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An Empirical Study of the PERMA Model of Positive Psychological Intervention for Parents of Preterm Infants Hospitalized in NICU

Qiu Guo (Corresponding Author), Shaohua Liu, Xin Fu, Xuelian Tian

Department of Pediatrics, Deyang People's Hospital

No. 173, Section 1, Taishan North Road, Jingyang District, Deyang City, Sichuan, China

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Abstract

In order to explore the effect of positive psychological intervention of PERMA model in parents of preterm infants hospitalized in NICU, 64 parents of preterm infants who were admitted to the NICU of Deyang People's Hospital between January 2024 and June 2024 within 24h after birth were selected by convenience sampling method as the study subjects. 32 parents of preterm infants in the control group implemented traditional nursing interventions, and 32 parents of preterm infants in the intervention group implemented positive psychological interventions based on the PERMA model on the basis of the control group. Through this study, the effects of the 2 nursing intervention methods were compared respectively. After the experiment, it is found that the CD-RISC scores, the FAD scores, the parental sense of parental competence (C-PSOC) scores and the satisfaction degree scores of parents of preterm infants in the intervention group were all significantly higher than those scores of parents of preterm infants in the control group ($P < 0.05$). Therefore, it could be drawn that positive psychological intervention based on the PERMA model could effectively improve the psychological condition of parents of preterm infants, enhance their family function, increase the parenting competence and satisfaction degree of parents of preterm infants, and enable parents of preterm infants to change their roles and face the occurrence of preterm births with a positive psychological state, and hence it is worthwhile to do further relevant research and popularize its application in clinical practice in the future.

Keywords: PERMA model, positive psychological interventions, preterm infants in NICU, parents of preterm infants

1. Introduction

The World Health Organization defines a preterm infant as “a fetus born at less than 37 weeks

of gestation or less than 259 days after a woman's last menstrual period" (Xingyanan et al., 2025). Unlike full-term newborns, preterm infants are prone to complications such as respiratory distress syndrome, bronchopulmonary dysplasia, cerebral hemorrhage, hypoxic-ischemic brain injury, sepsis, or feeding difficulties, which place a heavy burden on healthcare and families with preterm infants, and hence becomes a public health problem faced by countries around the world (Chen & Chen, 2022; de Figueiredo Vinagre et al. Chen & Chen, 2022; de Figueiredo Vinagre et al., 2022; Flannery & Puopolo, 2022; Gilfillan et al.). Although the current perinatal health care system is becoming more and more mature with the continuous development and advancement of health care system, the incidence of preterm infants is still high, and relevant studies have shown that there are about 15 million preterm infants worldwide each year, accounting for about 10.6% of the world's surviving fetuses, with Asia being one of the regions with the highest preterm infants' incidence (Chawanpaiboon et al., 2019). In China, relevant statistics show that the prevalence of preterm infants is about 6.09% and has been gradually increasing in recent years, with an annual growth rate of about 1.05%, which is the leading cause of perinatal mortality among Chinese children (Jing et al., 2020; Lu et al., 2020).

In the past few decades, with the improvement of neonatal medical technology, the survival rate of preterm infants has been greatly improved, the neonatal intensive care unit (NICU) as the main place for preterm infants, subject to medical diagnosis and treatment needs and hospital infection management and other requirements, preterm infants need to be treated independently in the NICU, which makes preterm infants' parents, who were originally worried about the prognosis of the infants' illnesses, have to suffer from separation anxiety again. This makes parents of preterm infants who are already worried about the prognosis of their children's diseases have to bear the separation from their children again, which generates separation anxiety, and at the same time, parents of preterm infants who become parents for the first time, the difficulty in changing their roles and the economic burden of the follow-up treatment of preterm infants will bring a great psychological impact to parents of preterm infants (Aagaard et al., 2015). Relevant studies have pointed out that the treatment of preterm infants in the NICU can cause preterm parents to develop adverse psychological emotions such as acute contingency disorder, post-traumatic contingency disorder, anxiety and depression (Aftyka et al., 2017). And unstable psychological emotions of parents of preterm infants can lead to great stress during subsequent feeding of preterm infants, making it difficult to establish benign parent-child relationship and thus detrimental to healthy growth and development of preterm infants (Lee et al., 2019). As a result, necessary psychological interventions are essential for parents of preterm infants receiving care in the NICU.

