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Fathers' Involvement in the Developmental Care of Their Preterm Newborns and its Impact on the Bonding and Self-Efficacy: A Nonrandomized Clinical Trial

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Abstract

Background: Premature birth and postpartum hospitalization can hurt the father-newborn bonding and self-efficacy.

Aim: This study aimed to investigate the effect of fathers' involvement in premature newborns care on paternal-infant bonding and self-efficacy.

Method: This nonrandomized clinical trial was conducted on 80 fathers of hospitalized newborns in the Neonatal Intensive Care Unit at Arash Hospital, Tehran University of Medical Sciences, Tehran, Iran, 2017. The samples were selected by the convenience sampling method and divided into two groups. Pre- and post-intervention outcomes were collected using the Parent-Infant Bonding Scale (originally the Mother-Infant Bonding Scale) and the Perceived Maternal Parenting Self-Efficacy tool. The gathered data were analyzed using independent t-test, paired t-test, repeated-measures ANOVA.

Results: The mean±SD of the scores of the bonding score was reduced by 2.3±2.17 in the Control group and 5.27±2.57 in the intervention group. A lower score represented a better bonding. The self-efficacy score increased in both groups; however, it was significantly higher in the intervention group, which was increased by 8.85±5.046, compared to 1.27±3.31 in the Control group.

Implications for Practice: Developmental care by fathers can improve the father-infant bonding and increase the paternal self-efficacy for the care of the high-risk newborn.

Keywords: Bonding, Developmental care, Father involvement, Neonate, Self-efficacy

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Introduction

About 8% of newborns in developed countries and 25% of newborns in developing countries are premature (1). In Iran, the birth rate of premature newborns was reported to be 9.2% (2). Premature births and hospitalization can create numerous challenges for both the newborn and the family, including the disturbance in parent-neonate communication, bonding, and self-efficacy (3-5).

In most cases, parents of a premature newborn in need of intensive care feel frustrated, and this situation might lead to the separation of parents from the newborn (6). Mothers cope with it through collaborative and non-collaborative behaviors, such as looking, touching, talking, hugging, and talking to others (7). However, fathers may feel that they have a limited role in taking care of the newborns (8). Even though nurses often consider mothers as the main caregivers, it is common that fathers are the first ones who visit the newborns in the neonatal intensive care unit (NICU) since the mother may not be well enough following delivery (9).

In some cases, it is reported that fathers are more likely to be affected by neonatal illness during hospitalization in the NICU than mothers. Moreover, their bonding with the newborn may progress slowly due to the limiting conditions in NICUs (4). Theories related to mother-infant bonding include quality themes, interventions, and outcomes that may translate into the concept of father-infant bonding. As a representative case, researchers have found that fathers demonstrate some of the same behaviors as mothers; nevertheless, they progress from passive to active involvement, such as prolonged gazing, vocalizing distinct characteristics of the neonate, smiling, and being close to the neonate (10). Paternal absenteeism is associated with poorer developmental, behavioral, and educational outcomes that directly affect the behavior of the newborn and the child and may indirectly contribute to the development of marital problems (11). Furthermore, the results of some pieces of research have shown that paternal-infant bonding is greater in newborns whose fathers are involved in their care and that these newborns are more resilient during stressful conditions, and in their future lives, they show more courage and are more willing to explore unfamiliar surroundings (6, 7, 11, 12). It has been shown that successful father-infant bonding in the immediate postpartum period decreases cognitive delay, enhances weight gain in preterm neonates, and improves breastfeeding rates. Therefore, interventions that establish an immediate father-infant bonding may have a positive effect on active paternal involvement as the newborn grows and develops (10).

One of the negative consequences of a newborn's admission to the NICU is the lack of paternal-infant bonding (13). The term bonding describes how parents feel about the newborn (14, 15). Bonding may not always be established as soon as the first contact with the neonate and can be a more gradual and constructive process that is intensified with time (16). During pregnancy, mothers experience a significant increase in bonding (17). However, bonding in fathers often develops slowly, compared to mothers (17), occurring in the first few days after the delivery, during which the father forms a special permanent relationship with the newborn during the time (18).

