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Interactions among dyadic coping, self-efficacy, and negative emotions in Chinese parents of children with leukemia

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Abstract

Background and aim The prevalence of childhood leukemia in China has been on the rise, imposing significant psychological burden on parents. Currently, few studies have explored the dyadic coping status of parents of children with leukemia and its influencing factors. This study aimed to investigate the associations among dyadic coping, self-efficacy, anxiety and depression in parents of children with leukemia.

Methods A cross-sectional design was performed to conveniently sample 342 parents from the pediatric hematology ward of Peking University People's Hospital. The general demographic information, dyadic coping inventory, general self-efficacy scale, and hospital anxiety and depression scale were collected and analyzed using SPSS.22.0 software.

Results The average age of the parents was (37.29 ± 5.73) years, while the total score of dyadic coping was 122.95 ± 16.68, the self-efficacy score was 25.03 ± 3.93, anxiety score was 15.58 ± 3.59, and depression score was 16.27 ± 3.86. Dyadic coping was significantly positively correlated with self-efficacy ($r = 0.386$, $P < 0.01$), and negatively correlated with parental anxiety and depression scores (r=-0.372; r=-0.264; $P < 0.01$). Multiple linear regression revealed that self-efficacy($\beta = 0.262$), anxiety(β=-0.242), income per month (RMB,$\beta = 0.182$), knowledge of the child's illness($\beta = 0.138$), number of relapses(β=-0.135), current treatment programs(β=-0.149), education level($\beta = 0.101$) and the duration of diagnosis($\beta = 0.092$) were significant factors influencing the parents' dyadic coping level ($R^2 = 0.378$, $P < 0.01$).

Conclusion The dyadic coping level of parents of children with leukemia is generally moderate, is positively correlation with self-efficacy and negatively correlated with anxiety. Therefore, interventions targeting dyadic interactions between parents should be established to improve parental communication, foster coping mechanisms under stress, and alleviate the negative emotional responses.

Keywords Dyadic coping, Leukemia, Hematologic cancer, Pediatric, Parents, Cross-sectional study

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Introduction

The Global Burden of Childhood Cancer report [1], estimates that leukemia constitutes nearly 30% of all malignant neoplastic illnesses in children and is the leading cause of death in children. In 2020, 66,000 new cases of childhood leukemia were reported [2], with approximately 40,000 cases occurring in China each year [3]. Notably, the incidence rate of this condition in China exceeds the global average, standing at 125.72 per million compared to the global rate of 34 per million [4]. This suggests that leukemia is a major disease that threaten the health of Chinese children.

The recent emergence of new targeted therapies, immunotherapy, and other treatment modalities [5, 6], have improved the remission rate of children with acute lymphoblastic leukemia to 90%, with the 5-year survival rate reaching as high as 72% [7]. However, the treatment cycle often requires 2–3 years, with costs ranging from 1 to 10 million RMB, which imposes a significant economic burden on families, with about 95.56% of the affected families experiencing significant challenges arising from the high medical expenses [8]. It has been reported that parents with a child diagnosed with leukemia suffer from mental stress [9]. A considerable proportion of parents experience severe psychological issues soon after diagnosis, including anxiety, acute or post-traumatic stress symptoms, uncertainty, and guilt [10, 11]. In these parents, the rates of anxiety rates are estimated to be 87.8%, while depression rates are as high as 45.9% [12], both significantly decreasing their quality of life.

Considering the age-specific characteristics of children with leukemia, the entire diagnostic and treatment process requires the active involvement and presence of parents and other family members [13]. In addition, parents play multiple critical roles in the care of children with leukemia. For instance, they act as treatment decision-makers, working in collaboration with doctors to evaluate the benefits and risks of various interventions. They also act as caregivers, managing the daily needs of the children such as diet and medication. Parents are important conveyors of the child's condition to healthcare teams and family members; providing emotional support, enhancing the child's confidence in adhering to treatment instructions, and offering financial support. However, these roles are a source of stress, anxiety, and depression, negatively affecting the patient's mental health [14]. Moreover, sex differences have been shown to affect parental coping strategies, with mothers more likely to express concerns and seek emotional support, while fathers tend to internalize stress and are less open to expressing emotions [15]. Although these differences may create marital tension and conflict, in some cases, they foster stronger bonds between partners. Moreover, parental emotions, mental health, and behaviors significantly affect the children's disease outcomes and quality of life [16, 17]. This calls for the need to explore the emotional and mental health of parents of children with leukemia.

Dyadic coping refers to couples' shared reactions and techniques in the face of stressful events [18], whereas individual parental stress management emphasizes the independent application of self-regulation strategies (e.g., relaxation, cognitive restructuring) to cope with stress. According to the Systemic Transactional Model of Couple Stress and Coping [19], stressors always affect both partners in an intimate relationship, either directly or indirectly, and couples face increased psychological stress when the stress affects both partners (i.e., shared stress, in cases such as a child diagnosed with cancer). Therefore. stress and coping are key systemic issues affecting relationship dependency and interplay.