The PERMA model of positive psychological interventions is a theoretical framework of well-being proposed by Martin Seligman, the founder of positive psychology, which contains 5 core elements, namely positive emotions, engagement, relationships, meaning and achievement (Al-Hendawi et al., 2024). This psychological model guides individuals to cultivate positive and optimistic emotions, increase stress resilience, gain deep satisfaction by increasing personal attention, and advocate the establishment of positive social support and interpersonal relationships to gain a sense of well-being, fulfillment, and self-efficacy. The

psychological model meets the relevant requirements of the bio-psychosocial medical model, which is helpful in assisting patients or their families to identify and resolve their negative emotions in a timely manner, and is also suitable for Chinese culture and can better measure the well-being of Chinese adults (Nie et al., 2024; Sun et al., 2024). However, this psychological model has been less frequently used in psychological interventions for parents of preterm infants in the clinic so far across the world. Based on the current situation, the present study applied this psychological model to a positive psychological intervention for parents of preterm infants hospitalized in NICUs to investigate its effects on the psychological and family functioning of parents of preterm infants hospitalized in NICUs.

2. General Information and Methodology

2.1 General Information

This study adopts a classic experimental research method, using convenience sampling method to select the parents of preterm infants who were admitted to the NICU of Deyang People's Hospital in the neonatal department between January 2024 and June 2024 within 24h after birth as the study subjects. Inclusion criteria: (1) Preterm babies suitable for gestational age: birth weight＜2000g or gestational age＜32 weeks; (2) Time of preterm babies hospitalization≥7 days; (3) Age of preterm babies' parents≥20 years old; (4) Preterm babies whose parents were clearly conscious and able to cooperate with this study; (5) Parents had the basic reading and comprehension ability; (6) Parents gave informed consent to participate in this study. Exclusion criteria: (1) Parents who had a combination of serious physical or mental disorders, (2) Those who were unable to participate in the intervention for 2 consecutive times, and (3) Those who had left for the field due to changes in the family's business. The final calculation of the study was based on the formula "$n1=n2=2[(u\alpha+u\beta)/(\delta/\sigma)]2+0.25u\alpha2$" required for the comparison of the means of the 2 samples, where $u\alpha$ and $u\beta$ are the values of u corresponding to the test level α and the probability of type II error β, respectively, δ is the value of the difference between the 2 overall means, and σ is the overall standard deviation. The 2-sided α takes the value of 0.05, 1-β takes the value of 0.90, assuming $\delta/\sigma=0.95$, obtaining the effective sample size of 26 cases for each of the 2 groups. Considering the exclusion of samples, sample size was increased by 20%, and thus 32 cases were included in each of the intervention and control groups. In the sample of 32 cases in the intervention group, there were 17 males and 15 females with preterm births, in which birth weights of 1579g-2326g with a mean birth weight of (1789.78±389.54)g, hospitalization days of 9-32 days with a mean hospitalization day of (15.82±9.38) days, parents of preterm births aged 21-39 years with a mean age of (29.78±6.49) years old, and the education level of parents of preterm infants: there were 28 cases with bachelor's degree or above, 26 cases with college education, and 10 cases with less than college education; among the 32 samples in the control group, there were 16 males and 16 females of preterm infants with birth weights of 1,481g-2,263g, and average birth weights of (1,752.62±362.81)g. The number of days of hospitalization ranged from 10-30 days, with an average of days of hospitalization (16.22±8.19) days, the age of the parents of preterm infants was 22-41 years old, with an average age of (30.72±7.13) years old, and as for the education level of the parents of preterm infants, there were 22 cases with bachelor's degree

or above, 24 cases with college education, and 18 cases with less than college education. By comparison, there was no significant difference in the general information of preterm infants and parents of preterm infants in the 2 groups (P＞0.05).