One of the main factors in successful paternal-infant bonding is parental self-efficacy (19). Parental self-efficacy is the parents' perception of the ability to play a caring role for the newborn and provide positive conditions for the growth and development of the newborn (20). Parents without enough self-efficacy are more likely to be unable to provide high-quality care for their newborns, which would negatively influence the sense of bonding (21).

Newborn Individualized Developmental Care and Assessment Program is a model of care that is based on the philosophy of respecting the special needs of preterm newborns. Preterm newborns' brains and body systems are vulnerable; however, in NICU they are deprived of routine parental care (17). One of the basic foundations of individualized developmental care is family-centered care (22). The potential benefits of a family-centered approach include improving parental satisfaction by involving them in the care and decision-making process, reducing parental stress, increasing the ability of parents to cope with the newborn's apparent condition and behavior, improving the breastfeeding, increasing parental relaxation, and empowering to provide care for their newborns after discharge (23).

Numerous studies have focused on the involvement of mothers, their self-efficacy, and maternal-infant bonding so far. Nevertheless, to the best of our knowledge, there is insufficient information about fathers' involvement in the care. Moreover, nurses may be more concerned with mothers'

involvement in the care and ignore the needs of fathers (13).

In Iran, because of cultural-religious beliefs, the father's long presence in NICU is not welcomed. For instance, in various cases, mothers' religious beliefs prevent breastfeeding or providing skin-to-skin care while a strange man is present in the unit. For the same reason, nurses also may feel uncomfortable since from their point of view NICU is a feminine workplace, and therefore, they are more comfortable with the mothers rather than fathers. Furthermore, organizational barriers, such as the visiting policies of hospitals limit the fathers' presence, and in the majority of the hospitals, they are allowed to visit their newborns only during specific hours (24).

Despite similarities in bonding behaviors between the mother/father and the neonate, fathers may need interventions directly related to the phenomenon of father-infant bonding (10). The present study aimed to investigate the effectiveness of the involvement of fathers in premature newborns on paternal-infant bonding and self-efficacy.

Methods

This nonrandomized trial study was conducted based on a pretest-posttest Control group design within April 2018-March 2019. The present research investigated the effectiveness of fathers' involvement in premature newborns on paternal-infant bonding and self-efficacy based on the principles of developmental care.

A convenience sampling method was used to select the samples from the fathers of premature newborns admitted to the NICU of Arash Hospital, affiliated with Tehran University of Medical Sciences, Tehran, Iran. Based on the results of previous studies, the sample size was calculated to be 40 individuals with a type I error of 5%, type II error of 20%, and a standard deviation of 4.6, which could detect at least 5.2 units in the neonatal bonding score (25). Fathers were included if they had a premature newborn with a gestational age less than 37 weeks; were able to comprehend, read, and respond in the Persian language; had no history of addiction and/or psychiatric illness; and had no previous preterm newborns. On the other hand, newborns having a life-limiting disease during the study (e.g., lung haemorrhage or intravenous cerebral haemorrhage), having mothers with depression or postpartum psychosis during the study, being admitted for more than 4 weeks, and being discharged earlier than 1 week were excluded from the research. Data collection included obtaining demographic information about newborns and parents. In this respect, the information regarding paternal age and job, maternal age, and family's economic status were gathered. Moreover, the collected variables related to the newborn included gender, age, hospitalization length, the type of birth, and the type of feeding. The process of data recruitment is depicted in Figure 1.

In this study, the Mother-to-Infant Bonding Scale (MIBS) was used to examine the relationship between the father and the newborn. According to Figueiredo et al., this tool can also be used to assess father-infant bonding (16). This 10-item questionnaire is scored on the Likert scale and examines the parent-infant bonding in the form of rejection, liking, or no reaction towards the newborn. The total score of the questionnaire ranges from 0-27, with low scores indicating good bonding and high scores showing poor bonding. In other words, the reduction in this score reflects the improvement in paternal-infant bonding. This tool has two factors: lack of affection (LA) and anger and rejection (AR).