Most studies investigating the psychological effect of leukemia in children have focused on individual parents rather than examining the coping responses of both parents together in response to this shared stressor. Only a few scholars in Western countries have explored the relationship between coping strategies of parents of children with hematologic cancers and specific psychological outcomes, such as fear of disease recurrence [20]. It has been shown that, when a child is diagnosed with cancer, parents often adopt different forms of dyadic coping, including positive dyadic coping [21]. This approach not only mitigates individual negative emotions but also enhances the stability of the parental relationship, by improving factors such as marital quality and health status.

In China, research on dyadic coping among parents of children with leukemia is limited. Most studies and psychological interventions focus on one parent rather than the couple as a unit. This gap may compromise the effectiveness of psychological interventions. While dyadic coping has been explored in illness management among Chinese adult couples (e.g., early dementia [22], infertility [23], or breast cancer [24]), its application in leukemia-affected parent dyads remains underexplored. Investigating dyadic coping strategies and mental health among parents of children with leukemia in China is essential. Implementing public health interventions, such as financial assistance and psychological support programs, can enhance social support for affected parents, promote family harmony, and facilitate the recovery and development of children with leukemia. Additionally, this approach will provide a theoretical basis for developing culturally appropriate dyadic coping interventions tailored to the Chinese population.

This study aimed to: (1) assess the levels of dyadic coping, negative emotions (anxiety, depression), and self-efficacy in parents of children with leukemia; (2) explore the relationships between dyadic coping and self-efficacy,

anxiety, and depression; and (3) to identify the primary factors influencing dyadic coping in these parents.

Materials and methods

Setting, study population, and sample selection

A cross-sectional, single-center design was adopted in this study. Between March and November 2022, convenience sampling was employed to identify suitable volunteers in the pediatric ward of a sizable general hospital in Beijing. The recruitment involved the posting of flyers on the bulletin boards in pediatric wards and advertising the study during weekly health education lectures to parents of pediatric patients. Parents who expressed interest in the study were approached by the research team for further explanation of the study's purpose and survey methods. The inclusion criteria were: children of at least 17 years old, diagnosed with leukemia through clinical, imaging, and cytological examinations, with stable vital signs, from married or cohabiting couples, and provided informed consent to participate. The exclusion criteria included: patents with cognitive impairment and unable to interact with one another or work together; the parents have recently gone through terrible experiences such as catastrophic accidents or death of loved ones.

Parents who met the inclusion criteria and voluntarily agreed to participate in the study were scheduled to gather in the pediatric demonstration room. The meetings were generally held in the afternoons when there were fewer treatments for the children. All participants signed informed consent forms prior to the study. Standardized instructions were provided before completion of the paper-based questionnaires, and the participants were informed of the importance of filling the questionnaire honestly and completely based on their true thoughts. Participants were instructed to seal the completed questionnaires in envelopes.

This study was approved by the Institutional Review Board of Peking University People's Hospital (2021PHB277-001). Moreover, this study is reported following the Strengthening the Reporting of Observational Studies in Epidemiology checklist (STROBE) (See Supplementary File 1) guidelines. The study conformed to the Declaration of Helsinki.

The sample size was calculated using the G*Power 3.1 software with an 80% power and $\alpha = 0.05$ to ensure statistical robustness [25]. Twenty-three dependent variables were included, with an average effect size of 0.15 [26]. Considering that 20% of the questionnaires were invalid, a minimum of 200 samples were needed to obtain the appropriate sample size. A total of 342 parents of children with leukemia were enrolled, with ages ranging from 22 to 54 years and a mean age of 37.29 ± 5.73 years; 65.2% lived in towns and 34.8% in cities.

Measures

General information questionnaire

A self-administered general information questionnaire was adopted to collect data. The questionnaire contained two parts: (1) information on leukemia therapy for children: gender, age, disease type, clinical stage, and occurrence of problems. (2) General information of the child's parents, such as gender, age, education level, occupation, place of residence and per capita monthly family income.

Dyadic coping inventory, DCI

The quality of stress communication and dyadic coping when both partners in an intimate relationship confront stress from a dichotomous viewpoint was evaluated using the DCI developed by Bodenmann [27]. The Chinese version of the DCI that had been validated was utilized, which had good construct validity with Cronbach's α of 0.51–0.80 [28]. The questionnaire consists of 37 items, including Supportive Dyadic Coping (10 items); Common Dyadic Coping (5 items); Stress communication (8 items); Delegated dyadic coping (4 items); Negative dyadic coping (8 items); Evaluation of dyadic coping (2 items). Couples self-reported their coping activities, how they perceived their partner's coping behaviors, their views about shared coping behaviors, and their overall satisfaction level with coping behaviors. A 5-level scale of 1 (very rarely) to 5 (very often) was used, negative coping support was reverse scored, and the 2 items of the evaluation of dyadic coping were not counted in the total score, which was 35–175, with 111 as the critical value, 111–145 as the normal range, and greater than 145 as the higher level. Higher scores indicated more supportive coping behaviors that couples engaged in regularly, reflecting a better dyadic coping status. The DCI had a Cronbach's alpha = 0.881.

Hospital anxiety and depression scale

The Hospital Anxiety and Depression Scale was developed by Zigmond [29] in 1983, which include two subscales of anxiety and depression for evaluating anxiety and depression. In 1993, a Chinese scholar Ye Weifei [30] translated to create a Chinese version, with 14 items, of which 7 items assess depression and 7 items assess anxiety. Each item is scores from 0 to 3, with higher scores indicating a severe degree of depression. The reliability and validity of this tool were good. The Cronbach's alpha for the Hospital Anxiety and Depression Scale was 0.859.

