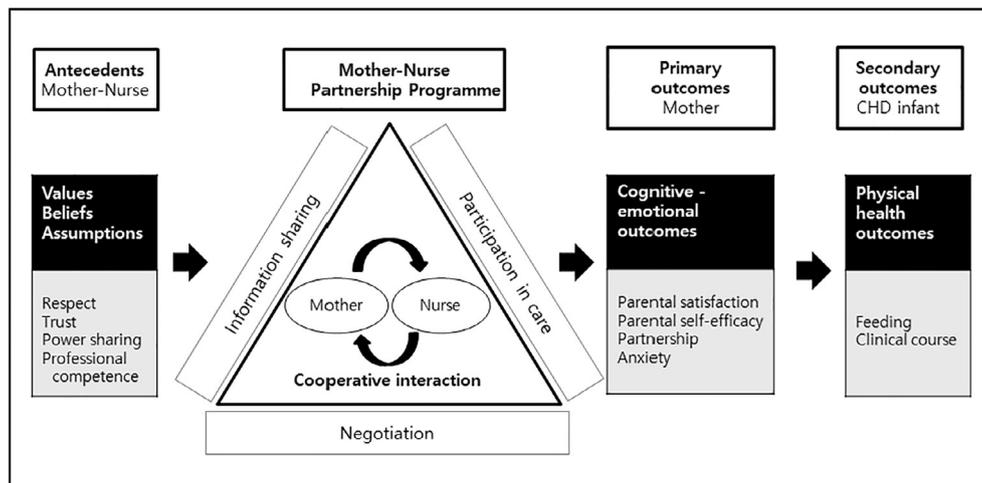
This study was performed after institutional review board approval (IRB No. 2015-1200) in Asan Medical Hospital. The researcher explained the necessity, aims and methods of this study and obtained the participating mothers’ informed consent.

*The development and implementation of the Mother-Nurse partnership programme*

The theoretical framework of this study is as follows (see Fig. 1). The mother-nurse partnership programme (MNPP) was developed based on the core components of a model of partnership development; information sharing, negotiation, and participation in care (Mastro et al., 2014). The MNPP development process comprised five stages: a literature review, in-depth interviews, development of a preliminary version of the MNPP, evaluation of programme validity and a pilot test.

The MNPP was provided for the experimental group during ICU hospitalisation following cardiac surgery. The control group received ordinary nursing care and a brochure including brief guidance regarding when infants would recover consciousness and be extubated, when they could feed and when they could be discharged. This programme was based on the components of the theoretical framework and provided mothers with concrete examples of how they could collaborate with nurses (see Table 1).

The MNPP was individually delivered in the ICU during visiting time (30 minutes) twice a day. It was delivered in five phases according to the infant’s progression. Orientation to the MNPP was delivered within 24–48 hours as the first phase. The second to fifth phase included information sharing, negotiation and participation. Primary nurses provided mothers with a tailored factsheet about the status of their infants. The CNS additionally provided mothers with information that they wanted to know more about. The authors designated the expected participation activities for each phase considering infants’ haemodynamic stability. Participation activities were selected from among these activities according to the mother’s condition, preference and negotiations between the mother and primary nurse. Mothers selected touching, hygiene and changing nappies during the intubation state, but more varied activities, including feeding and holding, during the post-extubation state. Feeding activity included dependent participation in tube feeding with nurses, independent bottle feeding and burping the infant under nurses’ supervision.



**Fig. 1.** Conceptual framework. CHD: Congenital Heart Defects.

**Table 1**  
Summary of Mother–Nurse Partnership Programme in ICUs.

Phase	Infant status	Goal	Sharing information	Negotiation and participation in care
1	Within 24–48 hours after admission	Programme orientation and recognition of each role	Providing programme orientation Introduction of ICU and staff	Introduction of activities to enhance unique parent–child connectedness
2	Mental recovery	Promoting a trusting relationship	Providing individualised and tailored information	Holding hands and feet, ensuring infant's hygiene, putting on the infant's socks, applying lotion
3	Beginning of ventilator weaning	Participating safely in the infant's care	Identification and reflection of mothers' preferences for infant care	Changing nappies, tube feeding, clothing the infant, positioning
4	Enteral feeding			Bottle feeding, burping the infant
5	Transfer to general ward			Holding to the infant, carrying the infant to other places