The internal consistency scores of the tool were calculated at 0.71 and 0.57 for LA and AR in the original study, respectively. After obtaining permission from the original designer, the questionnaire was first translated into Persian. Subsequently, it was back-translated into English by a fluent translator who did not have access to the original questionnaire; it then was compared to the original one. To validate the questionnaire, five faculty members and five nurses working in the NICU assessed the face validity of the instrument. After considering their opinions, the questionnaire was distributed among 15 fathers whose newborns were admitted to the NICU. The same fathers completed the questionnaire again 2 weeks later. The correlation of scores was obtained at 0.61 in both times ($P < 0.001$) (25).

Fathers' self-efficacy was examined with Perceived Maternal Parenting Self-Efficacy (PMP-SE). This 20-item questionnaire, developed by Barnes and Adamson (2007), measures the paternal perceived self-efficacy. The tool consists of four subscales related to care processes, seven subscales related to motivational behaviors, six subscales related to the perception of behaviors and messages, and three

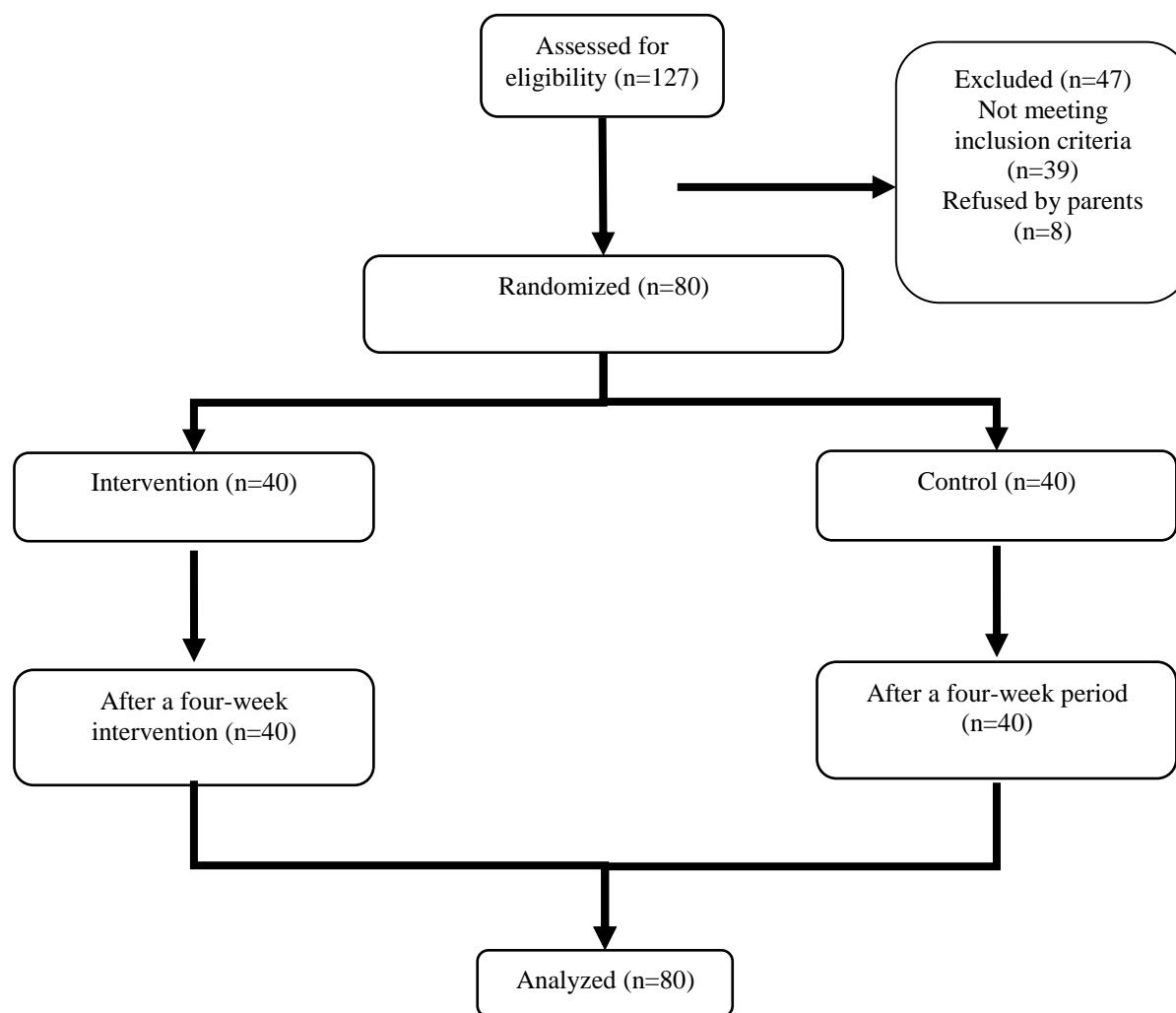


Figure 1. Flowchart of recruitment and allocation of study groups

subscales related to situational beliefs. The items are scored on a 4-point Likert scale of 1=strongly disagree, 2=disagree, 3=agree, and 4=strongly agree. The total score is estimated at the range of 20-80, with high scores reflecting a high level of self-efficacy. The internal consistency of the tool was calculated at 0.91 in the initial study. This tool was translated into Persian in a study conducted by Aliabadi (2013), and its validity and reliability have been confirmed ($\alpha=0.97$) (20).

The fathers were entered into the study sequentially from each group to prevent the transmission of information between the units of the Intervention and the Control groups. Study participants were included in eight groups of ten subjects, respectively. The first ten subjects were assigned to the Intervention group by coin flipping, and the other ten subjects were assigned to the Control group. None of the groups were studied in the same time interval to prevent the contamination of the information. This sequence continued until the end of the sampling, and the next group did not enter the study until the discharge of the newborn and the departure of the last father of the group. Based on the exclusion criteria, the new participant sample would have been replaced in case of a father sample withdrawal.

