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# The effect of instructing mothers in attachment behaviors on short-term health outcomes of premature infants in NICU

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**Abstract:**

**BACKGROUND:** The birth of a pre-mature infant and subsequent hospitalization and separation from the family can impair maternal and neonatal attachment and quality of maternal care. This study aimed to assess the effect of instructing mothers in attachment behaviors on short-term health outcomes of pre-mature infants admitted to neonatal intensive care units (NICUs).

**MATERIAL AND METHODS:** In this quasi experimental study, 80 mothers of pre-mature infants who were admitted to NICUs at two referral health centers in northern Iran were studied in two groups in 2018. Attachment behaviors were taught to mothers in the test group during four consecutive sessions. Mother–infant attachment behaviors were evaluated at both the beginning and the end of this study using a checklist derived from Avant’s Maternal Attachment Assessment Strategy. Moreover, infants’ short-term health consequences were investigated in two groups. SPSS 18 statistical software was used for data analysis.

**RESULTS:** On average, it took respectively  $34.90 \pm 12/65$  and  $31/15 \pm 14/35$  days for the infants in the control and the intervention group to reach full oral feeding and  $38/5 (38/4–42/11)$  and  $37 (31/85–42/14)$  days to gain the minimum weight required for discharge. Moreover, the mean length of stay for the infants in the control and the intervention group was  $41/80 \pm 13/86$  and  $39/02 \pm 16/01$  days, respectively ( $P > 0/05$ ).

**CONCLUSION:** Instructing mothers in attachment behaviors clinically improved short-term health-related outcomes. Hence, this intervention is recommended to be incorporated in the care program for mothers with pre-mature infants.

**Keywords:**

Behaviors, education, health care, infant, mother–child relations, mothers, outcome assessment, pre-mature

## Introduction

Every year, 14.8 million babies are born pre-term.<sup>[1]</sup> Hospitalization of a pre-mature infant is inevitable in the majority of the cases,<sup>[2]</sup> and the early life experiences in the neonatal intensive care unit (NICU) often involve separation from the mother.<sup>[3]</sup> Under such circumstances, the most important attachment factor, that is, physical contact

with the infant, is limited and the attachment process becomes impaired.<sup>[4]</sup> Attachment is a mutual mother–infant bonding formed during pregnancy which is promoted after birth through visual, olfactory, and skin contact between the mother and infant.<sup>[5]</sup> In pre-mature birth, the mother–infant connection is suddenly disrupted and mothers are not prepared enough for the birth of their babies.<sup>[6]</sup> In this

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situation, activities such as making eye contact, speaking, and responding to the needs of the infant, which increase mother–infant attachment, seem essential.<sup>[7]</sup> Accordingly, Forcada-Guex *et al.*<sup>[8]</sup> declared that these mothers do not sensitively respond to their babies' behavioral symptoms. They even postpone visiting or having physical contact with the infant because they are afraid that they might lose it while they still have its image in their mind. Mothers' inappropriate reactions disrupt mother–infant bonding and put them at serious risks including the infant's poor relationship with parents, slow weight gain, prolonged hospitalization, increased hospital infections, and increased medical costs.<sup>[6]</sup> Thus, enhancing the formation of mother–infant attachment improves the mother's capability in caring for the baby. It is because under these circumstances, the mother recognizes her baby's needs and responds properly<sup>[9,10]</sup> in a way that the mother's timely interaction with her infant can help regulate physiological responses such as heart rate, respiratory rate, temperature, and addressing nutritional needs and subsequently lead to speech, motor, and social development.<sup>[11]</sup> In fact, an infant, regardless of its pre-maturity, always seeks contact and interaction with its mother.<sup>[12]</sup> As a result, mothers should be instructed about how to communicate with and provide care for the infants.<sup>[13]</sup> Toosi *et al.*<sup>[14]</sup> have found out that instruction in attachment behavior has a positive impact on maternal–infant attachment. In a meta-analysis on 21 studies conducted by Mosayebi and Sepehrian, it has been reported that psychological interventions and training can enhance mother–infant attachment to a greater extent than what caring strategies can do.<sup>[15]</sup> Various studies have revealed that maternal massage and Kangaroo care increase the attachment between the mother and infant.<sup>[16]</sup> Heo and Oh have declared that parental involvement in infant care can promote mother–infant attachment.<sup>[17]</sup> Review of the literature indicates that most studies focus on the caring aspect of the attachment behaviors rather than their emotional aspect (looking, caressing, smiling, etc.). In this regard, the study of Borim Nejad *et al.* (2011)<sup>[18]</sup> showed that separation from the infant is one of the most stressful factors experienced in mothers that deprive mothers of the chance to initiate an attachment process. Based on their research findings, it is suggested that after birth, parents of pre-mature infants, especially mothers, should be provided with the necessary early preparations to face the infant in the intensive care unit and to establish proper communication with the infant by caring and looking.