### Data collection

The period of data collection ranged from December 2015 to December 2016. The pretest involved measurement of baseline data using self-administered questionnaires assessing demographic characteristics and primary outcomes within 18–36 hours after arrival in the PICU. The posttest was conducted 12 hours before discharge from the PICU using the same questionnaires. The time taken to reach full oral feeding and postoperative hospital stay were evaluated using chart reviews.

### Primary outcome measures

PICU parental satisfaction was measured using the short form of an instrument developed to measure parental satisfaction with the PICU (Latour et al., 2013). This scale contained 30 items in five subscales; information, care and cure, organisation, parent participation and professional attitude. All items were rated on a 6-point Likert scale. The Cronbach's  $\alpha$  value was 0.97.

Perceived parental self-efficacy was measured using the Karitane Parenting Confidence Scale (Crncec et al., 2008). The instrument comprised 15 items in three subscales (parenting, support, and development). All items were rated on a 4-point Likert scale. After reverse scoring one negatively worded item, all items are summed to produce a total score. A score of less than 31 indicates the severe clinical range, 32–35 indicates the moderate clinical range, 36–39 indicates the mild clinical range and 40 or more means the non-clinical range. The Cronbach's  $\alpha$  value was 0.90.

Use of both the PICU parental satisfaction instrument and the Karitane Parenting Confidence Scale was permitted by the original developers. Five persons were involved in the process of translating these into Korean, including three bilingual medical/nursing personnel. The three bilingual medical/nursing personnel had lived in America for more than 10 years. A bilingual nursing professor performed the forward translation. Following reconciliation of the authors, a bilingual doctor performed a backward translation. Subsequently, another bilingual nursing professor reviewed the backward translation and compared the original with the translated version, and then corrected the translated version with the authors to better suit a Korean context.

Perceived partnership was evaluated using the parent–nurse partnership scale (Choi and Bang, 2013). The scale contained 34 items in 7 subscales, including reciprocity, professional knowledge, sensitivity, collaboration, communication, shared information and cautiousness. All items were evaluated using a 5-point Likert scale. The Cronbach's  $\alpha$  value was 0.97.

Anxiety was measured using the state anxiety scale (Spielberger et al., 1976). The scale contained 20 items, and a published Korean version was used in this study (Kim and Shin, 1978). The items were evaluated with a 4-point Likert scale. The Cronbach's  $\alpha$  value was 0.95.

### Secondary outcome measures

Time taken by infants to reach full oral feeding (with a feeding goal of 100 ml/kg/day) and postoperative hospital stay were reviewed to investigate infants' health outcomes. Most infants are transferred upon reaching full oral feeding. Postoperative hospital stay in this study refers to the length of stay from ICU arrival to hospital discharge.

### Data analysis

Collected data were analysed with SPSS Statistics 21.0. Descriptive statistics were calculated for the demographic characteristics. We then examined the homogeneity of the groups at pretest using an independent *t*-test. Analysis of covariance (ANCOVA) was also used to investigate differences between the two groups concerning the main dependent variables while controlling for variables that significantly differed between groups at pretest. A *p*-value of less than .05 was considered statistically significant.

## Results

### Homogeneity test between the experimental and control groups

The general characteristics of the infants were homogenous between the groups (Table 2). However, the number of infants in the experimental group who received care in the neonatal ICU (NICU) in the pre-operative period was statistically significantly higher than that in the control group.

The mothers in the experimental group were similar to those in the control group (Table 3).

The homogeneity of the dependent variables was evaluated using the Kolmogorov–Smirnov test ( $p > .05$ ). Pretest values of organisation and professional attitude (parental satisfaction subscales) as well as reciprocity, sensitivity, and professional knowledge (perceived partnership subscales) were significantly different between the groups (Table 4).

