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Original article

Family environment, parental stressors, and post-traumatic stress disorder in the parents of premature infants in the Neonatal Intensive Care Unit

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Abstract

Background: The birth of premature infants and their admission to the Neonatal Intensive Care Unit (NICU) causes emotional stress in parents and in the whole family. This event can affect the interaction between family members and disrupt the family's environment. Therefore, the aim of the present study was to estimate the family environment, the parental stressors and the level of post-traumatic stress disorder (PTSD) in the parents of premature infants admitted to NICU.

Methods: This descriptive-analytic study was conducted in the two NICUs of a Specialized and Educational Hospital in South-East of Iran. A total of 140 parents (70 mothers and 70 fathers) were enrolled in the study using convenience sampling method. The data collection tool included a demographic questionnaire of parents and neonates, a Family Environment Scale (FES), a Parental Stressor Scale (PSS), and the Impact of Event Scale – Revised (IES-R). Data analysis was carried out using descriptive and inferential statistics, including independent t-test, one-way ANOVA, and Pearson correlation co-efficient in SPSS® ver. 18.

Results: The family environment was evaluated at the moderate level by mothers and fathers in the FES, with mean scores of 97.48 ± 11.46 and

98.70 ± 10.50, respectively. The mean score of parental stressors in the PSS was moderate in mothers (2.90 ± 0.86) and low in fathers (2.55 ± 0.90). Also, the mean PTSD score in the IES-R was moderate in fathers (35.10 ± 18.79) and in mothers (43.01 ± 17.14). The results showed no significant relationship between family environment and PTSD in mothers (r = 0.11, p = 0.36) and fathers (r = 0.04, p = 0.75), but a significant relationship was found for both parents in terms of parental stressors and PTSD (mothers: r = 0.48, p = 0.0001; fathers: r = 0.59, p = 0.0001).

Conclusion: The results revealed that family environment scores and PTSD scores in parents of premature infants were at the moderate level. The parents who experienced stressors without adequate support were at risk for PTSD. In this regard, parents should be considered as patients by the healthcare team who, recognizing signs of parental stress early, could play an important role in preventing adverse effects of stress on parents themselves and on the infants. Educational and counseling interventions by NICU nurses can help parents to adapt to NICU environment and to use coping strategies to manage stress, promote family cohesion, and reduce the risk of PTSD.

Keywords

Family environment, parental stressors, post-traumatic stress disorder (PTSD), premature infants, NICU, parents.

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Introduction

One of the most important health indicators of each society is the birth rate of premature infants [1]. Global statistics show that premature infants account for 5-15% of births [2]. Despite the significant advancement made in identifying the causes of prematurity, the birth rate of these neonates is increasing [3]. Premature infants are very vulnerable as a result of their own life-threatening pathological events [4].

The birth of a premature infant is an unexpected event for parents who are physically, mentally, and emotionally unprepared for dealing with its implication [5]. This experience involves varying degrees of stress depending on the diagnosis, the severity of the infant's conditions, the length of hospitalization, and the family relationships prior to birth [6]. Although scientific and technological advances have not only increased the survival of premature infants, but also reduced their clinical complications [5], their admission to the Neonatal Intensive Care Unit (NICU) often leads to depression and anxiety disorders, and to an impaired parental role [7]. Most parents are confused by the environment and technology of the NICU, and feel helpless, guilty, frightened, worried about the survival or the consequences of the disease, faced with many challenges which can also affect their parental roles [8], impairing the attachment to the infant at the time of discharge, and, in turn, the child and family stability [9]. It is important to investigate the parental stress because parents are the most important supporters of the infants, so they can receive stress and anxiety from their parents. Therefore, parental mood and emotion disorders can negatively affect the infant's emotional development [10]. Finally, the birth of a premature infant can affect the family environment as a stressor so much that it causes post-traumatic stress disorder (PTSD) in one or more family members during the hospitalization and even after the discharge [11]. PTSD is a severe disorder characterized by symptoms such as severe fear, disability, numbness, indifference, irritability, sleep and concentration disorders, avoiding remembering the stressful event [12]. Individuals with PTSD experience symptoms such as re-experience, psychological trauma, negligence of responses, and increased persistent hyperarousal [11].

In a study, mothers of preterm infants reported that one of the stressors in the transition to motherhood was the paternal role alteration and the absence of mothers next to them due to their participation in the care of the premature infant [13]. Carter et al. reported that parents with premature infants experience more stress than those with term ones, and mothers experience more stress and anxiety than fathers [14]. Shaw et al. reported that

one of the stressors in the transition to fatherhood is the role alteration of fathers also because of the frequent absence of mothers engaged in the care of the infant. They also showed that 33% of fathers and 9% of mothers of premature infants admitted to NICU had PTSD according to diagnostic criteria [15]. In a study on PTSD in parents of premature infants, Gangi et al. concluded that factors such as the level of emotional relationship between parents are effective in controlling and reducing PTSD and anxiety in parents [16].