The research objectives were explained to fathers, and informed consent was obtained from them. Research instruments, including a demographic characteristic form, the Mother-to-Infant Bonding Scale, and parents' self-efficacy scale were completed at the baseline. In the Intervention groups, a developmental care program was performed. The intervention included four 90-minute sessions. During the first session, in the environment of the NICU, both parents were educated on the characteristics of the premature newborns and their needs, with particular attention paid to the father. Afterward, the father and researcher attended to the newborn's bedside and hugged and touched the newborn with the support of the researcher. At the second session, the developmental care philosophy

and how to care for the newborn were presented on a Marquette based on the principles of developmental care. The care training included Developmental Positioning, proper developmental handling, newborn feeding, skin-to-skin caring. After learning the above-mentioned tasks, the father performed them according to the newborn's needs (e.g., feeding, changing diapers, and skin-to-skin care). The father practiced the care of the newborn in the presence of the researcher during the third and fourth sessions. If needed, he answered the questions of the researcher. Fathers were asked to complete the two outcome measures 4 weeks after the intervention. If the newborn was discharged, the questionnaires were completed by phone call or at the time of follow-up referral. In the Control group, the questionnaire was filled out at the beginning of the study and 4 weeks later.

Data were analyzed in SPSS software (version 16) using Shapiro's test to examine self-efficacy and bonding scores, which confirmed the normal distribution of scores. Between-group differences in self-efficacy and bonding scores were tested before and after the intervention by independent t-test, paired t-test, and repeated measures ANOVA.

Results

It was revealed that there were no significant differences in terms of gestational age, paternal age, and hospitalization length in the two groups. The mean scores pregnancy age in the Control and Intervention groups were obtained at 32.37 ± 2.45 and 32.90 ± 2.66 weeks, respectively ($t=0.916$, $P=0.363$). The mean age scores of fathers were estimated at 34.10 ± 5.57 and 35.50 ± 6.81 years in the Control and Intervention groups, respectively ($t=-1.07$, $P=0.285$). The mean values of hospitalization length were calculated at 17.60 ± 87.70 and 18.90 ± 5.54 days in the Control and Intervention groups, respectively ($t=0.74$, $P=0.462$). In this study, most of the neonates were male in both groups, and the type of delivery was the cesarean section in most subjects. No significant differences were observed between the two groups in the type of feeding, paternal job, marital relationship, and economic status. The characteristics of the newborns and fathers are reported in Table 1 .

