

Type D Personality Parents of Children With Leukemia Tend to Experience Anxiety

The Mediating Effects of Social Support and Coping Style

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Abstract: The aims were to access anxiety and type D personality (TDP) in parents of children with leukemia, and to determine the mediating effect of social support and coping style on the relationship between TDP and anxiety.

A cross-sectional study was conducted among 231 parents of children with leukemia and 261 parents of children with acute diseases in hospitals. Parents completed questionnaires on anxiety, TDP, social support, coping styles, children's clinical characteristics, and demographic characteristics.

Parents of children with leukemia showed higher prevalence of anxiety (64.5% vs 40.2%, $P < 0.01$) and TDP (44.2% vs 24.1%, $P < 0.01$) compared with controls. TDP (odds ratio [OR] = 4.34, $P < 0.01$), lower social support (OR = 1.92, $P = 0.02$), and less positive coping (OR = 1.87, $P = 0.02$) were independently associated with anxiety. Parents with TDP showed lower social support and less positive coping, but more negative coping compared with those without. Moreover, multiple mediation analyses revealed that the significant effect of TDP on anxiety was partially mediated by social support and positive coping.

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In conclusion, anxiety and TDP were highly prevalent in parents of children with leukemia. The predictive factors could be used to identify those parents who are at high risk of anxiety and may also be targets for prevention and intervention.

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Abbreviations: NA = negative affectivity, OSS = objective social support, PSST = problem-solving skills training, SAS = self-rating anxiety scale, SI = social inhibition, SSRS = Social Support Rating Scale, SSS = subjective social support, TCSQ = trait coping style questionnaire, USS = utilization of social support.

INTRODUCTION

Leukemia is the leading malignant tumor among children worldwide.^{1,2} Although advances in treatment can result in better prognosis and long-term survival, 20% of childhood leukemia may relapse after remission.³ Survivors usually suffer from physical and mental sequelae.⁴ In developing countries, the long-term outcomes of childhood leukemia are relatively poor due to financial problems and lack of early perception of illness.^{5,6} The diagnosis of childhood leukemia and its stressful treatments, not only adversely impact the physical and mental health of the children with leukemia, but also impose heavy mental burdens on their parents.⁷ Anxiety is very common in parents of children with leukemia.⁸ The researchers reported that relieving parental anxiety could result in positive outcomes for the treatment of their child's leukemia and lessen stress years after treatment.⁸

Type D personality (TDP) is characterized by the combined tendency of negative affectivity (NA, the tendency to experience negative emotions) and social inhibition (SI, the tendency to hold back the expression of one's emotions or behaviors in social interactions due to insecurity and tension).⁹ In the last decades, studies have found that TDP is associated with poor psychological health and poor physical health in patients with cardiovascular diseases or type 2 diabetes.^{9,10} Several studies found that TDP was stable over time as a personality trait.^{9,11} However, Dannemann et al¹² reported that TDP might be unstable in response to critical or life-threatening events. Most of the studies on TDP were done in cardiac patients or healthy populations without crucial life events happening during the test-retest period.^{9,13} Is it possible that the diagnosis and treatment of childhood leukemia, as a crucial life event, impacts the assessment of TDP in parents of children with leukemia? It is still unclear. In addition, individuals with TDP are more likely to get less social support¹⁴ and to adopt more negative coping (NC) strategies than those without,¹⁵ although both social support and coping styles play important roles in parental psychological adaptation to childhood cancer.^{16,17}

However, little is known about the prevalence of TDP and its relation with anxiety, social support, and coping styles in parents of children with leukemia. Moreover, demographic characteristics such as parental sex, job status, and family economic conditions also impact the psychological health and adaptation in parents of children with cancer.^{18,19}

We assumed that parents of children with leukemia may experience increased anxiety symptoms, which were associated with TDP, social support, coping styles, and demographic characteristics. The aims of this study were to evaluate the prevalence of anxiety and TDP in parents of children with leukemia, to explore the independent predictors of parental anxiety, and to determine the mediating effect of social support and coping style on the relationship between TDP and anxiety.

