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The effect of education based on the health belief model in improving anxiety among mothers of infants with retinopathy of prematurity

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Abstract:

BACKGROUND: Due to the role of education in improving anxiety and essential skills of mothers for caring for their infants, this study aimed to investigate the effect of education based on the health belief model (HBM) on anxiety among mothers of infants with retinopathy of prematurity (ROP).

MATERIALS AND METHODS: This randomized controlled clinical trial was performed on 67 mothers with premature infants admitted to the ROP unit of Khatam Al Anbia Eye Hospital in Mashhad, Iran from 2019 to 2020. Participants were randomly allocated to intervention and control groups. Intervention was designed based on HBM during six sessions, each of 45–60 minutes duration. The control group received routine educations according to the hospital policies. The maternal anxiety, adherence with follow-up examinations and the rate of neonatal retinal vascularization were evaluated using an HBM- based questionnaire and State-Trait Anxiety Inventory questionnaire and checklists, respectively. Data was analyzed by using SPSS software, version 16, using Chi-squared test, Fisher's exact test, independent *t* test, and Mann–Whitney *U* test.

RESULTS: Based on our findings, no significant difference was observed between the two groups before the intervention regarding the mean score of maternal anxiety ($P = 0.141$). However, after intervention, the mean score of maternal anxiety decreased significantly from 67.0 ± 6.3 to 38.5 ± 6.6 in the intervention group and increased from 69.8 ± 3.1 to 68.3 ± 3.4 in the control group ($P < 0.001$). In the intervention group, the mean scores of model constructs (perceived susceptibility and severity, perceived benefits, barriers, self-efficacy and cue to action) increased significantly after intervention ($P < 0.001$).

CONCLUSIONS: Education based on HBM appear to be an efficient method to improve maternal anxiety among mothers of infants with retinopathy of prematurity. Accordingly, nurses and treatment staff can provide interventions in the NICU based on the HBM to the parents of hospitalized and premature infants.

Keywords:

Anxiety, education, health belief model, mother-infant relations, premature infant

Introduction

Retinopathy of prematurity (ROP) is a serious problem among premature low birth weight infants.[1] ROP is a retinal vascular disorder that severely affects premature infants and is caused by abnormal blood vessel growth in the retina followed by abnormal vascular proliferation at birth.[2] ROP sometimes progresses very quickly, and delays in examinations, even for a few days, can lead to vision loss. For

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these reasons, timely diagnosis and treatment play a very important role in the rehabilitation of sight and vision of infants, and the emphasis on periodic examinations is especially necessary for parents. Visual impairment and blindness in infants impose a heavy psychological and physical burden on the child and it's a great tragedy for the family and society.[3]

The prevalence of ROP in newborns weighing less than 1,251 grams is reported to be 68% in the United States.[4] According to some studies, the prevalence of ROP in different regions of Iran varies from 1% to 70%.[5–8] The negative feeling of parents of premature infants, such as that their infant is vulnerable to any illness, may cause the sense of powerlessness and impairment resulting in a change in the parental role, and it could also increase anxiety and depression.[9–11] This attitude leads parents to inappropriate interaction with infants. It has been found that feelings of stress are associated with a decrease in maternal love and responsibilities, and can spread to babies.[12,13] Nurses play a critical role in assisting parents with premature infants; it is because during hospitalization of the infants, they are in connection with parents more than any other person, and also, they are more aware of the infant's status.[14] Studies show that mothers who have been supervised by communication and learning programs in the nursing system have less stress than mothers who have not learned these skills.[15] Considering that health education based on patterns can be effective in adoption of health behaviors, choosing a health education model is the first step in the process of designing a health education research program.[16]

One of the patterns is the health belief model (HBM) that can be used to design appropriate educational interventions for determining the relationship between health beliefs and behavior.[17] HBM is the most important model implemented in the development and design of prevention programs and is one of the patterns of education and behavior change of people at risk which is widely used by health educators.[18] The HBM has six constructs including: perceived sensitivity (a person's subjective perception of a risk of getting illness), perceived severity (a person's feelings on the seriousness of a disease), perceived benefits (a person's perception of the effectiveness of various methods for reducing the risk or severity of disease), perceived barriers (a person's feelings on the barriers such as costs to performing a health action), cue to action (a stimulus that makes one feel the need to do something), self-efficacy (a person's confidence in his or her ability to perform a behavior).[9] Many studies have been performed in different communities including patients, pregnant mothers, etc., which has shown the positive effect of HBM in reducing anxiety.[19–22]

Considering the 10-year history of working in Khatam Al Anbia Eye Hospital in Mashhad, we realized that most parents are not aware of the complications of anxiety and delayed the follow-up examination; so the researcher intends to create appropriate care behavior by creating perceived sensitivity and threat in parents. Therefore, the HBM is a suitable method in designing the intervention.