Table 1. Homogeneity of features related to the newborns and fathers between the two groups

Variables	Group		Chi-square test
	Control n (%)	Intervention n (%)	
Newborn's gender			
Female	13 (32.5%)	15 (37.5%)	P=0.639
Male	27 (67.5%)	25 (62.5%)	
Type of delivery			
Vaginal	6 (15%)	12(30%)	P=0.108
Cesarean section	34 (85%)	28 (70%)	
Type of feeding			
Breastfeeding	18 (45%)	13 (32.5%)	P=0.421
Infant formula	4 (10%)	7 (17.5%)	
Feeding based on order	18 (45%)	20 (50%)	
Paternal job			
Self-employed	30 (75%)	32 (80%)	P=0.820
Employed	7 (17.5%)	5 (12.5%)	
Unemployed	3 (7.5%)	3 (7.5%)	
Marital relationship			
Excellent	18 (45%)	27 (67.5%)	P=0.096
Good	21 (52.5%)	13 (32.5%)	
Relatively good	1 (2.5%)	0 (0.0%)	
Economic status			
Poor	8 (20%)	5 (12.5%)	P=0.660
Moderate	24 (60%)	26 (65%)	
Good	8 (20%)	9 (22.5%)	

Table 2. Comparison of the dimension scores of the bonding scale between the two groups before and after the intervention

Intervention	Statistical test	Control	Intervention	Statistical test
5.6±1.31	$t=1.33$ P=0.185 95% CI: -0.933 to 0.183	4.57±0.98	4.02±0.158	$t=3.49$ P<0.001 95% CI: -0.681 to 0.781
7.8±1.45	$t=0.136$ P=0.892 95% CI: 0.236 to 0.863	6.57±1.53	4.6±0.67	$t=7.45$ P<0.001 95% CI: 1.44 to 2.502

The mean values of the bonding score before the study in the Control and Intervention groups were obtained at 15.82±2.89 and 15.92±2.8, respectively ($t=0.15$, $df=78$, 95% confidence interval [CI]=-1.37 to 1.17, effect size=0.035, $P=0.876$). The mean values of the bonding score in the Control and intervention groups were calculated at 13.47±2.23 and 10.65±0.66 ($t=7.68$, $df=78$, 0.001, 95% CI=2.09 to 3.55, effect size=1.715) after 4 weeks. The mean bonding score reduced by 2.3±2.17 in the Control group ($t=6.82$, $df=39$, 95% CI=1.65 to 3.04, $P=0.001$) and 5.27±2.57 in the intervention group ($t=12.97$, $df=39$, $P<0.001$) ($f(1.78)=9.19$, 95% CI=4.45 to 6.09, $P=0.003$). There was a statistically significant correlation between the lack of affection and the anger-rejection sub-scales on the MIBS scale ($r=0.389$, $P<0.001$). Fathers showed higher scores in anger and rejection scores than in the lack of affection in both groups. In the Control group, the score of this dimension continued to be higher than the lack of affection after 4 weeks. However, in the intervention group, this dimension was significantly lower than that in the Control group. Furthermore, the score of lack of affection significantly decreased in the intervention group, indicating improved paternal-infant bonding regarding this dimension (Table 2).