General self-Efficacy scale, GSES

The GSES was developed in 1981 by Schwarzer et al. to evaluate people's confidence in their capacity to complete tasks [31]. The GSES, which is based on the Bandura's theory of self-efficacy, is theoretically sound and comprises only 10 items, making it robust and simple to administer. It has been found to exhibit high cross-cultural adaptability

and is the preferred scale for assessing self-efficacy internationally. In 2001, Wang et al.[32] obtained the internal consistency coefficient of the Chinese version of the GSES: Cronbach's alpha = 0.87, re-test reliability = 0.83, and folded half reliability = 0.82, suggesting that the scale has good reliability and good predictive validity. The scale uses a 4-point Likert scale, with "1 = not at all true" and "4 = completely true." Higher scores indicate greater self-efficacy, reflecting an increase in the participants' confidence in their abilities. The Chinese version of the GSES is currently widely used in China, particularly among families of children with oncology, especially leukemia [33]. In the present study, the Cronbach's alpha of the total scale of the GSES was 0.762, and the subscales ranged from 0847 to 0.884.

Data collection procedure

Initially, the study was approved by the Ethics Committee of Peking University's People's Hospital (Approval No. 2021PHB277-001). Four trained master's nursing nurses ($n = 2$) and undergraduate nursing nurses ($n = 2$) served as investigators. They described the aim of the survey to the respondents, obtained informed consent from those willing to participate. The surveys were distributed one-on-one and face-to-face, and each participant was instructed on how to complete them. The respondents filled the questionnaires independently and returned them on the spot. A total of 400 surveys were distributed, with 342 effective questionnaires returned, translating to effectiveness rate of 85.5%. The confidentiality of the data was ensured during the entire procedure.

Statistical analyses

All data were entered into the Microsoft Office Excel 2019 and analyzed using IBM SPSS Statistics 22.0. Univariate analysis methods, including t-tests and chi-square tests, were utilized to assess the impact of individual independent factors on the dependent variable. Pearson correlation analysis was conducted to examine relationships between variables. Multiple linear regression was selected for its ability to account for multiple variables, quantify their impact through regression coefficients, and provide clear and interpretable results. Multicollinearity between variables was explored using the variance inflation factor (VIF) and tolerance. We assessed the pattern of missing data using Little's missing completely at random(MCAR) test and confirmed that the data met the MCAR assumption. Multiple imputation was chosen over listwise deletion because it more effectively utilizes all available data, reduces bias in parameter estimation, and accounts for uncertainty due to missing data.

Results

Demographic and clinical characteristics of parents

A total of 342 parents of children with leukemia, with an average age of 37.29 ± 5.73 years and 88.9% were of the Han ethnic group, were enrolled in this study (Table 1). Overall, 50.58% of parents had a college education or higher. Among them, 37.4% had a monthly per capita income of more than 5,000 RMB. Moreover, 67.8% of the parents had partial knowledge about their child's disease and 57% of the children had acute lymphoblastic leukemia, with 46.7% of them receiving the first phase of chemotherapy.

Dyadic coping levels among the parents

The total dyadic coping score of parents with leukemia was 122.85 ± 16.68, which is considered moderate. The score dimensions for the parents' dyadic coping with self and perceived spouse partners are shown in Table 2. The mean stress communication score among the parents was 14.78 ± 2.95, and that of the parents' perceived spouse coping was 14.60 ± 2.84. Notably, there was no significant difference in stress communication between the parents and the parents' perceived spouse's coping ($t = 1.440$, $P = 0.15$, 95% CI[-0.07,0.04]). The mean supportive coping score among parents was 18.38 ± 3.67, and that of the parents' perceived spouse coping was 18.29 ± 3.29. It was observed that the parents' supportive coping and parents' perceived spouse coping as determined by the *T*-test ($t = 0.52$, $P = 0.61$, 95% CI[-0.37,0.22]) were comparable. The scores of delegated coping of the parents and the parents' perceived spouse were 6.54 ± 1.54 and 6.31 ± 1.49, respectively. Analysis of the *T*-test results ($t = 3.04$, $P = 0.003$, 95% CI[0.08,0.38]) revealed that the scores of parents' delegated coping and their perceived spouse were not markedly different. In addition, the negative coping scores of parents and parents' perceived spouses were 12.80 ± 3.01 and 13.14 ± 2.98, indicating significant differences between them ($t = 3.07$, $P = 0.002$, 95% CI[-0.55,-0.12]).

The relationship between dyadic coping and self-efficacy, anxiety, and depression

The total self-efficacy score of parents of children with leukemia was (25.03 ± 3.93), the anxiety score was (15.58 ± 3.59) and the depression score was (16.27 ± 3.86). Self-efficacy of the parents was positively correlated with the level of dyadic coping ($r = 0.386$, 95% CI[0.291,0.472], $P < 0.01$, Fig. 1A). On the other hand, anxiety (r=-0.372, 95% CI[-0.460,-0.277], $P < 0.01$, Fig. 1B) and depression scores of the parents were negatively correlated with the level of dyadic coping (r=-0.264, 95% CI[-0.360,-0.162], $P < 0.01$, Fig. 1C). The detailed results are shown in Table 3.