For what has been stated above and taking into account the resources of the NICU, a careful closeness to the parents by the health staff would allow to have an insight of the family environment, to identify parents' stressors and the first symptoms of PTSD. Healthcare team could therefore help to a better provision of infant care after discharge and to an improved family quality of life. Considering the lack of relevant studies on PTSD in parents of infants admitted to the NICUs in Iran, the aim of the present study is investigating the family environment, the presence of parental stressors, and the incidence of PTSD in the parents of premature infants in our NICUs.

Method

Study design and setting

This descriptive-analytic study was conducted in two NICUs of Afzalipour Educational and Specialized Hospital affiliated to Kerman University of Medical Sciences. This hospital admits premature infants from South-Eastern Iran.

Participants and sampling

The research population included all parents of premature infants, but not all who had been admitted to the NICUs of the hospital met the inclusion criteria.

The sample size was calculated based on the results of a pilot study where the minimum correlation coefficient between the main variables was estimated to be 0.34. Considering $\alpha = 0.05$ and $\beta = 0.2$, the calculated sample size was 128 parents (64 fathers and 64 mothers), which increased to 140 parents to enhance the reliability of results. A total of 140 parents (70 fathers and 70 mothers) were therefore enrolled in the study.

Iranian parents of infants whose gestational age was less than 37 weeks and who had been admitted to the NICUs for at least 3 days were included. Parents had to have reading and writing literacy. Parents who were hospitalized in another ward and parents whose neonates suffered from congenital abnormalities were excluded.

Instruments

In this research, data was collected using a demographic information questionnaire, a Family Environment Scale (FES), a Parental Stressor Scale (PSS) (Parental Stressor Scale: Neonatal Intensive Care Unit [PSS:NICU]), and the Impact of Event Scale – Revised (IES-R).

Demographic information questionnaire

The demographic information questionnaire consists of 13 items, including type of delivery, infant's gender, father's age, mother's age, father's job, mother's job, infant birth weight, length of stay in the NICU, multiple pregnancy, unwanted pregnancy, gestational age, other children previously admitted to a NICU, parity.

Family Environment Scale (FES) short version

In this study, 27-item FES short version, developed and validated by Earls et al., was used. This instrument includes 27 items that assess the environmental and social characteristics of families, especially family performance aspects such as individual growth, communication, and family structure. This questionnaire helps to evaluate the whole family's environment and its influence on mental stability of family members. Each item is assigned scores ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). The total score of FES is obtained summing up 27 items and ranges from 27 to 135. A higher score indicates a greater coherence in the family environment. Scores 27-63, 64-99, and 100-135 were considered as low, moderate, and high levels, respectively. The reliability of FES has been reported by calculating the Cronbach's alpha coefficient (0.82) [17].

To carry out cultural adaptation on the Persian version of this questionnaire in the present study, forward-backward method was used; to this end, the FES was translated into Persian and then translated back to English by two English language experts. Then the adaptation rate was checked and the Persian version of the scale was prepared. To determine the content validity, the questionnaire was provided to 10 faculty

members of the Faculty of Nursing and Midwifery and their corrective comments were applied on the questionnaire and the final questionnaire was prepared. To determine the reliability of the questionnaire, in a pilot study, the questionnaire was given to 20 parents of premature infants admitted to the NICUs and the Cronbach's alpha coefficient obtained was 0.76 and 0.70 for mothers and fathers, respectively.

Impact of Event Scale – Revised (IES-R)

The IES-R was designed by Marmar and Weiss in 1997 to assess psychologic symptoms that occur after a specific traumatic event or post-traumatic stress. The IES-R measures the mental responses to an incident in the areas of response to intrusion of unwanted thoughts, avoidance, and hyperarousal. The IES-R consists of 22 items that contain 8 items related to the "Intrusion" subscale (items 1, 2, 3, 6, 9, 14, 16, 20), 8 items related to the "Avoidance" subscale (items 5, 7, 8, 11, 12, 13, 17, 22) and 6 items related to the "Hyperarousal" subscale (items 4, 10, 15, 18, 19, 21). Each item was assigned a score ranging from 0 ("Not at all") to 4 ("Extremely"). To obtain the total score of the questionnaire, scores of 22 questions are summed up: it can be a score between 0 and 88, with a higher score indicating higher levels of helplessness and stress [18]. In this study, scores 0-29, 30-59, and 60-88 indicated a mild, moderate, and severe PTSD, respectively.