As far as we know, there is no written program for parents of infants with ROP in the country, and no research has been done on training parents in this regard. The aim of the present study was that parents with regular visits for follow-up examinations, in addition to reducing the complications of ROP, also reduce their anxiety and are able to care for their infants.

Material and Methods

Study design and setting

This study was a double-blind, randomized, controlled trial with a pre-test and post-test design. The study population consisted of mothers who had their infants admitted to the ROP unit of Khatam Al Anbia Eye Hospital in Mashhad, Iran from 2019 to 2020.

The inclusion criteria for mothers included: written consent to participate in the study, being able to read and write, no depression or anxiety disorder confirmed by a specialist doctor during the study, women who never had a pre-term infant, and lack of moderate or high level of hidden anxiety. Exclusion criteria included reluctance to continue cooperation, more than one absence in training sessions, severe stressful events such as the death of first-degree relatives, divorce, or severe family disputes.

The inclusion criteria for infants included newborns with a gestational age of 34 weeks (33 weeks and 6 days), infants who had zone II and stage 2 involvement in the first retinal screening examination, no severe asphyxia and major congenital anomalies. The exclusion criteria included infant death, hospitalization in NICU, respiratory distress syndrome, and the need for mechanical ventilation.

Study participants and sampling

Screening examination for all infants referred to the ROP unit was performed by a retinal specialist, and infants with ROP stage 2 were introduced to the researcher. The first-time retinal examination was performed based on gestational age at birth.[23] The specialist was blinded about the groups until the end of the study.

The researcher consulted in person with the parents of newborns who were referred to the premature neonatal clinic for screening for ROP. Of the 74 mothers

who's own and their infant met the inclusion criteria, 67 participants (34 infants and their mothers in the intervention group and 33 infants and their mothers in the control group) were enrolled, using simple sampling method [see Figure 1]. By lot, even days were assigned to the intervention group and odd days to the control group.

Data collection tools

A demographic characteristics form that included age, education, occupation, economic status, weight, number of children, insurance status was used.

A researcher-made HBM-based questionnaire in Persian: This questionnaire comprised of 34 questions based on six HBM constructs including six questions on perceived susceptibility, perceived severity (six questions), perceived benefits (four questions), perceived barriers (nine questions), cues to action (four questions), and self-efficacy (five questions). Likert scoring method was used to assess the answers as follows: (certainly agree = 4, agree = 3, no idea = 2, disagree = 1, and certainly disagree = 0) with a score range of 23–115.

The validity of this tool was examined by seven academic expert members of Mashhad School of Nursing and Midwifery. Some modification was made based on their opinions until it became acceptable.

The internal consistency method (Cronbach's alpha coefficient) was used by conducting a pilot study on 10 parents in one test. Cronbach's alpha for the whole questionnaire was calculated to be 89%, which was acceptable.

State-Trait Anxiety Inventory (STAI): This questionnaire was designed by Spielberger in 1970 and revised in 1983.[24] It consists of 40 questions with Likert score, of which 20 are related to the state anxiety subscale and another 20 to the trait anxiety subscale. Scoring is reversed for expressions that indicate no anxiety. Anxiety scores ranged from 20–73 with different rangers indicating different levels: 20–31 for mild anxiety; 32–42 for moderate-to-low anxiety; 43–53 for moderate-to-high anxiety; 53–62 for relatively severe anxiety; 63–72 for severe anxiety; and ≥73 for very severe anxiety. Parents whose latent anxiety levels were not moderate to high (<42) were included in the study.

Content validity and reliability were assessed as mentioned about HBM-based questionnaire; a Cronbach's alpha of 0.91 was obtained which was acceptable.