The key components of early intervention programs include determination of the direct effects of components on parents and their pre-term infants categorized by the review of Benzies *et al.* (2013).<sup>[19]</sup> All interventions used some form of parenting education and should consider including psycho-social support for mothers.

If the intervention involves mothers, outcomes for both mothers and pre-term infants should be measured to better understand the mechanisms for change.

Adeli and Aradmehr (2018) performed the study for the early skintoskin maternal–neonate contact during the first hour following birth, which prepares both the mother and baby to establish a twoway, interactive pattern of interaction and compare abdominal and kangaroo skin contact on maternal attachment behaviors. Kangaroo skin contact has an effect, similar to the abdominal skin contact, on the maternal attachment behaviors and has a positive effect on proximityseeking behaviors and some components of emotional behaviors compared to abdominal skin contact.<sup>[20]</sup>

Meijssen *et al.* (2011)<sup>[13]</sup> found that 30% of the mothers had non-balanced attachment representations. Therefore, early support for mothers of very pre-term born infants to develop a healthy mother–infant relationship is recommended, especially for mothers who report negative first experiences.

Considering the above and the high pre-mature birth rate in Iran (varies from 5.4% to 19.85% in different cities)<sup>[21]</sup> and the importance of formation of attachment during the early post-partum years and thereafter as well as its role throughout life, the present study aimed to investigate the impact of instructing mothers in attachment behavior on short-term health outcomes of pre-mature infants.

## Material and Methods

### Study design and setting

This interventional (quasi-experimental) study was conducted in two level III NICUs of two referral centers (Ayatollah Rouhani and Imam Ali hospitals) from August 2018 to May 2019 in northern Iran.

### Study participants and sampling

After obtaining mothers' consent to participate in the study and abiding to all ethical considerations including confidentiality of information, obtaining written consent from mothers, and voluntary agreement to participate in the study, the mother–infant demographic questionnaire, a checklist derived from Avant's Maternal Attachment Assessment Strategy, and the infants' files were used as sources of data. A total of 80 mothers who had a pre-mature infant born at less than 34 weeks, weighed 1500 gram or less, had an Apgar score above 7, and had no congenital anomalies were divided into two groups of 40. The inclusion criteria for mothers included their willingness to participate, having the ability to read and write, having no chronic physical or mental illness, and no opioid or alcohol addiction, and the exclusion

criteria were the mother's withdrawal from participation and disruption of the infant's general stability. Control samples were collected prior to test samples in order to prevent information exchange between the two groups in both study environments. (During the study period, the mothers of the two groups had no contact at all because the infants in the control group were discharged).

### Data collection and measurements

To check the face and content validity of the mother–infant attachment checklist, which was derived from Avant's Maternal Attachment Assessment Strategy, it was given to some faculty members and experts to receive their feedback. Then, some behaviors related to the mother and infant's conditions were selected to be used as indicators of mother–infant attachment. The content validity index of each item was calculated, and then the average content validity index of all items was obtained. Total validity was confirmed with a validity index of 0.9. This checklist is a tool that has repeatedly been utilized in national research.<sup>[22,23]</sup> The reliability of the checklist was assessed using the reliability evaluation strategy; in other words, two observers simultaneously documented mothers' behaviors (ten eligible mothers) in the checklist, and then their agreement coefficient (Kappa) was calculated, which showed 78% agreement.

The checklist comprised behaviors such as looking at, cuddling, talking, smiling, touching, and hugging the baby, which were observed and documented by two research assistants at the beginning and the end of the study in both groups. The trained research assistants, who were unaware of the purpose and methodology of the study, were positioned at a certain distance so that they would not interfere with the mother–infant interaction throughout the assessment process. The occurrence or non-occurrence of attachment behaviors was then documented every 15 minutes in a way that the first 30 seconds of each minute was dedicated to observation of behaviors and the remaining 30 seconds to documentation of them. Each behavior was recorded only once in each minute. Hence, the maximum number of times that a particular behavior was observed during 15 minutes was 15.