Factors associated with dyadic coping among parents of children with leukemia

To identify the influencing factors for the dyadic coping scores in the parents, univariate analysis was performed (Table 1). Notably, the scores for the duration of the diagnosis, the severity of the illness, treatment duration,

Table 1 Univariate analysis of dyadic coping score of parents of children with leukemia($n=342$)

Variables	Number	Score (Mean ± SD)	t/F	*P*
Parents				
Age(years)				
<30	25	118.88 ± 15.51	0.835	0.435
30~	203	123.43 ± 16.11		
40~	114	122.68 ± 17.90		
Gender				
Female	223	123.88 ± 16.47	0.097	0.756
Male	119	120.93 ± 16.97		
Ethnic				
Han	304	123.00 ± 17.03	1.228	0.299
Zang	17	122.59 ± 15.96		
Hui	7	129.00 ± 6.48		
Man	9	121.44 ± 12.42		
Tujia	5	108.20 ± 6.14		
Years of marriage (years)				
<10	132	121.88 ± 15.23	3.097	0.046
10~	153	125.68 ± 15.57		
20~	57	119.07 ± 21.55		
Education level				
Primary school or less	44	114.70 ± 15.10	7.983	<0.001
Middle school	55	117.53 ± 16.98		
High school	70	124.70 ± 16.81		
College or above	173	125.86 ± 15.95		
Living environment				
Urban	223	124.33 ± 15.81	2.263	0.241
Rural	119	120.07 ± 17.94		
Employment status				
Full-time(>35 h)	186	126.52 ± 17.09	4.571	0.207
Not employed	156	118.47 ± 15.10		
Income per month (RMB)				
<2000	78	118.18 ± 15.37	10.135	<0.001
2000~	136	119.84 ± 16.76		
5000~	52	127.23 ± 14.96		
8000~	76	130.01 ± 16.14		
Number of children				
1	145	123.03 ± 16.96	0.124	0.886
2	160	122.35 ± 16.03		
3	29	124.93 ± 18.58		
4	8	121.75 ± 19.97		
Knowledge of the child's illness				
unaware	74	115.09 ± 16.44	16.994	<0.001
partial understanding	232	123.67 ± 16.02		
well-informed	36	133.44 ± 14.42		
Children				
Gender				
Female	175	122.79 ± 16.92	-0.057	0.766
Male	163	122.90 ± 16.49		
Age(years)				
<3	69	122.81 ± 19.03	0.119	0.949
3–7	89	123.57 ± 14.36		
8–12	113	122.18 ± 16.51		
13–16	71	123.03 ± 17.53		
Duration of diagnosis				

Table 1 (continued)

Variables	Number				Score (Mean ± SD)	t/F	*P*
≤ 6 months	100				117.66 ± 14.58	5.503	0.001
7 months – 1year	112				123.32 ± 16.11		
1year~	61				125.82 ± 16.11		
2 years~	69				126.96 ± 15.71		
Cancer Diagnosis							
Acute lymphoblastic leukemia	195				123.17 ± 17.69	2.056	0.086
Acute myeloid leukemia	98				120.84 ± 15.10		
Acute Mixed Leukemia	14				132.71 ± 15.39		
Chronic Granulocytic Leukemia				18	119.11 ± 18.86		
other	17				126.53 ± 6.54		
Disease criticality							
Low risk	94				128.60 ± 15.66	7.860	<0.001
Medium risk	109				122.53 ± 15.23		
High risk	103				117.45 ± 18.31		
unknown	36				124.22 ± 13.82		
Treatment duration							
First treatment after onset of illness	160				120.71 ± 16.83	2.964	0.032
After the first treatment	84				122.13 ± 16.18		
Maintenance chemotherapy		60			126.73 ± 17.35		
Completed chemotherapy		84			127.29 ± 14.67		
Number of relapses							
0	97				124.48 ± 17.76	5.928	0.001
1	198				123.27 ± 14.72		
2	37				120.27 ± 20.39		
≥ 3	10				102.50 ± 15.65		
Current treatment programs							
Conventional Chemotherapy			170		125.25 ± 16.23	4.479	0.002
Conventional Chemotherapy + Targeted Agents			65		124.71 ± 17.74		
CART therapy				34	122.29 ± 16.43		
Stem Cell Transplant				52	115.77 ± 15.09		
Other				21	116.05 ± 15.63		

Table 2 Scores on dimensions of dyadic coping for parents of children with leukemia($n = 342$)

Item	Score(Mean ± SD)	Item	Score(Mean ± SD)
Stress communicated by oneself	14.78 ± 2.95	Delegated dyadic coping of the partner	6.31 ± 1.49
Stress communicated of the partner	14.60 ± 2.84	Negative dyadic coping by oneself	12.80 ± 3.01
Supportive dyadic coping by oneself	18.38 ± 3.67	Negative dyadic coping of the partner	13.14 ± 2.98
Supportive dyadic coping of the partner	18.29 ± 3.29	Common dyadic coping	17.98 ± 3.64
Delegated dyadic coping by oneself	6.54 ± 1.54	Evaluation of dyadic coping	7.29 ± 1.53

number of relapses, current treatment programs, knowledge of the child's illness, the years of marriage, education level of the parents, and income per month were statistically significant ($P<0.05$).