Weiss and Marmar obtained the content validity index of the IES-R (0.85) and estimated its reliability by calculating the Cronbach's alpha coefficient for the "Avoidance" scale (0.87), the "Intrusion" subscale (0.84), and the "Hyperarousal" subscale (0.98) [18].

The Persian version of IES-R was validated by Panaghi and Mogadam in Iran. The Persian version of IES-R has good internal consistency and Cronbach's alpha of subscales were reported to be between 67% and 87%. Test-retest method showed that reliability of subscales was between 0.8 and 0.98 [19].

In the present study, the content validity of the questionnaire was approved by 10 faculty members of the Faculty of Nursing. Cronbach's alpha method was used to determine the reliability of the questionnaire. For this purpose, the questionnaire was provided to 20 qualified mothers and fathers. After collecting data, Cronbach's alpha obtained was 0.90 and 0.94 for mothers and fathers, respectively.

Parental Stressor Scale: Neonatal Intensive Care Unit (PSS:NICU)

This questionnaire is a self-report inventory for measuring the stress of parents of premature infants admitted to NICU, which was designed by Miles & Funk in 1998. The questionnaire consists of 34 items in 3 subscales. The subscale of "NICU sights and sounds" consists of 6 items, the subscale of "Infant behavior and appearance" includes 17 items and the subscale of "Parental role alteration" includes 11 items. Each item is scored from 1 ("Not at all stressful") to 5 ("Extremely stressful"). If the parents did not experience any of the items, they would choose the "Not applicable" option. The total score of this questionnaire is between 34 and 170, and a higher score indicates higher levels of stress [20]. To measure the parental stress level in this study, the average stress scores were calculated and scores 1-2.59, 2.60-3.59, and 3.60-5 were considered as low, moderate, and high stress levels, respectively.

In Iran, Borimnejad et al. used forward-backward method for the preparation of the Persian translation of the questionnaire and its cultural adaptation [21].

In the present study, the content validity of the questionnaire was confirmed by 10 faculty members of the Faculty of Nursing. Cronbach's alpha method was used to determine the reliability of the questionnaire. To this end, the questionnaire was provided to 20 qualified mothers and fathers. After collecting data, Cronbach's alpha for mothers and fathers was equal to 0.95 and 0.90, respectively.

Data analysis

Data analysis was carried out using SPSS® ver. 18. To this end, the normal distribution of variables was first investigated using Kolmogorov-Smirnov test. Data analysis was then carried out using descriptive statistics (such as frequency, percentage, mean and standard deviation) and, considering normal distribution of variables, inferential statistics (such as independent t-test, ANOVA, and Pearson correlation coefficient). The significance level was considered as $p < 0.05$.

Ethical considerations

In this research, the Code of Ethics (IR.KMU.REC.1396.2022) was obtained from the Ethics Committee of Kerman University of Medical Sciences. Then the introduction letter from the

Faculty of Nursing was presented to the research environment. The research objectives were explained to parents who met the inclusion criteria, and oral consent was obtained from them. Also, parents were informed about the optional entry and withdrawal from the study and assured that their information would be kept confidential.

Results

Descriptive results

The results showed that 57.1% of mothers aged ≤ 30 years (mean ± SD: 28.93 ± 5.32). A total of 64.3% of fathers aged ≤ 35 years (mean ± SD: 33.29 ± 5.53). 82.9% of mothers and 70% of fathers were housewives and self-employed, respectively. Approximately 75.7% of mothers underwent cesarean section. Singleton births account for 72.9%; pregnancies were wanted in the 88.6% of cases.

Approximately 87.1% of the participants did not have other NICU experiences (i.e., admission of other newborn infants to NICU at birth) and 50% of the mothers were para 0. 52.9% of the neonates were boy, 70% of neonates had a gestational age between 32 and 37 weeks, 64.3% had a birth weight 1,000-1,500 g. 42.9% of neonates had a length of stay in NICU of 8 to 14 days (**Tab. 1**).

Table 1. Sociodemographic and medical variables.

Variable			n	%	M	SD
Parents	Mother's age	≤ 30	40	57.1	28.93	5.32
		> 30	30	42.9		
	Mother's job	Housewife	58	82.9	-	-
		Employee	12	17.1		
	Type of delivery	CS	53	75.7		
		NVD	17	24.3		
	Other children previously admitted to a NICU	Yes	9	12.9		
		No	61	87.1		
	Father's age	≤ 35	45	64.3	33.29	5.53
		> 35	25	35.7		
	Father's job	Self-employed	49	70	-	-
		Employee	21	30		
	Parity	0	35	50		
		1	21	30		
		> 1	14	20		
	Multiple pregnancy	Yes	19	27.1		
		No	51	72.9		
	Unwanted pregnancy	Yes	8	11.4		
		No	62	88.6		
Infants	Gender	Girl	33	47.1		
		Boy	37	52.9		
	Birth weight (grams)	< 1,000	17	24.3	1,890.43	518.39
		1,000-1,500	45	64.3		
		> 1,500	8	11.4		
	Gestational age (weeks)	< 28	0	0	32.73	2.11
		28-31	21	30		
		32-37	49	70		
	Length of stay in the NICU (days)	≤ 7	16	22.9	14.54	9.79
		8-14	30	42.9		
		15-21	8	11.4		
		> 21	16	22.9		

CS: cesarean section, NICU: Neonatal Intensive Care Unit; NVD: normal vaginal delivery.