Regular check-up checklist: This checklist was prepared in accordance with the national executive regulations of retinopathy care in premature infants for the next examination of the newborn. The parents' adherence to the mentioned schedule was evaluated by the opinion of the retinal specialist in the intervention and control group. After the first examination, based on the zone (maximum area with normal blood vessels) and stage of the disease, the examination intervals were determined. It was performed 5 days a week and in the morning shift. Evaluation of attendance for follow-up

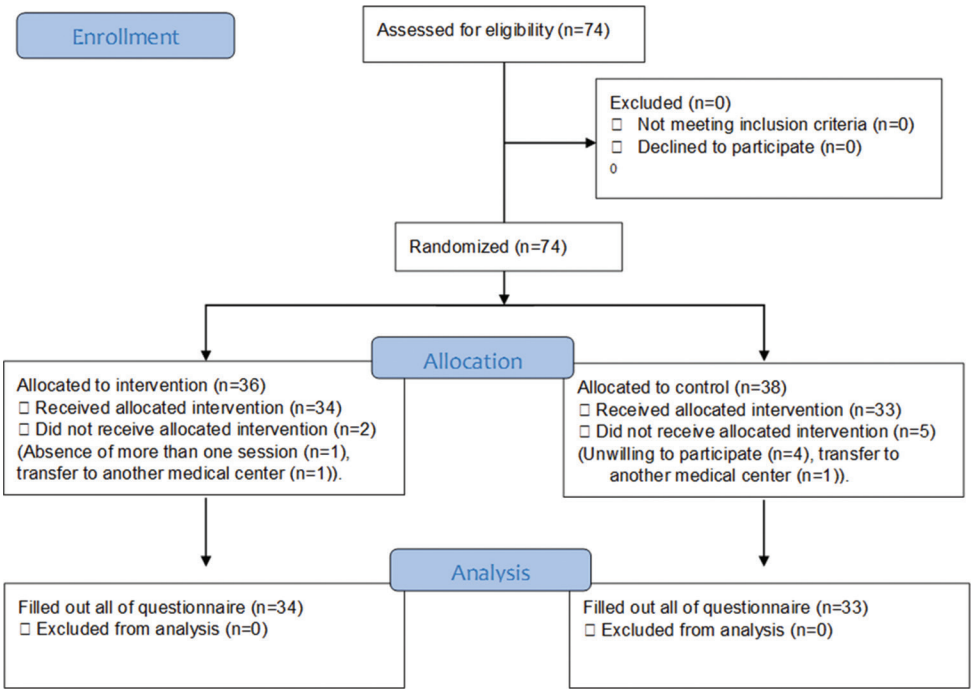

Figure 1: Flow of participants through each stage of the program

examinations included referral exactly on the day of examination, referral with telephone reminder with 1–2 days delay, with 3 days to one week delay, with more than one week delay, and non-referral despite the phone reminder.

Checklist for evaluation of retinal vascularization status in preterm infants: The rate of retinal vascularization from the first examination was monitored (by the retina specialist) until the complete retinal vascularization, according to the time interval determined by the retinal specialist (based on the zone and stage of the disease). Data analysis was based on the number of weeks that vascularization was completed.

Ethical consideration

This study was conducted after the approval and permission of Mashhad University of Medical Sciences Research Committee IR.MUMS.NURSE.REC.1398.089 and was conducted with consideration of Helsinki Declaration in all phases of the study. Confidential data treatment was guaranteed.

Implementation

The researcher visited the parents and explained the purpose of the study for the participants. Informed consent and demographic information form were given to the mothers. Then the HBM and anxiety questionnaires were completed by participants.

The control group was given routine education provided by the hospital including education and answering the questions of parents by a nurse working in the pre-term infant clinic.

In the intervention group, 6 sessions of 45–60 minutes each were performed in the form of lectures, group discussions, questions and answers, videos and slides. The content of the training included empowering mothers to comply with treatment, attendance for follow-up examinations, care needs of premature infants, controlling infant pain during eye exams, infant sleep and feeding patterns, and managing stress and anxiety in parents.

According to the results of the HBM questionnaire in the pre-test stage, the constructs of perceived barriers and perceived sensitivity were considered more than other constructs. The designed intervention in the form of a health belief model are shown in Table 1.

Data analysis

In this study, descriptive analysis was performed using mean score and standard deviation (SD). Data was analyzed using Chi-squared test, Fisher's exact test, independent *t* test, and Mann–Whitney *U* test in SPSS version 16 (SPSS, Inc., USA). A *P* value lower than 0.05 was considered statistically significant.