### Intervention

Mothers in the intervention group were instructed theoretically and practically based on their capacity (mental and physical status) within four sessions of half an hour individually and face to face in the feeding room of the NICU beside their babies' beds. The intervention was designed to begin its first session at mothers' first meeting with their infants and the rest at intervals of 2 to 3 days. For more emphasis, the mothers were provided with some of the essential materials, which were prepared as educational pamphlets.

Moreover, a question and answer session was held at the end of each session to facilitate comprehension of the materials. Throughout the study, the researcher was available to test samples so that the mothers could receive counseling through the telephone or in person if needed.

The educational contents of attachment behaviors, which have been prepared according to authentic books and articles,<sup>[5,23-25]</sup> were approved by nursing faculties, nursing professors, and pediatricians. The content of the sessions was as follows: First session: familiarizing the mother with the environment of the NICU and ward equipment, the appearance and behavioral characteristics of the pre-mature infant, and the nature and importance of attachment behaviors. Second session: the interaction of the mother with the infant, such as looking, cuddling, talking, smiling, calling the infant by its name, and the impact of these behaviors on the health of the mother and the infant. Third session: touching and massaging the hospitalized infant regardless of attached equipment. Fourth session: infant hugging, skin and health care, and diaper change. On the other hand, the control group received routine care.

The short-term health outcomes assessed in the present study included the time it took for the infants to reach full oral feeding and gain the minimum weight required for discharge as well as the length of stay. To track and calculate the length of time it took to gain enough weight for discharge, the infants in both groups were weighed on a daily basis from their birth to the time they reached 1500 grams under the same conditions (without clothes and diaper) using a scale (Seca, made in Germany) with an accuracy of  $\pm 10$  grams. Moreover, regarding the length of hospitalization and the length of time required for the infants to reach full oral feeding (in days), the pertinent data were extracted from the infants' files [Figure 1].

### Ethical considerations

Ethical permission was obtained from the Ethics Committee of MUBABOL.HRI.REC.1397.113 University of Medical Sciences under the code 970567 and Trial registration: IRCT20180718040513N1. Also, informed written consent was obtained from the participants before initiating the data collection process. Anonymity and confidentiality of information were maintained and informed about their freedom of choice.

### Statistical analysis

After collecting the final data, they were analyzed using SPSS 18 and statistical tests including Chi-square, independent t-test, analysis of variance, survival analysis, and log rank. A *P* value of less than 0.05 was considered statistically significant.

## Results

A number of 80 mothers aged 19–40 participated in this study. Most of these mothers were housewives, had intended pregnancy, underwent a cesarean section, and had not experienced pre-mature birth before. The majority of the infants were girls, firstborns, and firstborn twins. They were 26–34 weeks old and weighed 745–1450 grams at the time of hospitalization. Moreover, the two groups were identical in terms of demographic characteristics ( $P > 0/05$ ) [Table 1].