Family environment (according to the Family Environment Scale [FES])

The mean family environment score was at the moderate level for mothers (97.48 ± 11.46) and fathers (98.70 ± 10.50). Independent t-test showed no significant difference between mothers and fathers (**Tab. 2**). The lowest mean scores in both parents were related to two questions: "Family members often try to one-up or outdo each other" and "Family members believe that if you sin you will be punished". The highest mean family environment scores in mothers were related to the two items "Family members sometimes get so angry they throw things" and "The Bible is a very important book in our home". In fathers, the highest mean family environment scores were related to the two items "Family members sometimes get so angry they throw things" and "Family members sometimes hit each other" (**Tab. 3**). Overall, 52.9% of fathers and 47.1% of mothers evaluated family environment at moderate level. Finally, the family environment was assessed optimal by 47.1% of fathers and 46.4% of mothers.

Parental stressors (according to the Parental Stressors Scale [PSS])

The findings showed a significant difference between mothers and fathers in terms of the mean score of parental stressors and their dimensions, so that the mean score of parental stressors was

Table 2. Mean scores of parental stressors (according to the Parental Stressors Scale [PSS]), post-traumatic stress disorder (PTSD) (according to the Impact of Event Scale – Revised [IES-R]), and family environment (according to the Family Environment Scale [FES]).

Variable		Mothers		Fathers		Statistics	
		M	SD	M	SD	t	p
Parental stressors	NICU sights and sounds	2.87	0.78	3.83	0.84	7.55	**0.001**
	Infant behavior and appearance	3.32	0.99	3.01	0.97	7.82	**0.001**
	Parental role alteration	2.79	0.87	2.59	0.84	7.08	**0.001**
	Total score	2.90	0.86	2.55	0.90	7.76	**0.001**
PTSD	Intrusion	16.19	7.53	13.17	6.95	2.40	0.17
	Avoidance	14.10	6.41	12.07	7.30	1.79	0.074
	Hyperarousal	12.69	5.58	9.86	6.18	2.99	**0.003**
	Total score	43.01	17.14	35.10	18.79	2.66	**0.009**
Family environment		97.48	11.46	98.70	10.50	0.75	0.45

NICU: Neonatal Intensive Care Unit; PTSD: post-traumatic stress disorder.

Table 3. Family Environment Scale (FES) items in parents of premature infants admitted to the Neonatal Intensive Care Unit (NICU).

Parents	Family environment items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	M	SD
		%	%	%	%	%		
Mothers	Family members sometimes get so angry they throw things	5.80	4.30	10.10	10.10	69.60	4.33	1.18
	The Bible is a very important book in our home	4.30	1.40	13.00	15.90	65.20	4.36	1.05
	Family members often try to one-up or outdo each other	42.00	7.20	21.70	17.40	11.60	2.49	1.47
	Family members believe that if you sin you will be punished	44.90	15.90	10.10	14.50	14.50	2.38	1.53
Fathers	Family members sometimes get so angry they throw things	4.40	1.50	10.30	11.80	27.10	4.46	1.04
	Family members sometimes hit each other	5.90	4.40	8.80	5.90	75.00	4.40	1.19
	Family members believe that if you sin you will be punished	38.20	16.20	26.50	10.30	8.80	2.35	1.23
	Family members often try to one-up or outdo each other	35.30	14.70	20.60	17.60	11.80	2.56	1.43

moderate in mothers (2.90 ± 0.86) and low in fathers (2.55 ± 0.90) (**Tab. 2**). The highest mean scores in the "NICU sights and sounds" domain in both parents were related to the "Presence of monitors and equipment" and the presence of noises ("Presence of constant noises" and "Sudden noises" for fathers and mothers, respectively). The lowest mean score in the "NICU sights and sounds" domain in both parents was associated to the item "Large number of people working in the unit". With regard to the "Infant behavior and appearance" domain, the highest mean score in both parents correlated to the item "Stops breathing". The lowest mean score in the "Infant behavior and appearance" domain in mothers and fathers related to items "Wrinkled appearance" and "Jerky movements", respectively. With regard to the "Parental role alteration" domain, the highest mean score in both parents was linked to the item "Feeling unable to protect baby from pain". The lowest mean score in the "Parental role alteration" domain in mothers and fathers was related to items "Not being able to share baby with family" and "Sometimes forgetting what baby looks like", respectively (**Tab. 4**). Overall the

Table 4. Parental Stressors Scale (PSS) items in parents of premature infants admitted to the Neonatal Intensive Care Unit (NICU).