Results

The study results showed that there was no significant difference between the two groups in terms of demographic variables before intervention ($P > 0.05$). The mean age of the mothers were 29.85 ± 7.17 years. The majority had elementary education ($n = 24$, 35.8%), were housewife ($n = 52$, 77.6%), poor in terms of economic conditions ($n = 19$, 28.3%), had one child ($n = 24$, 35.8%) and were without insurance coverage ($n = 36$, 53.7%).

A majority of neonates were boys ($n = 36$, 53.7%), with a mean birth weight of 1877.16 ± 296.88 grams. The infant's age and weight in the first screening of retinal disease of pre-term infant were 38.53 ± 0.5 weeks and 2522.16 ± 498.68 grams, respectively. The average hospitalization in NICU for the intervention group was 2.49 ± 2.47 days. Moreover, 95.5% of neonates did not have ventilation. The infant's age was reported to be 34 weeks of pregnancy in both groups. More details are shown in Table 2.

In the intervention group, the mean scores of maternal anxieties before and after the intervention were 67.0 ± 6.3 and 38.5 ± 6.6, respectively. In the control group, the mean scores of maternal anxieties before and after the intervention were 69.8 ± 3.1 and 68.3 ± 3.4, respectively. No significant difference was observed between the two groups before the intervention regarding the mean score of maternal anxiety ($P > 0.05$). However, the difference between the two groups regarding the premature infants' maternal anxiety was significant after the intervention [Table 3].

Results showed no significant difference between the intervention and control groups in terms of perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy before the intervention ($P > 0.05$). However, after the intervention, the intervention group showed a significant increase in each of these areas compared to the control group ($P < 0.001$) [Table 3].

The mean of timely referral score was 95.0 ± 10.9 in the intervention group and 65.2 ± 31.1 in the control group after the intervention. Based on Mann–Whitney *U* test, this difference was significant ($P < 0.001$) [Table 4].

The mean duration of complete vascularization was 9.5 ± 1.7 weeks in the intervention group and 11.3 ± 1.5 weeks in the control group. Based on Mann–Whitney *U* test, this difference was significant ($P < 0.001$) [Table 4].

Table 1: The designed intervention in the form of a health belief model

Steps	Objectives	Educational method	Details
First	Increased perceived susceptibility	Group discussion, lecture, questions and answers, PowerPoint, educational pamphlet	Introduction to ROP and its symptoms, complications and diagnosis
Second	Increased perceived severity	Posters, movies	Showing videos of babies who have become blind
Third	Promotion of perceived benefits	Group discussion, sharing positive results, video playback	Follow-up examinations reduce your baby's odds of developing eye complications and make you experience less anxiety. Also significantly reduce treatment costs.
Forth	eliminate perceived barriers	Questions and answers about perceived barriers and overview of practical solutions	Adherence to the baby's eye examination schedule takes a little time. These examinations are simple and without side effects.
Fifth	Introducing cues to action	Posters, pamphlets, cyberspace, telephone consultation	Giving a pamphlet to the parents and asking the mother to encourage her husband to come in time, create a telegram group and send a message in it
Sixth	Promotion of self-efficacy	Practical demonstration, repetition and practice	Showing an educational video on how to take care of the baby

Table 2: Demographic variables of infants and mothers in two groups before training