2.2 Methodology

2.2.1 Control Group

The control group implements traditional nursing interventions, the specific interventions are as follows: after the admission of children to the hospital, health care personnel actively communicate with parents of preterm infants, establish a good doctor-patient relationship, listen carefully to the demands of parents of preterm infants with a sincere attitude, try to understand the inner thoughts and concerns of the parents of preterm infants, give them effective persuasion and encouragement, and offer preterm infants' parents psychological support and guidance of the ability to take care of a baby.

2.2.2 Observation Group

The observation group implements PERMA-based positive psychological interventions on the basis of the control group, and the specific interventions are as follows:

2.2.2.1 Establishment of the PERMA-model positive psychological intervention team which consists of a pediatrician, a psychologist, a head nurse, and 3 specialized nurses.

2.2.2.2 Development of the positive psychological intervention program of the PERMA model: team members discussed the development of the first draft of the positive psychological intervention by reviewing the literature related to positive psychology, the PERMA model and preterm infants, combining with the expected goals of the clinical intervention, and consulting with the psychologists for assistance. 10 experts from tertiary general hospitals in Sichuan Province were invited to participate in the consultation process. The selection criteria for the experts were: (1) healthcare professionals with 10 years or more of clinical experience in neonatology or psychology; (2) intermediate or higher titles; (3) ≥5 years of research experience; and (4) interest in and active participation in the study. After 2 rounds of correspondence, the final positive psychological intervention program of the PERMA model was developed, and the total intervention time was 4 weeks.

2.2.2.3 Implementation of the PERMA model: (1) Guide parents of preterm infants to establish a positive perception of the disease and rational concepts (first week): we proactively and enthusiastically communicated with parents of preterm infants to assess the degree of awareness of the disease and the psychological condition of the preterm infants' parents, and used the correct and appropriate communication methods, such as glances, smiles, soothing and other non-verbal communication skills to bring us closer to their parents, and encouraged them to speak out their minds unfearful. Besides, we also encouraged parents of preterm infants to express their worries and anxieties, reasonably pointed out the irrationality and harmfulness of the ideas and beliefs, corrected the misperceptions of parents of preterm infants and carried out health education, introduced the positive cases in the past, enhanced the confidence of parents of preterm infants in the treatment, and guided the parents

of preterm infants to establish a positive and rational concept. (2) Guide parents of preterm infants to cultivate a sense of gratitude and establish positive emotions (P) (Week 2): we shared with parents of preterm infants the good and happy things in life, encouraged parents of preterm infants to pay more attention to the positive aspects in life, tried to cultivate a sense of gratitude, enhance positive emotions, and helpt them learn to think positively, e.g., instead of thinking negatively about the negative emotions: the baby is still in hospital, why not switch to positive emotions? Think positively like: the baby will be discharged from the hospital in a few days, we should feel happy, relived and comfortable. Parents of preterm infants were instructed to learn to relax, to recall and record daily the things that moved them deeply and people they needed to thank, so as to improve their happiness index, and to provide timely support to parents of preterm infants who showed a positive mindset. (3) Engagement (E) and establishment of positive interpersonal relationships (R) (Week 3): Parents of preterm infants were explained the positive effects of the “Blessed Flow” state, and relevant activities were carried out according to the preterm parents' preferences, such as calligraphy, handicrafts, and traveling, so that parents of preterm infants could be engaged in these activities to prevent them from focusing only on the condition of the preterm infant, which could lead them into a state of anxiety, and to promote a positive attitude toward life among parents of preterm infants. These endeavours would prevent parents from focusing solely on the condition of the preterm baby and getting themselves into a state of anxiety, and promote the creation and formation of a positive psychology in preterm parents. Meanwhile, we explaint to parents of preterm infants the importance of positive interpersonal relationships and appropriate communication skills, instructed parents of preterm infants to role-play with their family members around the 4 response modes: positive active, positive passive, negative active, and negative passive, and through role-playing, making parents of preterm infants realize the role and vitality of positive communication, thus to promote positive communication among parents of preterm infants, and establish good interpersonal relationships among parents. (4) Meaning (M) and Realizing Achievements and Goals (A) (Week 4): We helpt parents of preterm infants to explore the meaning of life, such as family and social responsibilities, to establish a sense of purpose, to take good care of themselves and their children, to set short-term goals, and to learn about their own physical tolerance. We provided preterm parents with guidance on caregiving abilities, gave positive recognition and encouragement for each ability or operation they have accomplished, guided preterm parents to share their own sense of accomplishment and positive psychological experiences with each other, and explaint the positive psychological effects of accomplishment. At the same time, parents of preterm infants were encouraged to make use of their own strengths to do what they were good at, so that they could gain a sense of accomplishment, and parents of preterm infants were also guided to use their own strengths in their daily care of their infants.