Subscale	Parent	Items	N/A	1	2	3	4	5	M	SD
			%	%	%	%	%	%		
NICU sights and sounds	Fathers	Presence of monitors and equipment	17.9	13.4	13.4	26.9	13.4	14.9	3.04	1.31
		Presence of constant noises	13.4	10.4	25.4	13.4	22.4	14.9	3.07	1.32
		Large number of people working in the unit	10.4	26.9	19.4	28.4	10.4	4.5	2.40	1.18
	Mothers	Presence of monitors and equipment	5.8	13.0	17.4	18.8	23.2	21.7	3.25	1.37
		Sudden noises	2.9	7.2	20.3	13.0	31.9	24.6	3.48	1.28
		Large number of people working in the unit	8.7	33.3	30.4	15.9	8.7	2.9	2.10	1.10
Infant behavior and appearance	Fathers	Stops breathing	17.9	11.9	13.4	11.9	14.9	29.9	3.45	1.49
		Jerky movements	14.9	14.9	26.9	19.4	17.9	6.0	2.68	1.20
	Mothers	Stops breathing	10.1	11.6	7.2	5.8	13.0	52.2	3.97	1.47
		Wrinkled appearance	2.9	27.5	17.4	29.0	15.9	7.2	2.57	1.27
Parental role alteration	Fathers	Feeling unable to protect baby from pain	10.4	17.9	26.9	6.0	20.9	17.9	2.93	1.50
		Sometimes forgetting what baby looks like	28.4	29.9	20.9	4.5	13.4	3.0	2.15	1.12
	Mothers	Feeling unable to protect baby from pain	5.8	17.4	8.7	11.6	24.6	31.9	3.48	1.50
		Not being able to share baby with family	4.3	30.4	30.4	20.3	11.6	2.9	2.23	1.12

NICU: Neonatal Intensive Care Unit.
N/A: not applicable; 1: not at all stressful; 2: a little stressful; 3: moderately stressful; 4: very stressful; 5: extremely stressful.

incidence of mild, moderate, and severe stress was 52.2%, 43.3%, and 13.4%, respectively in fathers, 46.4%, 34.8%, and 18.8%, respectively in mothers.

Post-traumatic stress disorder (according to the Impact of Event Scale – Revised [IES-R])

The mean scores of PTSD in the IES-R in mothers (43.01 ± 17.14) and fathers (35.10 ± 18.79) were evaluated at moderate level. The highest mean score correlated to the "Intrusion" dimension in both parents, but the mean score was significantly higher in mothers than in fathers for the "Hyperarousal" dimension (**Tab. 2**). In both parents, the highest and lowest mean "Intrusion" scores were related to the items "I had trouble staying asleep" and "I had dreams about it", respectively. The highest mean "Avoidance" score in mothers and fathers belonged to the items "I stayed away from reminders of it", and "I tried to remove it from my memory", respectively. The lowest mean "Avoidance" score in mothers and fathers was related to the items "My feelings about it were kind of numb", and "I stayed away from reminders of it", respectively. The highest mean "Hyperarousal" score was related to the items "I felt irritable and angry" and "I felt watchful and on-guard" in mothers, and "I had trouble falling asleep" in fathers. The lowest mean "Hyperarousal" score in both parents was related to the item "Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart" (**Tab. 5**). Overall, mild, moderate, and severe PTSD was experienced by fathers in 34.3%, 60%, and 7.5% of cases, respectively. Moderate, mild, and severe PTSD was also experienced by mothers in 62.9%, 18.6%, and 18.6% of cases, respectively.

Table 5. Post-traumatic stress disorder (PTSD) items (in the Impact of Event Scale – Revised [IES-R]) in parents of premature infants admitted to the Neonatal Intensive Care Unit (NICU).