### Hypothesis testing

The results indicated that mothers in the experimental group reported significantly higher parental satisfaction, parental self-efficacy, and perceived partnership, and significantly lower anxiety compared with mothers in the control group.

Hypothesis 1: Parental satisfaction will be higher in mothers of the experimental group, who underwent the MNPP, compared with mothers of the control group, who did not.

Mothers of infants with CHD at posttest showed a significant difference in improvement in parental satisfaction with a score of  $5.49 \pm 0.43$  in the experimental group compared to  $4.45 \pm 0.75$  in the control group ( $p < .001$ ). All subscales were significantly different ( $p < .001$ , although the organisation subscale *p*-value was only

**Table 2**  
Characteristics of Infants (N = 73).

Variables	Characteristics	Categories	Exp. (n = 36) n (%) or M ± SD	Cont. (n = 37) n (%) or M ± SD	$\chi^2$ or t	p
General	Age (day)		19.89 ± 21.98	29.22 ± 25.14	1.690	.096
	Body weight (kg)		3.14 ± 0.63	3.39 ± 0.54	1.884	.064
	Gender	Male	18 (50.0)	20 (54.1)	0.729	.816
		Female	18 (50.0)	17 (45.9)		
	Prematurity	Yes	7 (19.4)	7 (18.9)	0.955	>.999
		No	29 (80.6)	30 (81.1)		
Non-cardiac anomaly	Yes	7 (19.4)	7 (18.9)	0.955	>.999	
	No	29 (80.6)	30 (81.8)			
Pre-operative	NICU care	Yes	30 (83.3)	19 (51.4)	0.004	.006
		No	6 (16.7)	18 (48.6)		
Operative	RACHS-1	≥4	11 (30.6)	9 (24.3)	0.551	.607
		<4	25 (69.4)	28 (75.7)		
	One stage total correction	Yes	20 (55.6)	16 (43.2)	0.293	.353
		No	16 (44.4)	21 (56.8)		
Opened sternum	Yes	14 (38.9)	12 (32.4)	0.565	.630	
	No	22 (61.1)	25 (67.6)			
Post-operative	Peritoneal dialysis	Yes	16 (44.4)	19 (51.4)	0.555	.642
		No	20 (55.6)	18 (48.6)		
	Use of muscle relaxant	Yes	31 (86.1)	34 (91.9)	0.429	.479
		No	5 (13.9)	3 (8.1)		
	First date of ventilator weaning (POD)		2.19 ± 1.69	2.41 ± 2.11	0.470	.640
	First date of feeding (POD)		3.06 ± 1.53	3.57 ± 2.57	1.032	.306
	Duration on ventilator (day)		6.50 ± 5.79	7.76 ± 6.86	0.850	.401
ICU stay (day)		10.53 ± 7.24	10.43 ± 7.67	-0.055	.957	

Exp. = Experimental group; Cont. = Control group; RACHS = Risk Adjustment for Surgery for Congenital Heart Surgery; NICU = Neonatal intensive care unit; POD = Postoperative day; ICU = Intensive care unit.

**Table 3**  
Characteristics of Mothers (N = 73).

Variables	Characteristics	Categories	Exp. (n = 36) n (%) or M ± SD	Cont. (n = 37) n (%) or M ± SD	$\chi^2$ or t	p
Socio-demographic	Age (yr)		33.00 ± 3.76	32.92 ± 4.67	-0.082	.935
	Employment	Employed	23 (63.9)	25 (67.6)	0.741	.808
		Not employed	13 (36.1)	12 (32.4)		
	Religion	Yes	20 (55.6)	20 (54.1)	0.897	>.999
		No	16 (44.4)	17 (45.9)		
	Education level	High school	6 (16.7)	3 (8.1)	1.722	.423
		College	28 (77.8)	30 (81.1)		
		Graduate school	2 (5.6)	4 (10.8)		
Monthly income (one million won)	<2.5	5 (13.9)	10 (27)	2.074	.354	
	≥2.5 ~ <5	21 (58.3)	17 (45.9)			
	≥5	10 (27.8)	10 (27)			
Health related	Diagnosed disease	Yes	3 (8.3)	2 (5.4)	0.620	.674
		No	33 (91.7)	35 (94.6)		
	Delivery	Normal	14 (38.9)	21 (56.8)	0.127	.162
		C/Sec	22 (61.1)	16 (43.2)		
	Parity	Primiparity	30 (83.3)	25 (67.6)	0.118	.175
		Multiparity	6 (16.7)	12 (32.4)		
	Foetal diagnosis	Yes	33 (91.7)	35 (94.6)	0.620	.674
		No	3 (8.3)	2 (5.4)		
Self-rated health status (VAS)			6.56 ± 1.75	6.22 ± 1.89	-0.796	.428