2.3 Evaluation Criteria

2.3.1 Psychological Resilience Evaluation

The Psychological Resilience Scale (CD-RISC) (Kuiper et al., 2019) was used to evaluate the stress tolerance and coping ability of parents of preterm infants in the 2 groups of this study. The scale was developed by Connor Davidson et al. from Duke University in the United

States in 2003 on the basis of the study of post-traumatic stress disorder (PTSD), and the Chinese version of the CD-RISC was translated and revised by Xiao Nan et al. to assess the psychological resilience of the Chinese population. The Cronbach's alpha coefficient of the scale is 0.91, and the Cronbach's alpha coefficients of each subscale range from 0.50 to 0.83. The Chinese version of the CD-RISC scale consists of 25 items, including the dimensions of resilience, strength, and optimism, and adopts a 5-point Likert Scale, with 0 representing “never” and 4 representing “almost always”, and the total score ranges from 0 to 100, in which the higher the score, the higher the level of psychological resilience (Wang et al., 2022).

2.3.2 Family Function Assessment

Family Assessment Device (FAD) was used (Beierlein et al., 2017) to determine the functioning of various aspects of the family system of the parents of the children in the 2 groups in this study. The scale has 60 entries, each with 4 options: very much like my family, like my family, not like my family, not like my family at all, which are scored as 1, 2, 3, and 4 points (some entries are reverse scored as 4, 3, 2, and 1 points).The FAD consists of 7 sub-scales including Problem Solving, Communication, Role, Emotional Response, Emotional Involvement, 6 dimensions of Behavioral Control and a General Functional Rating.

2.3.3 Parenting Competence of Parents of Preterm Infants

The Chinese version of the Parenting Sense of Competence Scale (C-PSOC), which is suitable for use by Chinese people, was used in this study to evaluate the parenting competence of parents of preterm infants in both groups (Li et al., 2021). The overall Cronbach's alpha coefficient, Cronbach's alpha coefficient of the efficacy dimension, and Cronbach's alpha coefficient of the satisfaction degree dimension of the scale were α=0.82, α=0.80, and α=0.85 respectively, which had a high degree of validity and reliability and high practicality of quantitative analysis in the sense of parental competence of newborn parents in China. The scale contains a total of 17 entries in 2 dimensions of efficacy (8 entries) and satisfaction degree (9 entries), of which questions 2-5, 8, 9, 12, 14, and 16 adopt the reverse scoring rule, and the total scale has a maximum score of 102 points and a minimum score of 17 points, with the higher scores indicating the higher level of parenting competence of parents of preterm infants.

2.3.4 Satisfaction Degree Index

A self-made questionnaire was used to make a comprehensive assessment from the service attitude, language communication, professional skills, and intervention process of the healthcare personnel, and the questionnaire was divided into 4 grades: very satisfied, satisfied, generally satisfied, and dissatisfied, of which the higher the percentage of very satisfied and satisfied, the higher the level of satisfaction degree represented by the parents of the affected children.

2.4 Statistical Methods

All data were statistically analyzed by SPSS 26.0, and statistical significance was indicated when P<0.05. For general information, frequency, percentage, （$\bar{x} \pm s$） were used for statistical description. Measurement data were statistically analyzed by Independent Samples T-test, and count data were statistically analyzed by Chi-square Test. The data of the Psychological Resilience Scale (CD-RISC), Family Functioning Scale, and Parental Competence Measurement Instrument for Parents of Preterm Infants were statistically described by （$\bar{x} \pm s$）, and statistically analyzed by Independent Samples T-test and Repeated Measures Analysis of Variance (ANOVA).