PTSD	Parents	Items	1	2	3	4	5	M	SD
			%	%	%	%	%		
Intrusion	Mothers	I had trouble staying asleep	7.10	18.60	17.10	27.10	30.00	2.54	1.29
		I had dreams about it	45.70	18.60	20.00	8.60	7.10	1.13	1.28
	Fathers	I had trouble staying asleep	11.40	20.00	25.70	20.00	22.90	2.23	1.32
		I had dreams about it	47.10	18.60	24.30	5.70	4.30	1.01	1.16
Avoidance	Mothers	I stayed away from reminders of it	18.60	18.60	20.00	21.40	21.40	2.09	1.42
		My feelings about it were kind of numb	30.00	28.70	22.90	11.40	10.00	1.46	1.30
	Fathers	I tried to remove it from my memory	30.00	20.00	20.00	15.70	14.30	1.64	1.43
		I stayed away from reminders of it	22.90	21.40	18.60	15.70	21.40	1.19	1.47
Hyperarousal	Mothers	I felt irritable and angry	10.00	12.90	27.10	24.30	25.70	2.43	1.28
		I felt watchful and on-guard	20.00	7.10	18.60	18.60	38.70	2.43	1.52
		Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart	38.60	27.10	10.00	11.40	12.90	1.33	1.42
	Fathers	I had trouble falling asleep	22.90	24.30	17.10	17.10	18.60	1.84	1.44
		Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart	47.10	17.10	11.40	14.30	10.00	1.23	1.43

PTSD: post-traumatic stress disorder.
1: not at all; 2: a little bit; 3: moderately; 4: quite a bit; 5: extremely.

Correlational analysis

The results showed no significant relationship between family environment and PTSD in mothers (r = 0.11, p = 0.36) and fathers (r = 0.04, p = 0.75), but a significant relationship was found for both parents in terms of parental stressors and PTSD (mothers: r = 0.48, p = 0.0001; fathers: r = 0.59, p = 0.0001) (**Tab. 6**). Results showed no statistically significant correlation between parental stressors, PTSD, family environment, gestational age, birth weight, and length of stay in the NICU.

Discussion

The results showed that the parents of infants admitted to the NICU evaluated their family environment at the moderate level. This finding is consistent with the results of studies by Makela et al. [22], Feeley et al. [23], and Finlayson et al. [24]. Makela et al. showed that balancing closeness and separation as a double-edged sword was a major theme for parents whose newborns were admitted to the NICU, and that they did not have enough time to prepare themselves for their neonate's condition. Parents also make efforts to get close to their infant and preserve and consolidate their relationship into the family and, accordingly, to adapt themselves to circumstances [22]. Feeley et al. in a descriptive study assessed mother-infant interaction and infant development in mothers of very low birth weight infants. Mothers reported their need to spend time with their infant as a member of the family, which is considered as a normal response to becoming a parent [23]. In another study, Finlayson et al. revealed that parents perceived the parent-infant relationship as a normal proximity. Parent-infant closeness helped parents experience the true parental feelings and better accept separation from the child [24]. In this study, parents accepted separation from the infant but regarded it as an emotional challenge and a stressful condition. The results of this study support the present study in terms of family cohesion. Although scientific advances increase the chance of having an alive infant, NICU experience causes a lot of stresses. In fact, the family sees their infant as a fragile and vulnerable creature, and this view changes the family-infant relationship, especially the mother-infant relationship [25]. Even if the overall sense of separation, the lack of neonatal-personnel interaction, and the sense of detachment in parents negatively affect their parental identity, when they are caring for their infants, their

Table 6. Relationship of post-traumatic stress disorder (PTSD) (according to the Impact of Event Scale – Revised [IES-R]) with family environment (according to the Family Environment Scale [FES]) and parental stressors (according to the Parental Stressors Scale [PSS]) in parents of premature infants admitted in the Neonatal Intensive Care Unit (NICU).

Parent	Variable		Family environment	Parental stressors			
				NICU sights and sounds	Infant behavior and appearance	Parental role alteration	Total score
Mothers	PTSD	Intrusion	r = 0.091	r = 0.18	r = 0.37	r = 0.32	r = 0.38
			p = 0.46	p = 0.14	**p = 0.002**	**p = 0.006**	**p = 0.001**
		Avoidance	r = 0.10	r = 0.33	r = 0.42	r = 0.29	r = 0.45
			p = 0.39	**p = 0.006**	**p = 0.0001**	**p = 0.014**	**p = 0.0001**
		Hyperarousal	r = 0.10	r = 0.22	r = 0.44	r = 0.39	r = 0.45
			p = 0.41	p = 0.075	**p = 0.0001**	**p = 0.001**	**p = 0.0001**
		Total score	r = 0.11	r = 0.27	r = 0.46	r = 0.38	r = 0.48
			p = 0.36	**p = 0.024**	**p = 0.0001**	**p = 0.001**	**p = 0.0001**
Fathers	PTSD	Intrusion	r = 0.10	r = 0.35	r = 0.48	r = 0.45	r = 0.57
			p = 0.42	**p = 0.003**	**p = 0.0001**	**p = 0.0001**	**p = 0.0001**
		Avoidance	r = 0.03	r = 0.26	r = 0.36	r = 0.37	r = 0.45
			p = 0.76	**p = 0.031**	**p = 0.002**	**p = 0.002**	**p = 0.001**
		Hyperarousal	r = 0.05	r = 0.42	r = 0.48	r = 0.47	r = 0.61
			p = 0.67	**p = 0.0001**	**p = 0.0001**	**p = 0.0001**	**p = 0.0001**
		Total score	r = 0.04	r = 0.37	r = 0.47	r = 0.46	r = 0.59
			p = 0.75	**p = 0.0002**	**p = 0.0001**	**p = 0.0001**	**p = 0.0001**