The mean scores of the self-efficacy score in the Control and Intervention groups were calculated at 61.37±4.17 and 60.65±4.9 ($t=0.704$, $df=78$, 95% CI=-1.32 to 2.77, effect size=0.157, $P=0.483$), respectively. The mean values of self-efficacy score were obtained at 62.65±2.73 and 69.50±1.63 respectively in the Control and Intervention groups after the intervention ($t=13.61$, $df=78$, 95% CI=-7.85 to -5.84, $P<0.001$). The self-efficacy score increased in the Intervention group by 8.85±5.046 units ($t=11.09$, $df=39$, 95% CI=-10.46 to -7.23, $P<0.001$) and in the Control group by 1.27±3.31 units ($t=2.43$, $df=39$, 95% CI=-7.85 to -5.84, 95% CI=-2.33 to -0.21, $P=0.020$). The difference between the two groups was significant ($f(1.78)=21.88$, $P<0.001$). Self-efficacy increased in both groups in dimensions of the care process, the perception of behaviors and messages, and situational beliefs after 4 weeks. However, the level of self-efficacy decreased in the relaxation technique dimension in both groups; nevertheless, such a decrease was lower in the Intervention group than in the Control group. Furthermore, a significant difference was observed between the Control and Intervention groups in the care process before the intervention, indicating that the self-efficacy of fathers was greater in the Control group than in the Intervention group. The self-efficacy level in this dimension increased in both groups after 4 weeks; nonetheless, the Intervention group had a greater increase in self-efficacy score in this dimension, compared to the control group ($P<0.001$) (Table 3).

Table 3. Comparison of the dimension scores of the PMP-SE between the two groups before and after the intervention

Dimensions of the PMP-SE	Mean±SD before intervention		Statistical test	Mean±SD after intervention		Statistical test
	Control	Intervention		Control	Intervention	
Caretaking procedures	12.92±1.59	11.10±2.37	$t=4.04$ P=0.001* 95% CI: 0.92 to 2.72	13.95±2.12	15.20±0.96	F(1, 77)=13.69, P=0.001**

Table 3. Continued

Evoking behavior	21.95±3.30	19.77±2.72	$t=3.21$ P=0.002* 95% CI: 0.82 to 3.52	21.67±1.62	23.10±1.05	F (1, 77)=31.83, P=0.001**
Reading behavior or signaling	24.50±2.80	23.27±3.11	$t=1.85$ P=0.068* 95% CI: -0.09 to 2.54	24.90±3.31	27.15±1.02	F (1, 77)=19.81, P=0.001**
Situational beliefs	10.00±1.28	10.25±1.35	$t=-0.84$ P=0.399* 95% CI: -0.83 to -0.33	10.70±1.18	11.85±0.48	F (1, 77)=33.79, P=0.001**

*independent t-test

**ANOVA

Discussion

The current study aimed to investigate the impact of paternal involvement with preterm newborn care on father-infant bonding and father's self-efficacy based on the developmental care principles. The results of this study showed that bonding increased in both the Control and Intervention groups 4 weeks after the birth. However, the increase was significantly higher in the Intervention group than in the Control group. In addition, self-efficacy scores significantly increased in both groups after 4 weeks, indicating an improvement in self-efficacy. The fathers in the Intervention group significantly showed a greater increase in bonding and self-efficacy scores than fathers in the control group.

According to Iranian religious and traditional look at the presence of men in the unit, the long-term presence of fathers is not easily welcomed. Some nurses and mothers believe that fathers' presence prevents mothers from providing skin-to-skin care and breastfeeding. Therefore, thoughtful attention should be paid to integrating fathers into neonatal care (26).

The mother-to-infant bond has two dimensions of lack of affection and anger-rejection. The anger-rejection had a higher score than lack of affection, showing that fathers had more difficulties in this dimension. In the Control group, the scores in this dimension were still higher than the lack of affection after 4 weeks. Nevertheless, in the Intervention group, the scores of this dimension decreased significantly, compared to the Control group. Moreover, the score of lack of affection significantly decreased in the Intervention group, indicating the improvement of the paternal-infant bonding in this dimension.

This study was one of the few that examined the effect of developmental care on paternal-infant bonding. Several studies have been done on maternal-infant bonding. In a study performed in Japan on maternal-premature-newborn bonding, a high score of lack of affection was associated with decreased interest in the care of the newborn, and there was a negative feeling toward the newborn in the dimension of anger-rejection. However, there was a moderate correlation between the two dimensions of lack of affection and anger-rejection, showing that positive affections towards the newborn were not against anger-rejection. It means that parents can love their newborns with a sense of anger-rejection and cannot have a lack of affection (25).