Exp. = Experimental group; Cont. = Control group; C/Sec = Caesarean section; VAS = Visual analogue scale.

.001). In the control group, the mean subscale scores were 4.18–4.50 at pretest and 4.25–4.66 at posttest. In the experimental group, the mean scores were 4.55–4.93 at pretest and 5.39–5.55 at posttest. Therefore, Hypothesis 1 was supported (Table 5).

Hypothesis 2: Parental self-efficacy among mothers will be higher in the experimental group than in the control group.

At posttest, mothers showed significant improvement in parental self-efficacy, with scores of 52.29 ± 6.61 and 47.45 ± 7.30 in the experimental and control groups, respectively ( $p = .008$ ). In subscale analysis, only the parenting subscale differed significantly ( $p = .002$ ). In the control group, the parental self-efficacy of nine mothers was in the mild to severe clinical ranges at pretest; seven

mothers were still within the mild to moderate clinical ranges at posttest. In contrast, in the experimental group, eleven mothers were in the mild to severe clinical ranges at pretest, but all mothers were in the non-clinical range at posttest. The hypothesis was therefore supported (Table 5).

Hypothesis 3: Perceived partnership among mothers will be higher in the experimental group than in the control group.

Mothers at posttest showed significant improvement in perceived partnership scores, with scores of 4.68 ± 0.35 in the experimental group and 3.82 ± 0.51 in the control group ( $p < .001$ ). In the subscale analysis, all subscales showed significant differences ( $p < .001$ ). The hypothesis was therefore supported (Table 5).

**Table 4**  
Homogeneity of Dependent Variable (N = 73).

Variables	Exp. (n = 36)	Cont. (n = 37)	t	p
	M ± SD	M ± SD		
Parental satisfaction (overall)	4.68 ± 0.75	4.35 ± 0.83	-1.756	.083
Information	4.67 ± 1.02	4.35 ± 1.02	-0.41	.682
Care and cure	4.55 ± 0.91	4.50 ± 0.87	-0.09	.927
Organisation	4.93 ± 0.72	4.51 ± 1.01	-2.26	.028
Parental participation	4.59 ± 0.81	4.21 ± 0.86	-1.98	.053
Professional attitude	4.74 ± 0.89	4.18 ± 1.01	-2.72	.009
Perceive parental self-efficacy (overall)	43.06 ± 6.92	44.82 ± 7.49	1.042	.301
Parenting	21.01 ± 4.37	22.39 ± 5.07	1.248	.216
Support	15.75 ± 2.38	16.32 ± 2.26	1.056	.294
Development	6.31 ± 1.51	6.11 ± 1.22	-0.616	.540
Perceived partnership (overall)	4.10 ± 0.55	3.77 ± 0.57	-2.509	.014
Reciprocity	4.15 ± 0.67	3.73 ± 0.66	-2.700	.009
Professional Knowledge	4.26 ± 0.52	3.89 ± 0.69	-2.607	.011
Sensitivity	3.98 ± 0.70	3.52 ± 0.69	-2.846	.006
Collaboration	4.19 ± 0.63	3.99 ± 0.63	-1.379	.172
Communication	3.80 ± 0.75	3.63 ± 0.73	-1.018	.312
Shared information	3.90 ± 0.68	3.80 ± 0.75	-0.614	.541
Cautiousness	4.39 ± 0.61	4.15 ± 0.64	-1.634	.107
Anxiety	49.16 ± 12.96	51.57 ± 13.5	0.776	.440

Exp. = Experimental group; Cont. = Control group.