PTSD: post-traumatic stress disorder.

sense of involvement and identity are enhanced [26]. However, part of the infant's development depends on the exchange of emotional responses between parents and the infant and bring them together psychologically and physiologically. This relationship is strengthened by the family's emotional support, so that if such a relationship is correctly established, it will play an important role in the ability of parents, especially mothers, to express their affection during infancy and childhood [27]. Therefore, provision of support for parents, who experience parental role under difficult and abnormal conditions, is a central issue in NICU [28], because such families are at higher risk for separation, stress and financial problems

Our findings showed a significant difference between mothers and fathers in terms of parental stressors, so that parental stressors in mothers and fathers were evaluated to be moderate and low, respectively. This finding is consistent with the results of studies by Hosseini et al. [1], Arockiasamy et al. [29], Lee et al. [30], Alkozei et al. [31], and Matricardi et al. [32] and inconsistent with the results of a study by Hollywood and Hollywood [7].

Hosseini et al. in a study done in Iran showed that both parents experienced moderate stress due to admission of neonates to NICU [1]. Lee et al. showed in a qualitative study in Taiwan that the birth of premature infants and their admission to the NICU represented an unexpected crisis for mothers. Despite the low physical interactions with the infant, these mothers have created alternative ways to establish emotional relationships with their neonates and gradually accept their parental roles. Mothers experiences have shown that the support of care providers and social networks has helped them communicate with their infant and create a sense of becoming a parent [30]. Alkozei et al. in the United States showed that 52% of the mothers whose infant was admitted to the NICU had high stress and 38% of them experienced symptoms of depression [31]. Matricardi et al. in Italy also indicated that mothers with premature infants admitted to NICU experienced more stress than fathers, which can be attributed to differences in emotions and feelings of both genders [32].

In the present study, the highest mean scores in both parents related to the following items: "Presence of monitors and equipment", noises ("Sudden noises" and "Presence of constant noises" for mothers and fathers, respectively), "Stops breathing", and "Feeling unable to protect baby from pain". Arockiasamy et al. have shown that the admission of an infant to the NICU is very stressful, especially for parents whose infant has been admitted to the hospital for the first time, and mothers experience more stress than fathers. Stressors and the relevant responses were also reported to be different in fathers and mothers, so that the paternal stress was often related to the environment outside the ward and maternal stress was often related to the environment inside the ward and their child [29]. Among the stressors in the NICU there can be 8 important factors that affect the stress of the parents of neonates admitted to this ward: light, sound, infant appearance, aggressive procedures, infant behaviors, emotional responses, personnel conversations and behaviors, and reduction of parental role. In addition, the NICU is an important and great source of stress for parents due to unfavorable light, loud noises, various medical procedures and large number of medical staff, which can be reduced by providing ongoing information, establishing a good relationship between parents and staff, providing nursing care to meet the needs of parents and involving them in caring for their infants. Nurses can help parents cope with these stresses by providing transparency, support, improving parent-infant relationship, and providing advice and suggestions for coping.

However, inappropriate response of nurses to parents' needs increases parents' worries and anxieties, fears and misunderstandings [33]. In a study on the internal and external stressors in the parents of neonates at NICU admission, Grosik et al. concluded that the highest mean score for intra-personal stressors related to the item "Parents see their neonates distressed, or their neonates seem to be unwell". Among the NICU-related interpersonal stressors, the sound of devices was stressful. Among the items related to the parents-infant relationship, the highest mean score was obtained for the item "Separation from the infant and feeling helpless" [34]. The infant appearance and behavior, voice, separation from the infant in the NICU are among the most important and big stressors for parents. These results increase the nurses level of awareness about parental stressors in the NICU and emphasize the importance of counseling and providing strategies for stress reduction and adaptation by nurses such as providing continuous information, establishing proper communication with parents, providing nursing care to identify the needs of parents and engaging them in the infant care process [35].

Inconsistent with the results of the present study, Hollywood and Hollywood reported in a

phenomenological study in Ireland that fathers of premature infants also experienced disorders such as anxiety, frustration, and fear of lack of awareness and high stress levels [7]. This discrepancy may be due to the difference in the type and size of the sample of the two studies. Hollywood and Hollywood's study was carried out using a qualitative approach and small-sample size, while the present study was conducted using a quantitative approach on 140 parents of premature infants.