In a study conducted in Portugal (2007), the researchers used the same scale for both parents. For this purpose, they used the 'New Mother-to-Infant Bonding Scal' in order to study mother-to-infant and father-to-infant initial emotional involvement and differences between mothers. According to their results, maternal and paternal emotional involvement toward the newborn tended to be similar and no significant differences were found between them either for most items or for the positive and negative subscales (16). In another study conducted in Portugal, the contribution of fathers to cutting the umbilical cord improved the process of bonding between father and newborn (27). In our study, there was a strong relationship between the two dimensions of lack of affection and anger-rejection. Fathers in both groups had higher scores in the dimension of anger-rejection. Because of these correlations, a change in one factor can alter the other one. Consequently, it is important to consider the father-newborn relationship at the earliest opportunity. The discrepancy between the results of our study and those of the

study performed in Japan can be attributed to the cultural difference between Iran and Japan. The self-efficacy of the fathers in the present study was significantly higher in the Intervention group than in the Control group. The findings of a study conducted by Pennell showed that targeted interventions that improved parents' self-efficacy could reduce the mental impacts of parental perceptions of their competency (1). Targeted interventions included the involvement of parents, especially fathers. The fathers' involvement in the care of newborns creates a sense of competence and self-efficacy in the father. The increase in the self-efficacy of the father is directly related to effective communication with the newborn.

A study in Iran examined the effect of virtual space-based educational support on the satisfaction and self-efficacy of mothers of newborns admitted to NICU and showed a significant increase in the level of self-efficacy in the Intervention group (28). The care process dimension of the PMP-SE questionnaire was not significantly different before and after the intervention. Nonetheless, the dimensions of relaxation technique, the perception of behavior and messages, and situational beliefs in PMP-SE increased significantly. However, although in the present study the self-efficacy score in the dimensions of the care process, the perception of the behaviors and messages, and situational beliefs increased in both groups, it reduced in the dimension of the relaxation technique. This decrease was lower in the Intervention group than in the Control group indicating the effect of the intervention. The care program proposed by Melnyk et al. (2006) aimed at reducing the hospitalization length of premature newborns. In their study, educational content was provided for parents in the form of audiotapes and workbooks. This training program reduced parental depression and tension and improved their beliefs. Nonetheless, there was no significant difference in the interaction between the parent and newborn (29). In our study, with the direct involvement of the father in the care and the presence of a researcher at the bedside, fathers could interact with the newborn with a sense of tranquillity. A greater amount of this interaction will lead to greater self-confidence, a father-newborn relationship, and eventually, paternal self-efficacy.

Kadivar et al. (2012) used a care program called 'Hug Your Baby' in the care of preterm newborns. The training program was presented in the form of an educational film on the 4th or 5th day of admission. The questionnaires were completed both before the film presentation and 1-2 days before discharge. The results showed that the knowledge of fathers about neonatal behavior increased, and contrary to the results of the training program suggested by Melnyk, such an increase in knowledge promoted paternal sense and parenting tasks (13). Finally, the results of a study conducted on family-centered interventions to increase the parental-newborn relationship in the NICU indicated that the level of knowledge, dependence, and interactions in the Intervention group was higher than those in the Control group (30).

The main limitation of the present study was related to using the semi-experimental method. There were no other options than using a semi-experimental method to eliminate the possibility of data contamination. Another limitation was employing the PMP-SE tool for fathers since, at the time of performing the study, there was no other tool available to measure fathers' self-efficacy.

Implications for Practice

Paternal involvement in the care of premature newborns has many positive effects on neonatal developmental outcomes; as a result, paternal involvement in care in the NICU is necessary. The results of the current study showed that creating an emotional bond between the father and the newborn was possible, and the father's greater involvement in the care of the newborn led to their higher self-efficacy and the potential for the improved outcomes of these vulnerable neonates.

Ethical considerations

This study was approved by the Ethics Committee of the Tehran University of Medical Sciences (IR.TUMS.FNM.REC.1396.2241). The study also was registered in the Iranian Registry of Clinical Trials (IRCT20171010036690N1). All participants signed the informed consent and were informed about the possibility of study withdrawal at any research stage and the confidentiality of the information.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

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