3. Results

3.1 Comparison of the psychological resilience scale (CD-RISC) scores of parents of preterm infants in the 2 groups revealed that the CD-RISC scores of parents of preterm infants in the intervention group were significantly higher than those of the control group (P < 0.05), as shown in Table 1.

Table 1. Comparison of the Psychological Resilience Scale (CD-RISC) Scores of Parents of Preterm Infants in the 2 groups ($\bar{x} \pm s$, points)

Group	No.	CD-RISC Scores
Intervention Group	64	89.35±4.89
Control Group	64	78.68±5.26
t		11.885
P		0.000

3.2 Comparison of Family Assessment Device (FAD) scores of preterm infants in the 2 groups revealed that the FAD scores of preterm infants in the intervention group were significantly higher than those of the control group (P < 0.05), as shown in Table 2.

Table 2. Comparison of Family Assessment Device (FAD) Scores of Preterm Infants in the 2 groups ($\bar{x} \pm s$, points)

Group	No.	Problem Solving	Communication	Role	Emotional Response	Emotional Involvement	Behavioral Control	General Functional Rating
Intervention Group	64	9.32±1.89	13.65±3.78	19.67±3.33	8.67±1.78	10.33±1.84	14.78±2.89	18.53±4.13
Control Group	64	18.59±3.17	25.89±6.39	30.67±5.80	16.88±2.83	19.65±3.86	26.48±2.37	32.18±4.52
t		20.094	13.189	13.158	19.646	17.436	25.043	17.835
P		0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.3 Comparison of parenting competence of parents of preterm infants in the 2 groups revealed that the scores of the Parenting Competence Scale for Parents of Preterm Infants

(C-PSOC) in the intervention group were significantly higher than those of the parents of preterm infants in the control group (P < 0.05), as shown in Table 3.

Table 3. Comparison of Parenting Competence Scale (C-PSOC) of Parents of Preterm Infants in the 2 Groups ($\bar{x} \pm s$, points)

Group	No.	C-PSOC Scores
Intervention Group	64	92.46±6.21
Control Group	64	83.55±7.63
t		7.246
P		0.000

3.4 Comparison of the satisfaction degree of parents of preterm infants in the 2 groups revealed that the satisfaction degree of parents of preterm infants in the intervention group was significantly higher than that of the control group (p<0.05), see Table 4.

Table 4. Comparison of the Satisfaction Degree of Parents of Preterm Infants in the 2 Groups (n, %)

Group	No.	Very Satisfied	Satisfied	Generally Satisfied	Dissatisfied	Satisfaction Degree
Intervention Group	64	28（43.75%）	34（53.13%）	2（3.12%）	0（0.00）	62（96.88%）
Control Group	64	12（18.75%）	36（56.25%）	14（21.88%）	2（3.12%）	48（75.00%）
t						12.671
P						0.000

4. Discussion

4.1 Positive Psychological Interventions Based on the PERMA Model Could Be Effective in Improving the Psychological Status of Parents of Preterm Infants.

Preterm and low-birth-weight infants are an important cause of death of children under 5 years old worldwide (Kleinhout et al., 2021). In recent years, the birth and survival rates of preterm infants in China have both improved significantly (Zhang et al., 2022), but when intervening in the treatment of preterm infants one has to be aware of the negative impacts of preterm infants in the NICU on parents and their families, and preterm infants' parents urgently need to be provided with psychological support from the healthcare team (Sabnis et al., 2019). Positive psychological interventions constructed with the PERMA model emphasize the use of optimal human potential, strengths, and functioning by implementing emotional, thought, and behavioral interventions to help intervenees achieve well-being and health (Bazargan-Hejazi et al., 2021). In this study, we used the positive psychological intervention of the PERMA model to improve the psychological resilience of parents of preterm infants in the intervention group, also because the positive psychological intervention constructed by the PERMA model focuses

on the negative psychological conditions of parents of preterm infants, and positively guides the parents of preterm infants to be able to face the current situation of preterm hospitalization openly, and to avoid overly caring about the preterm infant's health condition and plunging themselves into pessimism. Thus, the positive psychological intervention based on the PERMA model could effectively improve the psychological resilience of parents of preterm infants, and help parents of preterm infants establish a positive and optimistic attitude toward life ahead and caring their newborn babies on their own.