**Table 5**  
Comparison of Mothers' Outcomes between the Two Groups (N = 73).

Variable	Exp. (n = 36)		Cont. (n = 37)		F	p
	Pretest	Posttest	Pretest	Posttest		
	M ± SD	M ± SD	M ± SD	M ± SD		
Parental satisfaction (overall)	4.68 ± 0.75	5.49 ± 0.43	4.35 ± 0.83	4.45 ± 0.75	39.29	<.001*
Information	4.67 ± 1.02	5.55 ± 0.49	4.35 ± 1.02	4.51 ± 0.86	24.26	<.001*
Care and cure	4.55 ± 0.91	5.54 ± 0.42	4.50 ± 0.87	4.54 ± 0.79	27.89	<.001*
Organisation	4.93 ± 0.72	5.39 ± 0.54	4.51 ± 1.01	4.66 ± 0.79	12.93	.001*
Parent Participation	4.59 ± 0.81	5.42 ± 0.59	4.21 ± 0.86	4.25 ± 0.95	27.31	<.001*
Professional attitude	4.74 ± 0.89	5.52 ± 0.54	4.18 ± 1.01	4.32 ± 0.96	31.67	<.001*
Perceived parental self-efficacy (overall)	43.06 ± 6.92	52.29 ± 6.61	44.82 ± 7.49	47.45 ± 7.30	7.45	.008*
Parenting	21.01 ± 4.37	25.22 ± 4.11	22.39 ± 5.07	22.25 ± 4.66	10.61	.002*
Support	15.75 ± 2.38	17.42 ± 2.08	16.32 ± 2.26	16.16 ± 2.22	2.57	.114*
Development	6.31 ± 1.51	6.78 ± 1.27	6.11 ± 1.22	6.05 ± 1.33	2.24	.140*
Perceived partnership (overall)	4.10 ± 0.55	4.68 ± 0.35	3.77 ± 0.57	3.82 ± 0.51	62.30	<.001*
Reciprocity	4.15 ± 0.67	4.78 ± 0.35	3.73 ± 0.66	3.86 ± 0.62	50.07	<.001*
Professional knowledge	4.26 ± 0.52	4.79 ± 0.33	3.89 ± 0.69	3.97 ± 0.50	48.19	<.001*
Sensitivity	3.98 ± 0.70	4.58 ± 0.44	3.52 ± 0.69	3.47 ± 0.68	52.38	<.001*
Collaboration	4.19 ± 0.63	4.70 ± 0.43	3.99 ± 0.63	4.02 ± 0.58	25.52	<.001*
Communication	3.80 ± 0.75	4.50 ± 0.55	3.63 ± 0.73	3.70 ± 0.63	22.05	<.001*
Shared information	3.90 ± 0.68	4.43 ± 0.61	3.80 ± 0.75	3.74 ± 0.67	15.33	<.001*
Cautiousness	4.39 ± 0.61	4.89 ± 0.32	4.15 ± 0.64	4.16 ± 0.71	25.69	<.001*
Anxiety	49.16 ± 12.96	34.31 ± 9.69	51.57 ± 13.5	45.19 ± 11.35	12.93	<.001*

\* ANCOVA conducted with covariates of preoperative NICU care, pretest value of organisation and attitude among parental satisfaction, and pretest value of reciprocity, sensitivity, and professional knowledge among perceived partnership; Exp. = Experimental group; Cont. = Control group.

Hypothesis 4: Mothers' anxiety will be higher in the experimental group than in the control group.

Mothers at posttest showed a significant decrease in anxiety, scoring 34.31 ± 9.69 in the experimental group and 45.19 ± 11.35 in the control group ( $p < .001$ ). Accordingly, the hypothesis was supported (Table 5).

Hypothesis 5: Time taken by infants of an experimental group to reach full oral feeding will be shorter than that of infants of a control group.