METHODS

Participants and Procedures

This study was a cross-sectional survey. Parents of children with leukemia from 5 top hospitals in South China were enrolled in the study group. Leukemia is the most common childhood cancer, whereas acute infectious diseases are the most common childhood diseases. Parents of children with leukemia or with acute infectious diseases in the same hospitals may face similar medical environment and economic condition. If parents of healthy children were enrolled as control group, the many social factors might be hard to compare. Thereby, a control group consisting of parents of children suffering from acute infectious diseases may be more suitable and comparable. Parents and their children should meet the following inclusion criteria: parents who had a child diagnosed with leukemia by bone marrow examination within 12 months were enrolled in the study group; parents who had a child suffering from acute respiratory or digestive infections within 1 week and without severe complications were enrolled in the control group; these acute diseases include acute upper respiratory infection, bronchitis, bronchopneumonia, and enteritis; children in both the groups were younger than 16 years old; parents (father or mother) were the primary caregivers of children in both the groups. Exclusion criteria included children with other chronic diseases, malignant diseases or brain lesions; parents suffering from previous psychological diseases (depressive disorder and anxiety disorder), dysgnosia, dyslexia, and serious diseases.

Researchers introduced the purposes and methods of the study to the pediatric attending doctors. From January 2009 to August 2009, 213 families with a child diagnosed with leukemia and 249 families with a child suffering from acute respiratory or digestive infections were identified as meeting inclusion criteria by attending doctors. Parents in these families were invited to participate in the study. The study protocol was approved by the ethics committee of our Sun Yat-sen University. Written informed consents were obtained from the parents of children.

There were 164 out of 213 families (76.9%) with a child diagnosed with leukemia and 178 out of 249 families (71.5%) with a child diagnosed with common acute diseases to agree to participate. Parents needed to complete a series of self-report questionnaires on anxiety, TDP, social support, coping styles, demographic characteristics, and children's clinical variables independently of their spouses. A total of 328 and 356 questionnaires were administered to parents in the study and control groups, respectively. We finally got 231 (135 by mothers and 96 by fathers) and 261 (151 by mothers and 110 by fathers) completed questionnaires from the study and control groups,

respectively, with at least 1 completed questionnaire from each family. There were no significant differences in response rate between the 2 groups (231/328 vs 261/356, 70.4% vs 73.3%, $P > 0.05$).

MEASURES

Demographic characteristics and children's clinical variables were obtained with a general questionnaire. Demographic variables included sex and age of children, and parental sex, age, education level, income level, methods of payment for medical expenses, place of residence, number of children, and the primary caregiver. Children's clinical variables contained children's diagnosis and time since diagnosis.

Zung SAS

We used Zung Self-Rating Anxiety Scale (SAS) to assess parental anxiety symptoms. Zung SAS is a 20-item construct for measuring severity of anxiety.²⁰ The total raw score of this construct ranges from 20 to 80. The standard score equals the raw score multiplied by 1.25 (ranging from 25 to 100).²¹ A cutoff of the standard score ≥ 50 is defined as having anxiety with higher scores indicating higher level of anxiety. The Chinese version of Zung SAS shows good reliability (Cronbach alpha, 0.85).²¹

Type D Scale-14

The Type D Scale-14 developed by Denollet⁹ was used to assess TDP, including 2 subscales NA and SI. Each subscale contains 7 items rated on a 5-point Likert-type scale. The total score ranges from 0 to 28 for both NA and SI. Patients who get a score >10 on both NA and SI are categorized as TDP.⁹ DS-14 shows good internal consistency and reliability in epidemiologic and clinical research.^{9,22}

Social Support Rating Scale

The Social Support Rating Scale (SSRS) developed by Shuiyuan Xiao is a 10-item questionnaire for measuring social support, including objective social support (OSS), subjective social support (SSS), and utilization of social support (USS).²³ Higher score indicates more social support. The SSRS is widely used and shows acceptable reliability and validity in the Chinese population.²³

Trait Coping Style Questionnaire

The trait coping style questionnaire (TCSQ) was used to assess coping styles, including positive coping (PC) (eg, attempt to take a more active role in dealing with a problem) and NC (eg, believe that nothing can be done to change the situation).²⁴ Each dimension contains 10 items scored on a scale of 1 to 5. TCSQ is a valid method for measuring coping styles in studies on individual psychological health in Chinese populations (Cronbach alpha is 0.71 for PC and 0.72 for NC, respectively).²⁵