4.2 Positive Psychological Intervention Based on the PERMA Model Could Effectively Improve the Family Functioning of Families With Preterm Infants.

The treatment of preterm infants in the NICU will seriously affect the family function of preterm infants and bring a heavy burden to the family. Families with preterm infants may experience anxiety due to the unstable condition of the child, the potential risks of treatment, and the separation anxiety between mother and child, and the secluded treatment environment may aggravate the separation anxiety of mother and child, affecting the establishment of benign parent-child relationship, which may lead to the inability of preterm parents to adapt to their roles and break the inherent harmonious rhythm of life in the family. Coupled with the high cost of medical care, it exacerbates the financial burden of the families with preterm infants (Ginsberg et al., 2024). Positive psychological intervention care based on the PERMA model helps parents of preterm infants explore the significance of assuming family and social responsibilities, establish a sense of short-term goals, pay attention to the positive aspects in life, cultivate a sense of gratitude, and learn to think positively about problems, hence reshaping the family's functioning, and laying the foundation for the establishment of close parent-child relationships for the preterm infants after their discharge from the hospital.

4.3 Positive Psychological Intervention Based on the PERMA Model Could Effectively Improve the Parenting Competence and Satisfaction Degree of Parents of Preterm Infants.

Relevant studies have pointed out that parents of preterm infants treated in NICUs often show high levels of mental stress, mainly due to the fact that parents of preterm infants have to worry about their children's physical conditions before they are able to adapt to their roles as competent parents, and the occurrence of preterm labor deviates from the expectations of parents of preterm infants for the fetus, causing the parents of preterm infants lack confidence in parenting their preterm infants as a result (Seiiedi-Biarag et al. 2020). In this study, the PERMA model, as an extended framework of positive psychology, was used to help parents of preterm infants to face the challenges of parenting with an optimistic attitude through positive gratitude exercises, helping parents to alleviate negative emotions, guiding preterm parents to enter into a state of “blissful flow” to improve the focus degree of preterm parents, and setting short-term achievable parenting goals so that preterm parents could continuously improve their sense of self-efficacy. The short-term achievable parenting goals were formulated so that parents of preterm infants could continuously improve their sense of self-efficacy, and thus the parenting competence of parents of preterm infants in the intervention group was significantly higher than that of parents of preterm infants in the control group as shown in the tables. Besides, the positive psychological intervention based on the PERMA model could effectively

improve the psychological condition of parents of preterm infants, enhance their family functioning, and improve the parenting competence of parents of preterm infants, so that parents of preterm infants could smoothly change their roles, and face the preterm birth with a positive psychological state, and thus the satisfaction degree of parents of preterm infants in the intervention group is significantly higher than that of the control group.

5. Limitations and Summary

The occurrence of a preterm birth event could be a stressful event for families of preterm infants, and parents of preterm infants are in great need to obtain psychological support from medical personnel and experts to help parents of preterm infants survive this crisis emergency. In this study, a positive psychological intervention using the PERMA model resulted in a significant improvement in the negative psychological status of parents of preterm infants, enabling them to face the preterm birth event with a positive psychological state and helping them to build up their self-confidence in parenting.

However, this study still has some limitations. First, this study was conducted in a small prefecture-level hospital in China rather than a major metropolitan city, and the sample size included was relatively small, which could not represent the entire population and be a typical case in this region. Additionally, the parents of preterm infants included in the study had a relatively high level of literacy and were able to understand the content and significance of the study; however, whether the effect of the intervention was still present and obvious in the less-educated population needs to be further observed. In the near future research, we will try to extend the implement model in major metropolitan hospitals and expand the scope of the psychological intervention of the PERMA model in order to verify the effectiveness of the intervention.

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Competing interests

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Obtained.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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