Linear regression analysis

To determine the factors affecting the dyadic coping methods of parents, multiple linear regression was performed. In this analysis, dyadic coping score served as the dependent variable, and factors found to be significant in the univariate analysis, as well as self-efficacy and anxiety, were included as the independent variables and assigned values as shown in Table 4. Moreover, VIF and tolerance were utilized to determine the existence of multicollinearity in this study. The residuals of the model were subjected to the Kolmogorov-Smirnov normality test, which yielded a p-value of 0.752. Considering this p-value, we did not reject the null hypothesis that the residuals adhere to a normal distribution at the significance level of $\alpha = 0.05$, suggesting that the residuals were normally distributed. In addition, the White's test was conducted to evaluate the homoscedasticity of the model, yielding a p-value of 0.893. This result indicated insufficient evidence to reject the null hypothesis of homoscedasticity at the $\alpha = 0.05$ significance level. The analysis indicated that the tolerance of the respective

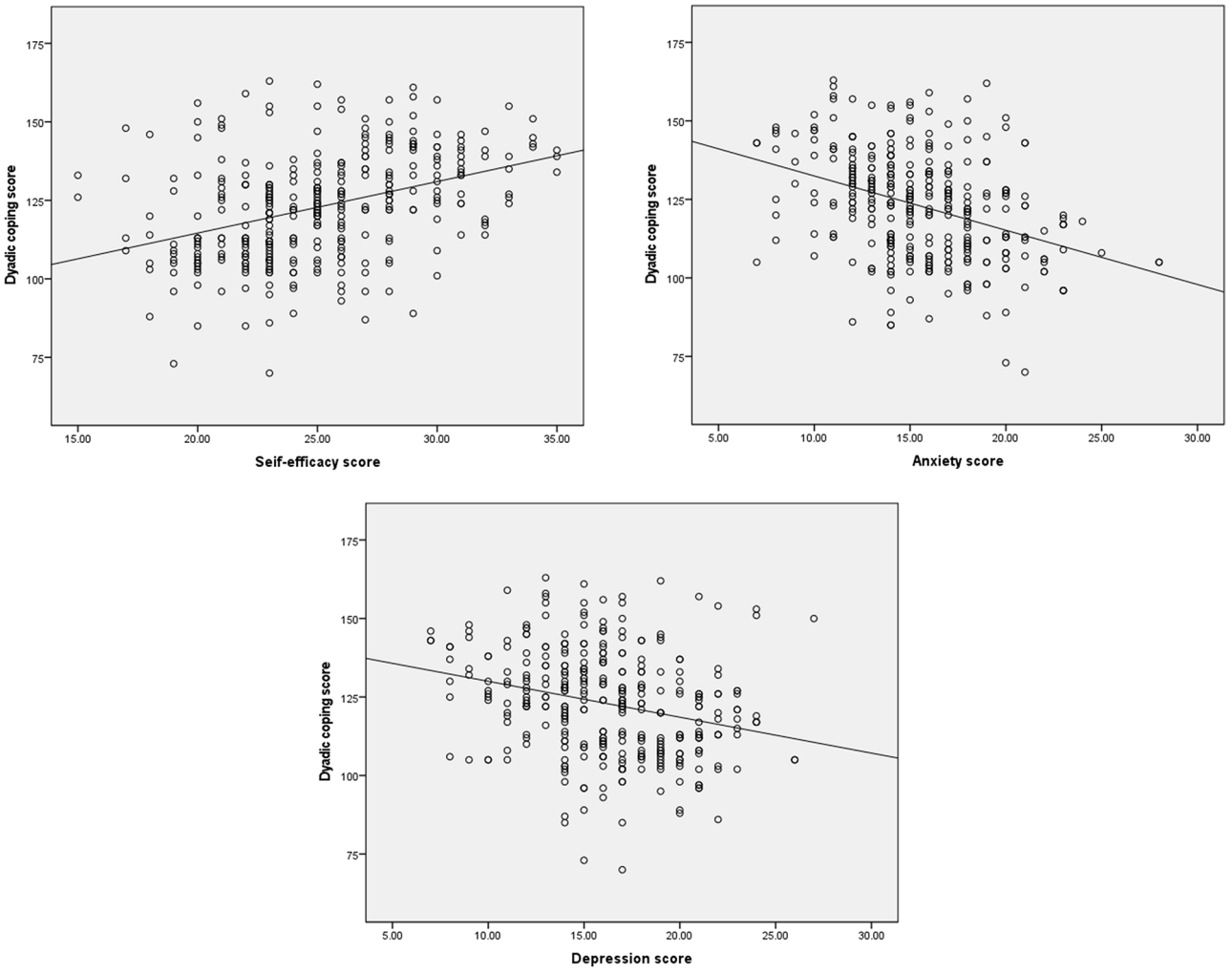

Fig. 1 Correlation analysis of the dyadic coping score and other factors. (**A**) Correlation analysis of dyadic coping and Self-efficacy; (**B**) correlation analysis of dyadic coping and Anxiety; (**C**) correlation analysis of dyadic coping and Depression

Table 3 Correlations between dyadic coping and self-efficacy, anxiety, and depression(r, $n = 342$)