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS, v.13.0; SPSS Inc, Chicago, IL) was used to perform data analyses. The level of significance was 0.05. Unpaired t test and χ^2 test were used to compare basic demographic data, clinical variables, anxiety, TDP, social support, and coping styles between the 2 groups. Univariate and multivariate logistic regression analyses were performed to evaluate the independent predictors of parental anxiety in both the groups. In logistic regression analyses, anxiety was entered as a dichotomous variable according to its cutoff ≥ 50 on Zung SAS. For a

continuous variable without an established cutoff value, its median or quartile can be used for categorization of the variable.^{26,27} Because of lack of preestablished cutoff, scores on SSRS (social support) and scores on TCSQ (positive or NC) were used as dichotomous variables according to their medians. Partial correlation analyses were conducted to assess correlations between parental anxiety, TDP, social support, and coping styles, adjusting for demographic and clinical variables. Furthermore, we also evaluated the predictive effects of TDP on parental anxiety, social support, and coping styles after controlling for demographic and clinical variables. Finally, we used bootstrapping methods for mediation analysis to estimate whether the significant effect of TDP on parental anxiety was mediated by social support and coping styles. An SPSS macro (INDIRECT) created by Preacher and Hayes²⁸ for bootstrap analyses was used to calculate multiple mediating effects, controlling for demographic and clinical variables.

RESULTS

Demographic and Clinical Characteristics

There were 164 children with leukemia (85 boys and 79 girls, 7.70 ± 4.38 years) in the study group and 178 children

with acute infectious diseases (97 male and 81 female, 8.18 ± 3.67 years) in the control group. As for the diseases among children in the study group, there were 130 children (79.3%) with acute lymphocytic leukemia and 34 (20.7%) with acute nonlymphocytic leukemia. Diseases among children in the control group included enteritis (58, 32.6%), acute upper respiratory infection (53, 29.8%), bronchitis (52, 29.2%), and bronchopneumonia (15, 8.4%).

Table 1 shows the demographic characteristics in both the groups. There were 231 parents (41.6% male, 31.5 ± 7.0 years) in the study group and 261 controls (42.2% male, 30.3 ± 6.5 years). There were more jobless parents (22.08% vs 4.21%, *P* < 0.01) and more families from rural areas (31.10% vs 20.22%, *P* = 0.02) in the study group. Other demographic variables, including parental sex, age, education level, income level, number of children, and methods of payment for medical expenses, showed no significant differences between the 2 groups (*P* > 0.05). In both the groups, most parents were at the age of 30 to 40 years and with an education level of high school or above. Usually, mothers were the primary caregivers. Most families had only 1 child, paid medical expenses at their own expenses, and had an income of US\$ 500 to US\$ 1200 per month.

TABLE 1. Demographic Characteristics in Parents Between the 2* Groups

Variables	Study Group		Control Group		χ ²	P
	N	%	N	%		
Sex						
Female	135	58.4	151	57.8	0.02	0.90
Male	96	41.6	110	42.2		
Age, y						
20–29	31	13.4	53	20.3	4.80	0.09
30–39	162	70.1	175	67.1		
40–49	38	16.5	33	12.6		
Education						
<High school	61	26.4	78	29.9	0.73	0.39
≥High school	170	73.6	183	70.1		
Job status						
Unemployed	51	22.1	11	4.2	35.51	<0.01
Employed	160	77.9	250	95.7		
Primary caregiver						
Father	28	17.1	35	19.7	0.38	0.54
Mother	136	82.9	143	80.3		
Number of children						
>1 child	32	19.5	23	12.9	2.75	0.10
Only 1 child	132	80.5	155	87.1		
Income, US\$/mo [†]						
<500	29	17.7	30	16.9	0.64	0.73
500–1200	88	53.7	97	54.5		
>1200	47	28.6	61	28.5		
Methods of payment						
At one's own expense	121	73.8	119	66.9	1.96	0.16
Not at one's own expense [‡]	43	26.2	59	33.1		
Residence						
City	113	68.9	142	79.8	5.32	0.02
Rural area	51	31.1	36	20.2		

* Demographic data on 231 parents from 164 families with a child diagnosed with leukemia (study group) and 261 parents from 178 families with a child having acute diseases (control group).

[†] Parental income level was calculated based on the rate of Chinese currency against the US dollar.

[‡] Commercial insurance, social medical insurance, and social donation.