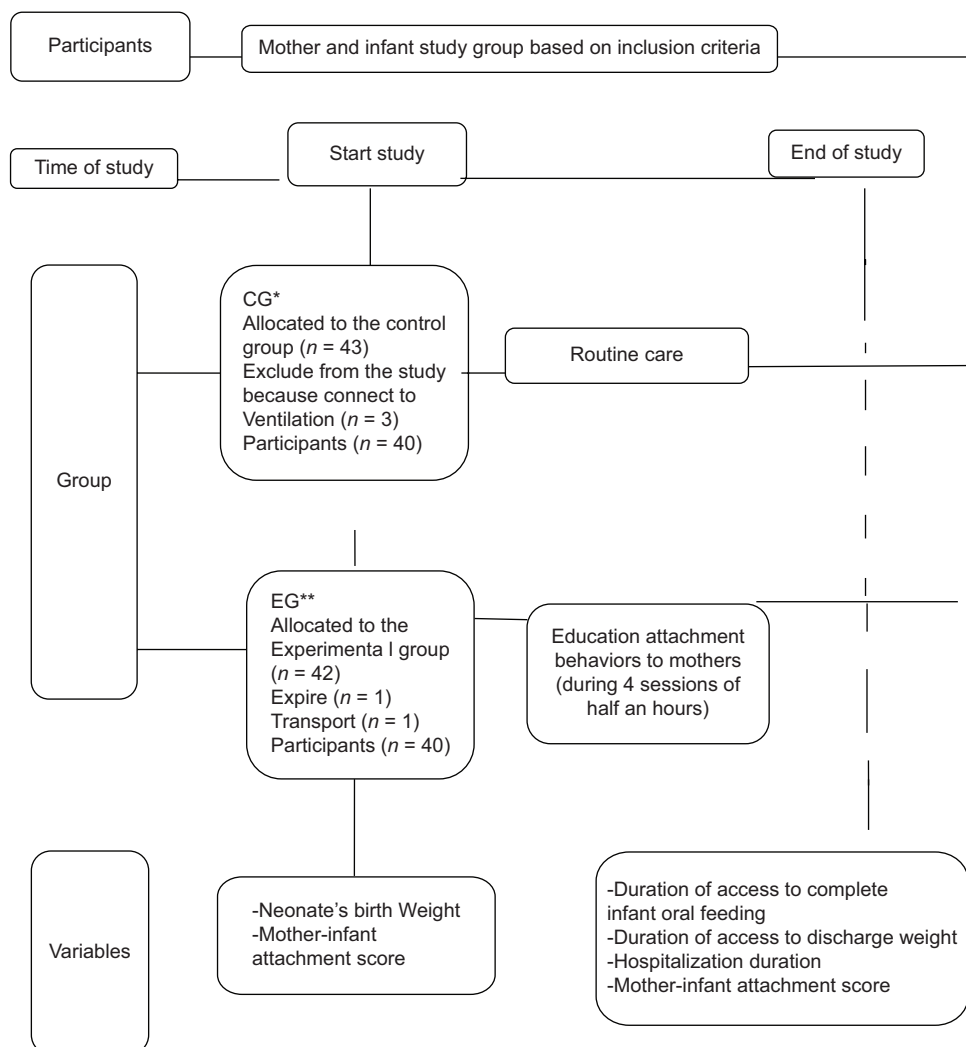
The results of the short-term health outcomes revealed that the length of time required for the infants in the intervention group to reach full oral feeding was  $34/90 \pm 12/56$  days, whereas in the control group, it was  $31/15 \pm 14/35$  days ( $P = 0/13$ ). Therefore, infants in the intervention group reached full oral feeding 3 days sooner than infants in the control group, which does not show any statistically significant difference [Table 2].

Regarding the length of stay, the results indicated that on average, infants in the intervention group were hospitalized for  $41/80 \pm 13/86$  days, whereas the length of stay for infants in the control group was  $39/02 \pm 16/01$  days ( $P = 0/13$ ). Therefore, infants in the intervention group were discharged from the hospital 2 days sooner than infants in the control group, which is not a statistically significant difference.

**Table 1: Comparison of means and standard deviations of quantitative variables in the two groups**

Group/Variables	Control Mean (SD)	Intervention Mean (SD)	P*
Mother's age (year)	29/17±5/99	30/45±5/99	0/07
Neonate's intra-uterine age (week)	29/37±1/90	29/57±2/22	0/12
Neonate's birth weight (gram)	1203/87±188/21	1186/12±225/66	0/12
Five-minute Apgar score	8/85±0/69	8/92±0/69	0/63

\*t-test



**Figure 1:** Flow chart of work. \*CG: Control group. \*\*EG: Experimental group



The results of survival and log rank test [Table 3] demonstrated that the mean length of time required for the infants to reach the discharge weight (1500 g) was 38/15 (43/18–42/11) days in the control group and 37/00 (31/85–42/14) days in the intervention group. Therefore, on average, infants in the intervention group reached the discharge weight 1 day sooner than infants in the control group, which is not considered a statistically significant difference ( $P = 0/96$ ).

Another finding of this study was related to the evaluation of mother–infant attachment behaviors. The results in Table 4 illustrate that the overall mother–infant attachment as well as its sub-elements were stronger and higher in the intervention group than in the control group ( $P < 0/001$ ).