Dimensions	Stress communicated by oneself	Stress communicated of the partner	Supportive dyadic coping by oneself	Supportive dyadic coping of the partner	Delegated dyadic coping by oneself	Delegated dyadic coping of the partner	Negative dyadic coping by oneself	Negative dyadic coping of the partner
Self-efficacy	0.339	0.333	0.306	0.368	0.102	0.047	0.140	0.137
Anxiety	-0.343	-0.374	-0.270	-0.358	0.036	-0.007	-0.188	-0.219
Depression	-0.222	-0.221	-0.190	-0.257	-0.014	-0.022	-0.151	-0.087

variables ranged from 0.54 to 0.95, which was > 0.25, and the VIF ranged from 1.05 to 1.15, which were both < 10.0 [34], suggesting no existence of multicollinearity in this study. Moreover, self-efficacy, anxiety, income per month, knowledge of the child's illness, number of relapses, the current treatment programs, education level, and the severity of the illness were found to be significant factors in the regression equation (Table 5). The F-test obtained $F = 26.030$, $P < 0.01$, indicating that the fitted equation was significant. $R^2 = 0.394$ and adjusted $R^2 = 0.378$, demonstrated that the eight independent variables explained 37.8% of the variance variability.

Discussion

To our knowledge, this is the first study to examine dyadic coping, self-efficacy, anxiety, depression, and their interrelations among parents of children with leukemia in China. The results presented here are expected to contribute to a deeper understanding of the psychological responses within this population and provide a

Table 4 Description of the assignment of independent variables

	Assignment method			
Knowledge of the child's illness	1 = unaware; 2 = partial understanding; 3 = well-informed			
Income per month(RMB)	1 = <2000; 2 = 2000~; 3 = 5000~; 4 = 8000~			
Education level	1 = Primary school or less; 2 = Middle school; 3 = High school; 4 = College or above			
Years of marriage (years)	1=<10; 2 = 10~;3 = 20~			
Duration of diagnosis	1 = ≤ 6 months;2 = 7 months~;3 = 1year ~;4 = 2 years~			
The severity of the illness	1 = Low risk;2 = Medium risk;3 = High risk;4 = unknown			
Number of relapses	1 = 0; 2 = 1; 3 = 2; 4 = ≥ 3			
Treatment duration(Xg)	(1)	(2)	(3)	(4)
First treatment after onset of illness	X1 = 1	X2 = 0	X3 = 0	X4 = 0
After the first treatment	X1 = 0	X2 = 1	X3 = 0	X4 = 0
Maintenance chemotherapy	X1 = 0	X2 = 0	X3 = 1	X4 = 0
Completed chemotherapy	X1 = 0	X2 = 0	X3 = 0	X4 = 1
Other	X1 = 0	X2 = 0	X3 = 0	X4 = 0
Current treatment programs(Xg)	(1)	(2)	(3)	(4)
Conventional Chemotherapy	X1 = 1	X2 = 0	X3 = 0	X4 = 0
Conventional Chemotherapy + Targeted Agents	X1 = 0	X2 = 1	X3 = 0	X4 = 0
CART therapy	X1 = 0	X2 = 0	X3 = 1	X4 = 0
Stem Cell Transplant	X1 = 0	X2 = 0	X3 = 0	X4 = 1
Other	X1 = 0	X2 = 0	X3 = 0	X4 = 0
Parental self-efficacy	Entered as the raw value			
Parental anxiety and depression	Entered as the raw value			

Treatment duration and Current treatment programs need to set dummy variables

Table 5 Multiple linear regression analysis of parents' dyadic coping score($n = 342$)

Item	**B**	**SE**	**β**	**95% CI**	**t**	***p***
Constant	102.932	7.544		(88.09;117.77)	13.644	<0.001
Self-efficacy	1.133	0.194	0.262	(0.732;1.494)	5.836	<0.001
Anxiety	-1.125	0.207	-0.242	(-1.533;-0.717)	-5.426	<0.001
Income per month (RMB)	2.842	0.700	0.182	(1.466;4.218)	4.063	<0.001
Knowledge of the child's illness	4.135	1.351	0.138	(1.478;6.792)	3.061	0.002
Number of relapses	-3.192	1.070	-0.135	(-5.296;-1.087)	-2.984	0.003
Current treatment programs	-1.871	0.551	-0.149	(-2.955;-0.787)	-3.395	<0.001
Education level	1.546	0.703	0.101	(0.162;2.930)	2.198	0.029
Duration of diagnosis	1.397	0.683	0.092	(0.054;2.740)	2.046	0.042

Note: 12 predictor variables initially enter the regression model. $R = 0.628$, $R^2 = 0.394$, after adjustment $R^2 = 0.378$, $F = 26.030$, $P<0.01$

foundation for developing future interventions targeting dyadic coping.