There were no significant differences in the time taken to reach full oral feeding: 10.22 ± 12.65 days in the experimental group and 14.14 ± 14.21 days in the control group ( $p = .145$ ). The hypothesis was therefore rejected.

Hypothesis 6: Postoperative hospital stay of infants of an experimental group will be shorter than that of infants of a control group.

The mean postoperative hospital stay was 19.25 ± 16.84 days in the experimental group and 26.59 ± 22.43 days in the control group ( $p = .087$ ). The hypothesis was therefore rejected.

## Discussion

This study was performed to investigate MNPP's impact on the outcomes of both mothers and infants in the immediate postoperative care period in a PICU in the Republic of Korea.

First, parental satisfaction level increased after implementation of the MNPP. This finding resembles the results of previous studies showing that parental participation in family-centred care positively influenced parental satisfaction (De Bernardo et al., 2017). Strategies for patient- and family-centred care could increase family satisfaction (Goldfarb et al., 2017). The mean of 4.68 at pretest

in the experimental group was lower than the mean score of 5.15 in a previous study (Latour et al., 2013), but the posttest mean of 5.49 was higher. In subscale analysis, all subscale scores significantly increased after implementation of MNPP, with especially great changes occurring in the care and cure domain. Mothers of infants with CHD reportedly feel supported when they are able to make contact with experts, obtain relevant knowledge, and have their demands for infant care met (Bruce et al., 2014). Presumably, sharing their current status, diagnostic results and further care plans during MNPP could help mothers of infants with CHD perceive that their child receives greater quality of care. Actually, mothers reported that they were satisfied with the quality of information before discharge and that the MNPP was helpful in teaching them to care for infants in this study. In addition, mothers could participate in caring for infants in their preferred time and way. We presume that the MNPP met mothers' preferences for participation in infants' care in the ICU, which consequently influenced their parental satisfaction. Changes in the organisation subscale were relatively small because MNPP could not improve environmental issues (e.g., the facilities themselves).

Second, the MNPP had a positive impact on parental self-efficacy. In the subscale analysis, only the parenting subscale showed a significant difference. This finding is comparable with those of previous studies showing that teaching mothers how to care for infants enhanced their parental confidence in neonatal care (Peyrovi et al., 2016). Each component of the MNPP involved teaching mothers skills about routine care of their newborn. Around 83% of participants were primiparas. These mothers tended to have lower confidence in basic skills of infant care. The MNPP provided mothers with opportunities to interact with nurses to identify their own weak points in caring for infants; from there, nurses resolved problems together with mothers and provided coaching and positive feedback. This individualised approach provided mothers with a positive experience by easing their care and ensuring continued learning towards independently providing infant care. Because there was little change in the support and development domains after MNPP, a revision programme is needed to intensify perceived support and development.

Third, the MNPP enhanced mothers' perceived partnership. In the subscale analysis, all subscales showed significant differences. There have been no studies on perceived partnership in a hospitalised environment that offer a precise comparison with our findings. We expect that the three main components of the MNPP had a considerable impact on perceived partnership, including its various domains. The attributes of reciprocity in particular should be reflected in the established partnership by ensuring that their opinions are incorporated into the decision making (Choi and Bang, 2013). In this study, participants wanted to collaborate with nurses in preparing infants for transfer to the general ward and they could effectively participate in decision making regarding the optimal timing for transfer. Thus, the reciprocity between mothers and nurses such as the reflection of mother's opinion on infants' care could increase perceived partnership.

Fourth, mothers' anxiety level significantly decreased following the MNPP. Anxiety scores were around 50 in both the experimental and control groups within 24–72 h after arrival in the PICU. This result resembles the score of 53.8 found in a previous study (Needle et al., 2009). Participants in this study were infants with a RACHS category of at least 3, and their high complexity could be related to a higher level of maternal anxiety (Scrimin et al., 2009) and patient acuity during ventilator application (Needle et al., 2009). Furthermore, as infants' condition improved over time, mothers' anxiety level decreased. A study (Keatinge and Gilmore, 1996) reported that the decrease in anxiety between the pretest and posttest in mothers who participated in their children's care during hospitalisation was 10.4. In this study, we found

that the decrease of anxiety was 15.1 following the MNPP, which suggests that providing additional information and emotional support along with participation in care intensified the decrease in anxiety levels.