Comparison of Parental Anxiety, TDP, Social Support, and Coping Styles Between the 2 Groups

The results on comparing parental anxiety, TDP, social support, and coping styles between the 2 groups are shown in Table 2. Parents of children with leukemia experienced significantly higher levels of anxiety than controls (56.56 ± 10.34 vs 48.74 ± 8.30 , $P < 0.01$). There were 149 parents (64.5%) in the study group and 105 parents (40.2%) in the control group experiencing anxiety symptoms, using a cutoff ≥ 50 on Zung SAS ($\chi^2 = 28.90$, $P < 0.01$). According to the recommended cutoff ≥ 10 on both NA and SI, the prevalence of TDP was more common among parents of children with leukemia than among controls (44.2% vs 24.1%, $P < 0.01$). There were no significant differences between the 2 groups in total social support on SSRS (40.36 ± 6.91 vs 41.20 ± 6.50 , $P = 0.17$), but significant differences were found between the 2 groups as for the specific scores on each dimension of social support. Parents of children with leukemia received more OSS (8.99 ± 2.28 vs 8.09 ± 2.92 , $P < 0.01$) and showed more USS (7.36 ± 1.27 vs 6.45 ± 1.93 , $P < 0.01$) than controls, whereas they reported less SSS than controls (24.01 ± 4.09 vs 25.97 ± 4.28 , $P < 0.01$). Compared with controls, parents of children with leukemia adopted more NC style (28.09 ± 4.58 vs 23.42 ± 5.56 , $P < 0.01$), but used less PC style (30.28 ± 6.46 vs 32.35 ± 5.51 , $P < 0.01$).

Univariate and Multivariate Logistic Regression Analyses on Assessing the Independent Predictors of Parental Anxiety in Both the Groups

Table 3 shows the results of univariate and multivariate logistic regression analyses on assessing the independent predictors of parental anxiety in both the groups. In univariate analyses, demographic factors, including study group, female sex, >40 years old, unemployed, lower education level, and paying the medical fares at one's own expenses, showed associations with increased parental anxiety. As for the effects of psychosocial factors, TDP, lower social support, less PC, and more NC were related to increased parental anxiety.

Multivariate logistic regression analyses showed that parents of children with leukemia had 2.51-fold odds ratio (OR) of experiencing anxiety as compared with controls after controlling for potential confounders. Demographic factors

including lower education level (OR = 1.79, $P = 0.01$) and paying the medical fares at one's own expenses (OR = 1.75, $P = 0.04$), and TDP (OR = 4.34, $P < 0.01$), lower social support (OR = 1.92, $P = 0.01$), and less PC (OR = 1.87, $P = 0.02$) showed independent and significant associations with elevated anxiety. Female sex (OR = 1.56, $P = 0.07$), lower income level (OR = 1.49, $P = 0.07$), and unemployed (OR = 1.63, $P = 0.10$) showed marginally predictive effect on parental anxiety. In multivariate analyses, NC and other demographic variables (age, residence, and number of children) did not show independent association with parental anxiety.

Relationship Between Anxiety, TDP, Social Support, and Coping Styles in Both the Groups

The results of partial correlation analyses are shown in Table 4. After controlling for demographic and clinical variables, TDP was positively correlated with anxiety and NC, but showed negative correlations with social support (including its 3 dimensions) and PC style. Besides, both social support (including its 3 dimensions) and coping styles (positive or NC style) showed significant correlations with anxiety. Multivariate logistic regression analyses were also used to determine the impacts of TDP on parental anxiety, social support (including its 3 dimensions), and coping styles, controlling for demographic and clinical factors (shown in Table 5). In line with the results above, TDP could predict parental anxiety in both the groups. Type D parents were more likely to get less social support (OR = 3.63, $P < 0.01$), including less OSS (OR = 2.06, $P < 0.01$), less SSS (OR = 2.48, $P < 0.01$), and less USS (OR = 1.76, $P = 0.02$). Moreover, TDP was independently associated with less PC style (OR = 3.26, $P < 0.01$) but more NC styles (OR = 3.42, $P < 0.01$). These results indicated that social support and coping styles might act as potential mediators between TDP and parental anxiety.