Variables	Intervention *n*=34	Control *n*=33	Total *n*=67	*P*
Mother's factors				
Mother's age (mean±SD)	31.8±7.6	27.8±6.2	29.85±7.17	0.081*
Mother's education, *n* (%)				
Elementary	10 (29.4)	14 (42.4)	24 (35.8)	0.517†
High school	5 (14.7)	4 (12.1)	9 (13.4)	
Diploma	7 (20.6)	6 (18.2)	13 (19.4)	
College degree	12 (35.3)	9 (27.3)	21 (31.4)	
Mother's occupation, *n* (%)				
Housewife	28 (82.4)	24 (72.7)	52 (77.6)	0.611††
Employee	4 (11.8)	6 (18.2)	10 (14.9)	
Others	2 (5.9)	3 (9.11)	5 (7.5)	
Economic status, *n* (%)				
Excellent	10 (29.4)	7 (21.2)	17 (25.4)	0.964†
Good	7 (20.6)	9 (27.3)	16 (23.9)	
Moderate	6 (17.6)	9 (27.3)	15 (22.4)	
Poor	11 (32.4)	8 (24.2)	19 (28.3)	
Numbers of children, *n* (%)				
One	10 (29.4)	14 (42.4)	24 (35.8)	0.078†
Two	10 (29.4)	13 (39.4)	23 (34.4)	
Three	7 (20.6)	3 (9.1)	10 (14.9)	
Four and more	7 (20.6)	3 (9.1)	10 (14.9)	
Insurance status, *n* (%)				
With insurance	15 (44.1)	16 (48.5)	31 (46.3)	0.720††
Without insurance	19 (55.9)	17 (51.5)	36 (53.7)	
Infant's factor				
Sex of infants, *n* (%)				
Female	17 (50.00)	14 (42.4)	31 (46.3)	0.534††
Male	17 (50.00)	19 (57.6)	36 (53.7)	
Birth weight (gram), (mean±SD)	1893.2±275.0	1860.6±321.4	1877.16±296.88	0.656*
Infant's age in first screening (week)	38.6±0.5	38.5±0.5	38.53±0.5	0.400†
Infant's weight in first screening (grams), (mean±SD)	2518.2±387.5	2526.2±598.4	2522.16±498.68	0.725†
Duration of ventilation (day), *n* (%)				
0	33 (97.1)	31 (93.9)	64 (95.5)	0.742††
2	0 (1)	1 (3.0)	1 (1.5)	
3	1 (2.9)	1 (3.0)	2 (3)	
Days in NICU, (mean±SD)	3.6±1.7	3.5±2.8	2.49±2.47	0.111†
Mode of delivery, *n* (%)				
Cesarean delivery	16 (47.1)	17 (51.5)	33 (49.3)	0.440††
Normal delivery	18 (52.9)	16 (48.5)	34 (50.7)	

*Independent *t*-test, †Mann-Whitney *U* test, ††Chi-squared test

Table 3: The mean of maternal anxiety and the HBM constructs before and after intervention in both groups

Variables	Group	Before intervention (mean±SD)	After intervention (mean±SD)	*P*
Maternal anxiety score	Intervention	67.0±6.3	38.5±6.6	<0.001†
	Control	69.8±3.1	68.3±3.4	0.89**
	Intra group test results	0.141††	<0.001††	
Health Belief Model Constructs				
Perceived susceptibility	Intervention	17.4±2.6	25.3±0.9	<0.001*
	Control	17.2±2.3	18.0±2.2	0.206†
	Intra group test results	0.815	<0.001	
Perceived severity	Intervention	21.0±4.0	27.6±1.1	<0.001†
	Control	20.6±4.1	20.3±2.3	0.461†
	Intra group test results	0.552	<0.001	
Perceived benefits	Intervention	15.5±0.6	19.6±0.8	<0.001†
	Control	15.5±2.5	15.6±1.5	0.644†
	Intra group test results	0.155	<0.001	
Perceived barriers	Intervention	24.9±3.1	40.6±2.3	<0.001†
	Control	26.0±7.7	24.9±4.6	0.576†
	Intra group test results	0.905	<0.001	
Cues to action	Intervention	13.4±0.9	19.2±0.9	<0.001†
	Control	13.3±2.7	14.2±0.9	0.073†
	Intra group test results	0.702	<0.001	
Self-efficacy	Intervention	14.6±1.5	22.0±0.9	<0.001†
	Control	13.8±3.4	14.2±5.4	0.857†
	Intra group test results	0.372	<0.001	
Total score of HBM of mothers	Intervention	106.7±4.6	154.2±3.6	<0.001†
	Control	106.5±6.0	107.2±4.3	0.517†
	Intra group test results	0.294	<0.001	

Data are presented as mean±standard deviation, *Paired *t*-test, †Wilcoxon test, **independent *t*-test, ††Mann-Whitney *U* test, *P*<0.001 considered to be significant

Table 4: Comparison of timely referrals score and duration of complete vascularization in the intervention and control groups before and after intervention

Variables	Intervention group (mean±SD)	Control group (mean±SD)	*P**
Timely referrals score	95.0±10.9	65.2±31.1	<0.001
Duration of complete vascularization (week)	9.5±1.7	11.3±1.5	<0.001

*Mann-Whitney *U* test, *P*<0.001 considered significant

Discussion

The results of this study showed that HBM-based intervention could reduce the level of anxiety in mothers of infants with ROP. In line with the present study results, Fakhri *et al*.[25] showed that education based on the HBM had reduced the anxiety of nulliparous women. In this regard, Shahnazi *et al*.[22] concluded that education based on the pattern of HBM reduces anxiety of pregnancy by increasing knowledge and changing beliefs and behaviors.