The total score of dyadic coping was 122.85 ± 16.68, which is considered moderate. The relatively low scores may be influenced by several cultural factors unique to China. Notably, Confucian values emphasize family honor, responsibility, and strong interpersonal bonds within the family. Following a diagnosis of leukemia in a child, parents are expected to take up the responsibility and commitment of caring for the Child. They place family stability above their own well-being and tend to suppress personal emotions, opting for endurance and self-sacrifice. Chinese culture places significant expectations on parents to nurture, educate, and protect their children. To improve the child's health and create a good future for them, parents are often willing to endure substantial psychological and financial pressures. Additionally, cultural norms in China promote reserved emotional expression. Parents of children with leukemia frequently internalize their emotions and avoid showing vulnerability in front of family members. This may lead to inadequate emotional communication between spouses, which could negatively affect the psychological support they offer one another. The treatment and relapse of childhood leukemia impose significant stress on parents, reducing their quality of life and dyadic coping levels [20]. In this study, we found that parents of children with leukemia scored higher on perceived spousal support and delegated coping, which is consistent with previous studies [21]. This observation is influenced by the individual

parents' subjective experiences, self-perception biases, emotional expression, and perceptions of roles and responsibilities [35, 36]. It should be noted that, each parent often prioritize their own stress, potentially overlooking their spouse's contributions to stress communication and support. Furthermore, differences in communication skills, emotional expression, and the willingness to seek spousal support can affect perceived levels of support. In cases where a patient perceives an unequal distribution of parenting roles and responsibilities, they may overlook spousal support, even when it is provided.

In the present study, we found that mothers demonstrated higher levels of dyadic coping than fathers, particularly in stress communication, which is consistent with the women's generally stronger abilities to express their stress situation and social support [20]. Compared to the findings of Van et al. [21], Chinese mothers has higher scores of negative coping when dealing with their child's illness. This is likely associated with their position as primary caregivers and the cultural anticipation of more expressive emotional behavior in women. Chinese mothers experience greater stress compared to fathers in Western cultures, where fathers are more actively involved in caregiving. Furthermore, cultural norms in China encourage women to express their emotions more openly, while men are expected to remain stoic and suppress their feelings [37]. These gender stereotypes may exacerbate the mothers' negative emotional responses when coping with their child's illness. These results suggest that nurses should pay attention to the emotional fluctuations and dyadic coping patterns of parents of children with leukemia. They should provide timely and supportive guidance to foster positive coping mechanisms, enhance marital relationships, and improve overall dyadic coping levels.

Further analysis, revealed with higher educational level, greater per capita income, and better knowledge of their child's illness demonstrated higher levels of dyadic coping. Higher education equips parents with stronger information processing, critical thinking, and communication skills, facilitating knowledge acquisition and effective stress communication [38]. On the other hand, higher economic status enables access to resources, such as information on the child's illness, medical care, and social support, which enhances parents' confidence in managing the disease [39]. It has been shown that understanding the disease can reduce anxiety, improve treatment adherence, and increase access to care [40]. Notably, education, income, and disease knowledge interact to provide parents with more psychological and social resources. The present results indicate that healthcare providers should prioritize support to parents with lower education levels and incomes, especially providing them with disease-related education, offering supportive resources, and promoting the adoption of positive coping strategies.

Previous investigations have shown that parents' emotional experiences and coping strategies vary with their understanding level of the child's illness, treatment stage, and disease progression [40]. The result further revealed that parents of children diagnosed within six months of disease onset and initial treatment had lower levels of dyadic coping. This may be due to their recent confrontation with the traumatic diagnosis and the fear, uncertainty, and negative emotions about the disease's progression trajectory. The recurrence of the child's illness led to severe anxiety and depression in the parents, causing their initial psychological defenses to collapse and further weakening their dyadic coping abilities [41]. Therefore, following the initial diagnosis and chemotherapy, healthcare providers need to continue providing support to the parents, offer medical information, psychological counseling, and economic assistance to increase their confidence in managing the disease. This requires an effective doctor-patient communication and active help-seeking channels to reduce the psychological burden on parents and promote positive dyadic coping. There is also a need to offer psychological support and medical interventions for parents experiencing a relapse.

Parents' self-efficacy was strongly positively correlated with dyadic coping, while anxiety exhibited a negative correlation. Self-efficacy refers to the belief in one's ability to successfully perform tasks or overcome challenges [42]. According to Bandura's self-efficacy theory [43], parents of children with leukemia who have high self-efficacy are more active in communicating with their spouses, seeking support, and collaboratively developing coping plans when facing disease-related stress. This interaction pattern not only alleviates individual anxiety but also enhances family functioning stability and significantly strengthens dyadic coping skills. Anxiety, as a negative emotion, can significantly impact parental communication [44]. While parents in Western cultures often manage stress by openly discussing their child's illness, Chinese parents typically adopt a different approach by concealing the diagnosis and relying on internal communication and implicit support. This tendency to withhold information may, in turn, affect the family's overall ability to cope effectively with the disease. Therefore, in clinical practice, clinicians should view the parents of children with leukemia as a unit and focus on dyadic interactions. Furthermore, coordinating family roles, boosting self-efficacy, and constructively managing negative emotions can improve family resilience and relationship satisfaction.