Mediating Effects of Social Support and Coping Styles on the Link between TDP and Anxiety

Figure 1 shows a multiple mediation model between TDP and anxiety through social support, PC, and NC. The significant effect of TDP on anxiety was partially mediated by social support, PC, and NC as a set. The total indirect effect of TDP on anxiety through the 3 potential mediators was significant ($a_1b_1 + a_2b_2 + a_3b_3 = 0.1434$; 95% bias-corrected (BC) bootstrap confidence interval (CI) 0.0853–0.2167). The total

TABLE 2. Comparison of Parental Anxiety, TDP, Social Support, and Coping Styles Between the 2 Groups*

Variables	Study Group (N = 231) Mean \pm SD/n (%)	Control Group (N = 261) Mean \pm SD/n (%)	t/ χ^2	P
Anxiety	149 (64.5%)	105 (40.2%)	28.90	<0.01
TDP	102 (44.1%)	63 (24.1%)	23.46	<0.01
TSS	40.36 \pm 6.91	41.20 \pm 6.50	-1.38	0.17
OSS	8.99 \pm 2.28	8.09 \pm 2.92	3.66	<0.01
SSS	24.01 \pm 4.09	25.97 \pm 4.28	-5.07	<0.01
USS	7.36 \pm 1.27	6.45 \pm 1.93	5.89	<0.01
PC	30.28 \pm 6.46	32.35 \pm 5.51	-3.80	<0.01
NC	28.09 \pm 4.58	23.42 \pm 5.56	9.83	<0.01

NC = negative coping, OSS = objective social support, PC = positive coping, SD = standard deviation, SSS = subjective social support, TDP = type D personality, TSS = total social support, USS = utilization of social support.

*Statistical analysis was performed in 231 parents of children with leukemia (study group) and 261 parents of children with acute diseases (control group).

TABLE 3. Univariate and Multivariate Logistic Regression Analyses on Assessing the Independent Predictors of Anxiety*

Variables	Univariate Analyses			Multivariate Analyses		
	OR	95% CI	P	OR	95% CI	P
Group (study group)	2.70	1.87–3.89	<0.01	2.51	1.47–4.28	<0.01
Sex (female)	1.79	1.24–2.57	<0.01	1.56	0.96–2.53	0.07
Age						
(0: <30 y)			0.16			0.25
(1: 30–40 y)	1.49	0.77–2.88	0.23	1.25	0.74–2.09	0.39
(2: >40 y)	2.91	1.18–7.14	0.02	1.64	0.84–3.20	0.15
Residence (rural area)	0.96	0.62–1.48	0.87	1.07	0.63–1.83	0.80
Number of children (only child)	1.84	0.65–5.19	0.25	1.24	0.76–2.03	0.39
Income (< US\$ 500 per mo)	1.94	0.97–3.86	0.06	1.49	0.97–2.29	0.07
Payment (at one’s own expense)	2.29	1.43–3.69	<0.01	1.75	1.02–3.01	0.04
Job status (unemployed)	1.59	1.08–2.34	0.02	1.63	0.90–2.95	0.10
Education (<high school)	2.28	1.15–4.54	0.02	1.79	1.13–2.86	0.01
TDP	6.23	3.87–10.02	<0.01	4.34	2.53–7.44	<0.01
TSS (scores < median)	2.29	1.38–3.77	<0.01	1.92	1.11–3.34	0.02
PC (scores < median)	1.98	1.37–2.85	<0.01	1.87	1.09–3.21	0.02
NC (scores ≥ median)	1.99	1.11–3.59	0.02	1.36	0.87–2.21	0.18

CI = confidence interval, NC = negative coping, OR = odds ratio, PC = positive coping, TDP = type D personality, TSS = total social support.
 *Statistical analysis was performed in 231 parents of children with leukemia and 261 parents of children with acute diseases.

effect of TDP on anxiety became smaller, but remained significant when potential mediators were included in the model (total effect $c = 0.5624$, $P < 0.01$; direct effect $c' = 0.4190$, $P < 0.01$). As for the specific indirect effect through each proposed mediator, social support ($a_1b_1 = 0.0771$, 95% BC CI 0.0378–0.1329) and PC ($a_2b_2 = 0.0524$, 95% BC CI 0.0147–0.1038) were demonstrated as a significant mediators between TDP and anxiety, whereas NC ($a_3b_3 = 0.0140$, 95% BC CI –0.0038 to 0.0394) was not a unique mediator due to its 95% BC CI containing zero. These results demonstrated that the significant association between TDP and anxiety was partially mediated by social support and PC.

DISCUSSION

In the current study, we found that parents of children with leukemia showed higher levels of anxiety and higher prevalence of TDP than controls. The results showed that TDP, lower social

support, and less PC style were independent predictors of parental anxiety. Besides, some demographic and clinical factors, including lower education level and paying the medical fares at one’s own expenses, also showed independent associations with parental anxiety. Moreover, the present study demonstrated that parents with type D tended to report increased anxiety, lower social support, and less PC style but more NC style. As the strongest predictors of parental anxiety, TDP showed significant impacts on anxiety, in part, through the mediating effects of social support and copings styles.