### Discussion

The results of our study revealed that instructing mothers in attachment behaviors improves short-term health outcomes in pre-mature infants, including the length of time required for reaching full oral feeding and the discharge weight as well as the length of hospitalization. Although no statistically significant difference was observed between the two groups, the results are greatly important in terms of clinical application. That is to say, reaching effective oral feeding in pre-mature infants enhances the weight gain and reduces the length of

hospitalization,<sup>[26]</sup> which subsequently reduces the heavy financial burden imposed on families and health care systems. This also provides an opportunity for parents to build stronger emotional bonding with their children when providing care for them.<sup>[27]</sup>

Quite similar to the present study, a study by Amini (2014) revealed that on average, infants in the massage group reached oral feeding sooner than the ones in the control group; however, this difference was not statistically significant.<sup>[28]</sup> Moreover, the findings of the study by Chorna *et al.* (2014)<sup>[29]</sup> showed that playing mothers' recorded sound during non-nutritive feeding (pacifier) had an effect on infants' oral feeding in a way that infants in the intervention group reached full oral feeding in a relatively shorter time, which is completely consistent with the findings of the present study. However, there was a slight difference between the two studies. Although in the present study infants only received a voice stimulus (their mothers' voices), which was a part of attachment behaviors, in the study of Chorna *et al.*,<sup>[29]</sup> they received an oral stimulus (pacifier) in addition to their mothers' voice. Because non-nutritive feeding (pacifier) may improve sucking and accelerate infants' oral feeding,<sup>[30]</sup> it is assumed that the improved results in the study of Chorna *et al.*<sup>[29]</sup> might result from the simultaneous employment of the mother's voice and pacifier during feeding.

**Table 2: Short-term health outcomes of pre-mature infants in research units for each group**

Group/Variables	Control Mean (SD)	Intervention Mean (SD)	P*	Effect size
Time to start feeding**	2/45±0/59	2/42±0/59	0/85	0/05
Time to start oral feeding**	24/77±11/00	22/25±13/76	0/36	0/20
Duration of access to complete oral feeding**	34/90±12/65	31/15±14/35	0/21	0/27
Hospitalization duration**	41/80±13/86	39/02±16/01	0/41	0/18

\*t-test \*\*, Day

**Table 3: Comparison of mean duration of reaching the discharge weight (1500 g) for pre-mature infants by day for each group**

Group	Mean	Standard error	Confidence interval 95%		Analysis log rank		
			Lower line	Upper line	Test statistics	df	P*
Control	38/15	2/02	34/18	42/11	0/002	1	0/96
Intervention	37/00	2/62	31/85	42/14			

\*Log rank test

**Table 4: Comparison of mother-infant attachment in each group pre- and post-intervention**

Group/Variables	Control Mean (SD)		Intervention Mean (SD)		P
	Before	After	Before	After	
Look at the baby's face	7/55±0/87	8/17±1/39	7/90±1/15	10/17±1/17	<0/001*
Cuddling	2/95±1/15	7/15±1/35	2/72±1/03	8±1/33	0/001
Talking	2/70±1/18	5/45±1/01	2/60±1/46	6/75±1/12	<0/001*
Smiling	0/52±0/71	5/52±0/78	0/70±0/99	7/10±1/35	<0/001*
Touching	0/55±0/90	6/30±1/15	0/52±0/75	7/60±1/39	<0/001*
Hugging	-	4/87±0/75	-	5/85±1/44	<0/001**
Mother-infant attachment (total)	14/27±3/14	37/47±1/76	14/45±3/14	45/47±4/0	<0/001*

\*ANCOVA, \*\*t-test

Regarding the length of time required for weight gain, it was observed that infants in the intervention group reached the discharge weight 1 day sooner than the infants in the control group, which is not a statistically significant difference. Contrary to the results of the present study, Heo and Oh (2019)<sup>[17]</sup> reported that parents' participation in caring for pre-mature infants had no impact on infants' weight gaining. In their study, parents participated in care activities such as changing diapers, kangaroo care, singing lullaby, and talking to the infant, which comprise various aspects of mother-infant attachment behaviors including caring, closeness, and emotion. The only difference between Heo and Oh's<sup>[17]</sup> study and the present study was that in their study, both parents participated in caring for the baby, whereas in the present study, only the mothers performed this task.