Finally, this programme was not effective in decreasing the time taken to reach full oral feeding or postoperative hospital stay. In a previous study, parental participation in a recovery room helped the child intake fluids faster (Kristensson-Hallstrom et al., 1997) and parental participation in rounds led to a decrease in the length of hospital stay (Johnson et al., 2008). Mothers tend to be sensitive to their children's cues regarding whether they are hungry or not, or distressed or not (Harrison and Ferree, 2014), and their unique interactions with their children might help promote their faster recovery. However, infants' physical conditions, such as the presence of complications, might have a strong influence on feeding and postoperative hospital stay in this study. The impact of MNPP on infants' disease progression should be repeatedly evaluated in future studies.

Open visiting policies have been perceived favorably by families in other countries (Chapman et al., 2016) and longer visiting policies have been found to influence Korean patients' anxiety and family satisfaction (Lee and Kang, 2011). The extremely restrictive visiting policy could negatively influence parental satisfaction; nevertheless, parental satisfaction significantly increased and their anxiety decreased after the MNPP. Although the introduction of 24-hour ICUs has been considered a usual practice for decades in many countries, some ICUs continue to employ visiting policies with limited visiting hours (Giannini et al., 2017; Noordermeer et al., 2013; Soares et al., 2017; Spreen and Schuurmans, 2011). According to the results in this study, structured FCC such as MNPP could be a strategy to realise FCC under extremely restrictive practices.

## Limitations

First, this study was implemented in a PICU with a restrictive visiting policy, which could have influenced the study results. Second, this study has limited generalisability because it was a single-centre study. The implementation and evaluation of the MNPP should be repeated in other centres. Third, the baseline organisation and professional attitude scores (subscales of parental satisfaction) as well as the scores for reciprocity, sensitivity, and professional knowledge (parental partnership subscales) were higher than in the control group, indicating that mothers had different expectations. Therefore, we used ANCOVA to correct for differences in baseline scores. Fourth, this study was performed only with mothers of infants with CHD. Further studies should be expanded to include other family members, including fathers. Fifth, the translation of the scales was not undertaken using international standards. Finally, infants with various CHD diagnoses were enrolled. Although infants' operative complexity was included as a covariate, infants with only one disease should be enrolled in future studies to evaluate the MNPP's effects on infant outcomes across various CHD diagnoses.

## Conclusions

We developed the MNPP, a programme whereby parents were considered experts in caring for infants, by attending to the unique needs of mothers of infants with CHD. The MNPP effectively managed lack of understanding of infant care and encouraged mothers to participate in care for infants with haemodynamic instability. The MNPP's enhancement of collaboration between nurses and mothers of infants with CHD therefore might improve mothers' emotional-cognitive outcomes following their infants' cardiac

surgery. Consequently, the MNPP helped mothers independently care for their infants following immediate postoperative care and facilitated the successful transition from the PICU to the general ward and home. We believe that the implementation of a partnership programme to facilitate collaboration between nurses and mothers should be expanded.

Further research is needed to explore the impact of the programme on infants' physical outcomes by enrolling infants with a single disease, or those who underwent a single procedure. A modified MNPP that includes fathers as well as considers outcomes associated with a decrease in parental psychological problems and an increase in infants' recovery should be studied in the future as well.

### Funding statement

This study was supported by a Mo-Im Kim research grant of Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University.

### Ethical statement

This study was performed after institutional review board approval (IRB No. 2015-1200) in Asan Medical Hospital, Republic of Korea. The research meets the ethical guidelines.

### Conflict of interest

There were no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

### Acknowledgments

The authors express their deep gratitude to all of mothers of infants with CHD as well as the paediatric nurses at the Children's Hospital at Asan Medical Center.

### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.iccn.2018.03.006>.

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