These studies have been performed on pregnant women, the elderly, respiratory patients, and ocular and orthopedic patients. Despite the substantial differences between the study groups, the HBM was able to reduce the anxiety of the intervention group in all of these studies. The HBM model protects clients against health risks by highlighting the complications and consequences of the disease and improving self-efficacy. Step-by-step training of individuals based on the HBM gives the client a fundamental understanding of the current situation, potential and actual risks, and supporting resources.

The results showed that education based on the HBM was able to improve caring performance of mothers and increase follow-up treatment by highlighting the perceived threat structure. In this regard, Zhang had emphasized the perceived threat structure to reduce anxiety and depression caused by bone fractures in the elderly.[26] Contrary to this approach, Langley *et al*.,[27] in their study on 243 psychology students, reported that the structure of perceived benefits is the strongest predictor of intent to seek help in anxiety disorders. The difference in age, gender, education, and the level of awareness of the study groups may be the reasons for these contradictions. The HBM model emphasizes the perceived threat structure in the face of illiterate clients and focuses more on the self-efficacy construct in front of informed and highly educated clients.[28–31]

In the present study, the structure of perceived barriers for mothers regarding the need for follow-up examinations

in the pre-intervention stage was almost identical in both groups. Still, a significant difference after the intervention between the two groups of mothers in this area indicates the effect of education based on the HBM on removing the perceived barriers in the intervention group. One of the main reasons for not performing hygienic behaviors is the obstacles people feel they will face while performing sanitary practices. In the present study, through group discussions and participation of all mothers, the existing barriers were identified by mothers. Mothers were then asked to describe their experiences dealing with these barriers. In the next step, mothers were asked to express in the form of brainstorming solutions that came to their minds to overcome the perceived obstacles. As the issue became clearer, mothers gradually came to believe that they could solve the problem and manage the situation in many cases. These findings were in line with a study by Diddana *et al*.,[32] who used group discussions and brainstorming methods to reduce the perceived barriers of pregnant women to nutritional performance. On the other hand, Sadeghi *et al*.[33] mainly used the lecture method to improve KAP in diabetes screening based on the HBM. Their study contained two training sessions, so it may not be possible to use methods such as brainstorming and training participation that require more time in this study.

Based on our results, before the intervention, the mothers' self-efficacy was almost the same in both groups, whereas after the intervention, there was a significant difference between the two groups in this regard, which shows that HBM-based education can improve anxiety management, adherence to follow-up examinations, and increase maternal self-efficacy, resulting in increasing vascularity and preventing eye disorders. Guilford *et al*.[34] showed that one of the main factors in performing breast cancer in women with high perceived self-efficacy are more committed to activities in the face of adversity and spend more time and effort doing things.

In the present study, the cue to action of mothers in managing anxiety showed a significant difference between the two groups after the intervention. These results were consistent with the study of Hazavehi *et al*.[35] This structure is divided into two categories of internal and external cue to action. In the present study, external cue to action was used to motivate mothers to pursue treatment and ultimately reduce anxiety. Most HBM-based studies also use external cue to action.[26,32,34] Contrary to this approach, Keshani *et al*.,[36] in their study to improve the quality of adolescent diet, used more internal cue to action. The probable cause of this problem goes back to the subject of the study. Adolescents are usually very interested in fitness, and this is an intrinsic motivation that can lead to dieting and sports activities in adolescents.

The limitation of this study was that parents used other sources such as media, cyberspace, newspapers, magazine, etc., to obtain information about their baby's illness, which was beyond the control of the researcher. It is recommended that a study be conducted using the HBM with a larger sample size and scope in other ophthalmological centers of the country.

Conclusion

The implementation of education based on the health benefit model had a positive and statistically significant effect on maternal anxiety, follow-up examinations, and retinal vascularization in infants with retinopathy of prematurity. With relying on the results of the present study, nurses and treatment staff can provide interventions and training in the NICU based on the health benefit model to the parents of hospitalized and premature infants.

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Conflicts of interest
There are no conflicts of interest.

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