The study conducted by Kafaei Atrian *et al.*<sup>[31]</sup> showed that there was no meaningful correlation between the infants getting hugged by their mother or their acquaintances and infant growth indices at 2, 4, and 6 months, which is in full conformity with the results of the present study. The only difference was that the infants in their study were healthier than the ones in the present study, who were pre-mature. The results of studies by Evereklian and Posmontier (2017)<sup>[32]</sup> and Kalhor *et al.* (2016)<sup>[33]</sup> demonstrated that the kangaroo care positively affected the weight gain in infants and reduced their length of stay, whereas in the present study, the difference between the two study groups in this regard was not statistically significant, which can be associated with the difference in mean gestational ages and mean birth weights because the gestational age and subsequently the birth weight can affect infants' further weight gain and prolong its process. Moreover, in the study by Kalhor *et al.*,<sup>[33]</sup> infants were fed only by breast milk, whereas in the present study, infants in both study groups were fed by both breast milk and formulated milk, which might have affected the results of the present study. However, breast milk is an important factor in pre-mature infants' health and is more effective on infants' weight gain compared to formulated milk.<sup>[34]</sup> The difference between the results of the present study and other studies might be because of the difference in weighing intervals. It seems that a longer time period should be dedicated to observing the weight index and controlling its alterations because as discussed earlier, the results of the present study showed that infants in the intervention group reached the discharge weight 1 day sooner than infants in the control group.

The results of instructing mothers in attachment behaviors demonstrated that on average, the infants in the intervention group were discharged from the hospital 2 days sooner than infants in the control group, which was not statistically significant. This is consistent with

the results of the study by Welch *et al.* (2013),<sup>[35]</sup> where parents' interaction with pre-mature infants and the family's empowerment program<sup>[36]</sup> reduce pre-mature infants' length of stay in the NICU. The results of the present study are different in this regard, which can be because of the fact that only mothers were involved in caring for and interacting with infants. It seems that the presence and cooperation of both parents in NICU can accelerate the treatment process and as a result decrease the length of stay.

Considering the results of the aforementioned studies, parents' presence can be further debated and more attention should be paid to it in policy making.

Moreover, the results of the present study revealed that instructing mothers in attachment behaviors increased mother-infant attachment. Mosayebi and Sepehrian (2018) claimed in their study that psychological intervention and training can increase mother-infant attachment to a greater extent than caring practices.<sup>[15]</sup> While emphasizing on psychological intervention and training, Shariati<sup>[37]</sup> and Toosi *et al.*<sup>[14]</sup> demonstrated that attachment behavior training elevates mother-infant attachment, which is in full conformity with the results of the present study. The only difference is that in their study, they instructed pregnant women, whereas in the present study, attachment behaviors were taught to mothers with pre-mature infants. Additionally, studies conducted at an international level such as Ahn *et al.*<sup>[38]</sup> and Cho E-S *et al.*<sup>[39]</sup> as well as some studies in Iran including the studies of Karimi *et al.*<sup>[40]</sup> have reported positive impacts of care interventions such as massage and kangaroo care on promotion of mother-pre-mature infant attachment, which is totally consistent with the results of the present study. Furthermore, Hasanzadeh *et al.* (2020)<sup>[41]</sup> studied the impact of education on attachment skills in the promotion of happiness among women with unplanned pregnancy. The mean score of happiness increased after the training, being significantly different from that in the control group. Therefore, happiness is a changeable feature that can be promoted among pregnant women via interventional methods.

### Limitations and recommendation

One of the limitations of this study is the lack of cooperation of mothers at designated hours, despite previous coordination with them and the mother's mental state and the presence of noise and traffic in the ward during the assessing of attachment behaviors that can affect the research results. Therefore, it is suggested that future studies be conducted on the effect of teaching attachment behaviors to mothers with pre-mature infants on the long-term health outcomes of infants. In this case, with the increase of the infant's age, study can

be performed in a calmer environment and outside the NICU with a more stable mental state of the mothers.

## Conclusion

Based on the findings of this study, it can be concluded that teaching attachment behaviors to mothers with pre-mature infants can lead to a better and more effective connection with and interaction between mothers and infants, and hospitalized pre-mature infants can benefit from connection with their mothers. Hence, employing this caring strategy is recommended to increase infant-mother attachment and improve infants' health outcomes.

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## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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