Our findings showed that fathers and mothers of premature infants admitted to NICU experienced moderate PTSD, which is consistent with the results of studies by Aftyka et al. [6, 36], and inconsistent with Feeley et al. [23].

Aftyka et al. concluded that PTSD was present in 60% of the mothers and 47% of the fathers. The authors reported similar results in a previous study [6]. Feeley et al. also concluded that 23% of the mothers with very low birth weight neonates had clinical symptoms of severe PTSD. Mothers with severe PTSD symptoms also showed less sensitivity and effectiveness in interacting with their infant [23]. An unexpected birth of a premature infant can make anxiety the prevailing emotional condition for parents. Under such circumstances, most parents cannot accept the appearance of their neonates and their need to remain in the NICU. Emotions are variable and uncertain in these situations and the parents feel distressed due to the lack of their caring role as a parent [16]. NICU environment is the major stressor for parents, who are shocked by equipment that supports their infant's life, when they see their infant for the first time. In addition, parents are incapable of understanding their infant's unique behaviors, which in turn leads to an inability to communicate with their infant. When parents realize their infant's fragility, they are afraid to leave the infant alone and may even be worried about the survival of their infant [25].

Our results revealed no significant relationship between family environment and PTSD in both parents. We did not find a study on the relationship between family environment and PTSD in parents of neonates admitted to NICU.

Shani-Sherman et al. investigated the impact of internal (such as problem solving skills) and external (such as general spousal support, adequate spousal support) resources on mental disorders such as PTSD in parents of premature infants in Israel. The findings showed that the stronger the internal and external resources are, the less frequent the PTSD would be. This finding is not consistent with the present study, which can be attributed to a different method and tool used to investigate these two variables [37].

De Bernardo et al. studied the relationship between family-centered care for the infant admitted to NICU and the level of stress and susceptibility to PTSD and concluded that the more active the parents were in the care of the infant, the lower the rate of damage caused by stress and mental disorders would be [38].

In a review study on mental injuries and stress levels of parents with NICU-admitted neonates, Sabnis et al. concluded that the greater the parental involvement in the infant care, the lower the damages caused by stress and mental disorders [39].

The results also showed a significant relationship between parental stressors and PTSD in both parents. This finding is consistent with the results of studies by Jubinville et al. [40], Morisod-Harari et al. [41], Ghorbani et al. [42], and Busse et al. [43]. Jubinville et al. concluded that the birth of a premature infant was a traumatic experience for mothers and led to emotional reactions such as acute stress disorder and depression [40]. Morisod-Harari et al. also showed that parents experienced significant stress when their neonates were admitted to the NICU, and they exhibited significant PTSD symptoms [41]. Busse et al. concluded that parents who experienced a lot of stress in NICU exhibited more mental, psychological, and physical complications. In addition, parental stressors were significantly associated with anxiety, depression, and sleep disorder in the parents of neonates admitted to NICU [43]. Ghorbani et al. in Iran showed that the parents of preterm neonates experienced more anxiety than the parents of term neonates and the mean score of PTSD was also higher in them [42].

Limitations

The limitations of the present study include the lack of attention to the severity of the neonatal disease, the lack of attention to the cultural, economic, and social differences of families, as well as loss of control over the emotional conditions facing families during the treatment of their neonates. Moreover, neonates were selected only from one healthcare center, which reduces the generalization of the results.

Conclusion

Our results showed that parents of premature infants admitted to a NICU would be more susceptible to PSTD if they did not receive enough support. Between them, mothers experience higher stress levels than fathers. In addition, the family cohesion degree was moderate to high. There was a significant relationship between parental stressors and PTSD, but there was no relationship between family environment and PTSD.

The results of the present study could help NICU staff to find appropriate strategies to manage stress of parents of sick infants, as well as improve the family environment. Hospital managers are recommended to ensure physical, mental, social, and spiritual well-being of infants' parents by creating a suitable environment for their involvement in the care of infants in the NICU. They should also adopt policies to encourage interactions among family members and reduce the distress resulting from their separation.

Nursing education policy makers are recommended to take steps towards improving nurses' skills in this field by holding training for them. Therefore, nurses, by knowing stress-coping strategies as well as family environment enhancing strategies, can reduce complications such as PTSD in parents providing quality care to premature infants and their family.

Nurses should be encouraged to involve parents in the care plan to help them know the infant's care needs, enhance their sense of self-confidence and competence, reduce stress complications and increase family cohesion.

Since this study is, to our knowledge, the first to have carried out with this topic in Iran, it may pave the way for further investigations in this field in other NICUs of this country.

Declaration of interest

The Authors declare that there is no conflict of interest.

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