To our knowledge, this is the first study to assess TDP in parents of children with leukemia and evaluate its relation with parental anxiety, social support, and coping styles. Our results demonstrated that the prevalence of TDP (44.2%) in parents of children with leukemia was significantly higher than that (24.1%) in parents of children with acute infectious diseases and (31%) in Chinese patients with coronary heart disease.¹³ The finding indicated that the diagnosis of childhood leukemia,

TABLE 4. Partial Correlation Between Anxiety, TDP, Social Support, and Coping Styles, Controlling for Demographic and Clinical Variables†

	1	2	3	4	5	6	7	8
1 Anxiety	—							
2 TDP	0.458**	—						
3 TSS	–0.318**	–0.292**	—					
4 OSS	–0.241**	–0.225**	0.643**	—				
5 SSS	–0.275**	–0.225**	0.859**	0.280**	—			
6 USS	–0.190**	–0.207**	0.425**	0.277**	0.152**	—		
7 PC	–0.283**	–0.301**	0.346**	0.279**	0.281**	0.202**	—	
8 NC	0.147*	0.164**	–0.123*	–0.061	–0.133*	–0.082	–0.121*	—

NC = negative coping, OSS = objective social support, PC = positive coping, SSS = subjective social support, TDP = type D personality, TSS = total social support, USS = utilization of social support.

†Statistical analysis was performed in 231 parents of children with leukemia and 261 parents of children with acute diseases. * $P < 0.05$; ** $P < 0.01$.

TABLE 5. Predictive Effects of TDP on Anxiety, Social Support, and Coping Styles, Controlling for Demographic and Clinical variables*

	OR	95% CI	P
Anxiety	5.40	3.24–9.00	<0.01
TSS (<median)	3.63	2.27–5.78	<0.01
OSS (<median)	2.06	1.31–3.24	<0.01
SSS (<median)	2.48	1.57–3.90	<0.01
USS (<median)	1.76	1.10–2.84	0.02
PC (<median)	3.26	2.10–5.10	<0.01
NC (≥median)	3.42	2.06–5.67	<0.01

CI = confidence interval, NC = negative coping, OR = odds ratio, OSS = objective social support, PC = positive coping, SSS = subjective social support, TSS = total social support, USS = utilization of social support.

*Statistical analysis was performed in 231 parents of children with leukemia and 261 parents of children with acute diseases.

as a crucial life event, might impact the assessment of TDP in parents. As expected, TDP was found being an independent predictor of parental anxiety in both the groups after adjusting for demographic and clinical factors. Previous studies have