Implications for clinical practice

This study has several strengths. First, this is the first investigation to explore dyadic coping among parents of children with leukemia in China, with the results

Table 6 Professional counseling intervention strategy content

Time schedule(Week)	Intervention content
1–4	Assess parental psychological states and family functioning, develop personalized intervention plans, and teach anxiety expression and relaxation techniques
5–8	Couples' joint counseling with case analysis to practice positive communication, joint decision-making, and mutual support
9–12	Consolidate and evaluate intervention effects; provide follow-up support recommendations

Table 7 Peer support group intervention strategy content

Time schedule(Week)	Intervention content
1	Orientation and introduction of course goals
2–3	Sharing personal experiences and building trust
4–5	Learning dyadic coping strategies and emotional support through group discussions and case analysis
6–7	Role-playing activities to practice coping strategies in common stress scenarios
8–9	Sharing experiences and outcomes of using dyadic coping strategies
10	Summary and closure

revealing the status of parents' dyadic coping levels and their influencing factors. Second, we explored the various aspects of pressure communication, supportive dyadic coping, negative dyadic coping, and empowerment among parents managing their child's illness, contributing to a better understanding of both individual and relational outcomes. Third, our findings may guide healthcare professionals to develop targeted interventions for parents with low dyadic coping, focusing on improving interactions between parents. Future interventions should include various support resources. These include regular psychological counseling sessions (1 session per week for 12 weeks, specific intervention strategies are shown in Table 6). Online Support Platforms: Information sharing and chat rooms for mutual support. Peer Support Groups: Weekly sessions (2 h each, for 10 weeks), recruiting 10–15 pairs of parents per group, Specific intervention strategies are shown in Table 7. Continuous provision of information and education about the child's disease and treatment is crucial, delivered through weekly lectures by healthcare professionals, brochures, videos, and consultation channels. This includes enhancing family caregiving skills such as medication management, nutritional support, infection prevention, and emergency measures. Overall, these interventions will improve the interactions, communication around stressors, and dyadic coping strategies for parents. In future, researchers should conduct cross-cultural comparisons to explore differences in parental psychological stress, coping strategies, social support systems, and family stability between Eastern and Western cultural contexts. Such studies need to include cultural variables influencing dyadic coping strategies in different populations. Finally, a cross-cultural dyadic coping theoretical framework applicable to diverse cultural backgrounds need to be developed. This approach would promote international collaboration and provide a broader perspective on dyadic coping strategies for parents of children with leukemia.

Limitations

This study has several limitations. First, it was conducted at a hospital in Beijing, China, using convenience sampling. Potential selection bias may arise from limited sample representativeness, geographical constraints, preferences in healthcare service utilization, socioeconomic and cultural disparities, and the specific timing of the survey. These factors may restrict the generalizability and applicability of the findings. Second, the coping abilities of parents may undergo dynamic and phase-specific changes as the child progresses through treatment and recovery. While our model accounted for 37.8% of the variance in dyadic coping, unmeasured variables such as individual psychological resilience may also play a role. Future research should consider these variables to provide a more comprehensive understanding of dyadic coping mechanisms. Moreover, multiple linear regression has certain limitations, including strict linear assumptions, sensitivity to outliers, and high data requirements, which may have affected the model's fit. Lastly, we only included one parent of each child, limiting the scope of the analysis. In future, researchers should adopt a multicenter design, increase the sample to include multiple healthcare institutions from various regions with different economic levels, cultural backgrounds, and social resources. It is also important to control variables in such studies to obtain robustness results. Additionally, a large-scale longitudinal study involving both parents of children with leukemia need to be formulated to allow long-term tracking and dynamic assessments. This would provide deeper insights into the changes in parental psychological states and coping strategies at different stages and allow analysis of the causal relationships between variables.

Conclusion

This is the first study to comprehensively analyze the dyadic coping levels of parents of children with leukemia in China and the associated clinical and psychosocial factors. The results show that parents generally demonstrate moderate dyadic coping abilities, which are influenced by diverse factors, such as self-efficacy, anxiety, income per month, the child's disease status (including number of relapses and the current treatment programs), and the knowledge of the child's illness. Therefore, healthcare professionals should pay attention to the emotional well-being and dyadic coping strategies of parents of children with leukemia. Optimized psychosocial interventions need to be formulated to address the individual needs of parents. Moreover, such interventions should address multiple aspects, including professional psychological counseling, peer support programs, and enhanced training and education. Educational initiatives such as specialized lectures by medical experts, informational materials, online medical consultation platforms, and training in family caregiving skills may also be appropriate interventions. Additionally, supplementary support resources, such as financial assistance and funding programs, should be provided. These measures designed to improve the interaction and proactive communication between parents, facilitating joint stress management. In future, multicenter, large-sample, and longitudinal study designs should be adopted to investigate the dynamic developmental trends of dyadic coping strategies in parents. Identifying critical stages where dyadic coping levels are low will help clinicians to determine optimal intervention timing, which is crucial to improving parents' coping with and managing the challenges posed by their child's illness.

Abbreviations

DCI	Dyadic coping inventory
GSES	General self-efficacy scale
VIF	Variance inflation factor

Supplementary Information

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Supplementary Material 1

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Author contributions

Yongli Wang: Conceptualization, Methodology, Data review, Writing-original draft and Writing-Reviewing and Editing; Shunhang Xu：Methodology, Data review and Data analyses, Writing-Reviewing; Hailing Yu: Data collection and Writing – original draft; Yi Liang: Data collection and Editing; Dongmei Jia: Conceptualization, Data review and Writing-Editing.

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

This project (RDN2021-18) supported by Peking University People's Hospital Scientific Research Development Funds. Ethical approval was obtained from the Ethics Committee of Peking University People's Hospital. Our study was compliant with the Helsinki Declaration, and all participants signed informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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