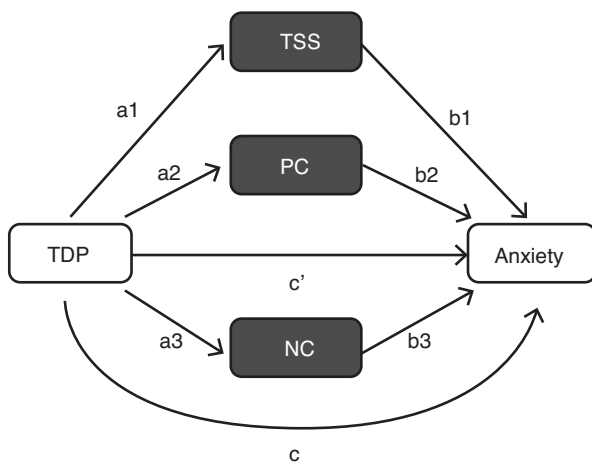


FIGURE 1. Social support and coping styles mediating the relationship between TDP and anxiety. The figure shows a multiple mediation model between TDP and anxiety through TSS, PC, and NC, controlling for demographic and clinical variables: a indicating the effects of TDP on 3 potential mediators, including TSS ($a_1 = -0.2921, P < 0.01$), PC ($a_2 = -0.2744, P < 0.01$), and NC ($a_3 = 0.1313, P < 0.001$); b indicating the effects of 3 potential mediators on anxiety, including TSS ($b_1 = -0.2639, P < 0.01$), PC ($b_2 = -0.1910, P = 0.01$), and NC ($b_3 = 0.1064, P = 0.17$); c representing the total effect of TDP on anxiety ($c = 0.5624, P < 0.01$); c' representing the direct effect of TDP on anxiety ($c' = 0.4190, P < 0.01$); ab indicating the specific indirect effect of TDP on anxiety through each proposed mediator, including TSS ($a_1b_1 = 0.0771, 95\% \text{ BC CI } 0.0378-0.1329$), PC ($a_2b_2 = 0.0524, 95\% \text{ BC CI } 0.0147-0.1038$), and NC ($a_3b_3 = 0.0140, 95\% \text{ BC CI } -0.0038 \text{ to } 0.0394$); $a_1b_1 + a_2b_2 + a_3b_3$ representing the total indirect effect of TDP on anxiety through 3 proposed mediators ($a_1b_1 + a_2b_2 + a_3b_3 = 0.1434, 95\% \text{ BC CI } 0.0853-0.2167$). BC = bias-corrected, CI = confidence interval, NC = negative coping; PC = positive coping; TDP = type D personality; TSS = total social support.

demonstrated that type D individuals are vulnerable to anxiety symptoms.¹⁰

The results found that TDP had significant association with both social support and coping styles. TDP was found negatively correlated with social support in parents in both the groups. Several studies had shown that individuals with type D tended to get less social support from different sources.¹⁴ Similarly, parents with type D not only received less OSS, but also showed less SSS and less USS in the present study. Moreover, lower social support was a predictor of parental anxiety. Previous researches have demonstrated that good social support is helpful to improve parental psychological health in dealing with their child's cancer.^{16,17} Moreover, TDP was independently associated with less PC style, but more NC styles in parental dealing with childhood leukemia. These results were consistent with findings in previous studies.^{29,30} Peek and Melnyk³¹ found that teaching parents PC strategies was helpful to promote parental mental health and family adaptation to childhood leukemia.³² In the present study, parents with type D tended to receive less social support and adopt less PC style. Meanwhile, poor social support and less PC styles were all independently related to higher levels of anxiety. These results indicated that social support and coping styles might mediate the relationship between TDP and anxiety. This hypothesis was confirmed by our multiple mediation analyses. A previous study by Williams and Wingate had found that the impact of TDP on subjective stress and physical symptoms in a noncardiac population were partly mediated by social support and coping styles.³³ Therefore, the increased anxiety symptoms in type D parents could be partly due to the lower social support and less PC style in them. Thus, to reduce parental anxiety, improving coping styles and social support are important strategies, particularly for parents with TDP. In the beginning of diagnosis of childhood leukemia, medical staff can conduct problem-solving skills training (PSST) to improve parental coping skills. For example, the Bright IDEAS PSST program is a well-established intervention for improving problem-solving skills.³⁴ Above all, medical staff and the related friends or relatives of patients should provide essential emotional or material supports.

The study also investigated the relationships between demographic variables and parental anxiety. In line with previous studies,^{35,36} parents who had a lower education level and/or paid medical expense at their own expenses were more likely to be anxious during the treatment of childhood leukemia in their children. In addition, female sex, lower income level, and unemployed showed marginally predictive effect on parental anxiety. These results indicate that family economic condition is still an important factor related to anxiety in parents of children with leukemia. Several studies reported that financial issue was the major factor for both the insufficient treatment of children with leukemia⁶ and poor psychological well-being in their parents in developing countries.⁷ Therefore, establishing a comprehensive medical care system and social security system may be helpful to improve mental health in parents, who have a child with leukemia, and also encounter financial problems.

There were some limitations in the study. First, it needs to mention the cross-sectional design and the reliance on self-report information. Second, the sample size was limited. Third, participants were only recruited from the 5 top hospitals in South China. Because the diagnosis and treatment of childhood leukemia in China are concentratedly conducted in top hospitals, the sample employed from these 5 hospitals might be

representative of the childhood leukemia population in Southern China.

In conclusion, the current study provides a unique contribution to the existing literature by reporting the higher prevalence of TDP and anxiety in parents of children with leukemia. Our data also revealed significant associations between parental anxiety and TDP, social support, coping style, and demographic characteristics. Importantly, we highlighted that the link between TDP and anxiety could be partly explained by social support and PC. Given the high prevalence of childhood leukemia and the harmful effects of parental anxiety, it is important to reduce anxiety in parents of children with leukemia, especially those with TDP, by adopting PC strategies and seeking more social support. These predictive factors could be used to identify those parents who are at high risk of anxiety and may also be targets for prevention and intervention.

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